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THE USE OF SOCIAL NETWORK AS A TOOL TO ANALYSE INTERNATIONAL TRADE: A SYSTEMATIC LITERATURE REVIEW

Review Article

Keywords

Systematic Literature Review;
International Trade;
Network Analysis;

Abstract

This study seeks to understand the current literature about international trade analysed through social network. To achieve the aim, four main objectives were set, which analyse the trend of studies in international trade network analysis over the years; find out which databases and tools researchers have been using; find out the journals across which the articles were published and find out which segments have been approached from the perspective of international trade. This systematic literature review is an important study, as it investigated the approaches adopted by the relevant studies in the area. It allowed to build a base for future research, and this study has clarified how the main articles have been made.

INTRODUCTION

International Trade

People have been trading items for thousands of years, as evidenced by the long-distance exchange of shells, arrowheads, and other products. There were certain marketplaces in ancient times when many buyers and sellers competed and prices were decided by supply and demand, but there were also many situations where trading reached a reasonably big size despite being regulated by totally different principles. (Pomeranz, 2017) Although this old presence on our civilization, the international trade gained more preeminence since the 1980s, being one of the big chances on our current era, mainly due to the liberalization policies adopted by developing countries at that time (Frankel, 2000; Milner, 1999).

A country tries to sell items where there is more than enough material to use, or there is more to produce than the population needs, it is then referred to as international trade when it occurs between countries, and in modern times has become theme of study which tries to investigate the results generated by these interactions, such as the gains from trade, or the impacts the international policy can imply on a given country (Krugman & Obstfeld, 2009). The most well-documented part of international economic interactions is goods trade. As a result, trade statistics provide a valuable source of information on the global distribution and displacement of economic activity (Balogh & Jámbor, 2017). David Ricardo, a 19th-century British economist first develop a theory to explain the reasons why countries trade and the differences of trade levels among nations, stating that two countries can both mutually benefit from the trade due to the comparative advantages (Krugman & Obstfeld, 2009; Taylor, Feenstra, & Romer, 2008). The way countries interact among themselves has been theme of analysis and different models tried to explain it, being one of the simplest and widely used the gravity equation, the relevance of this equation is such that it has been called the workhorse of international trade (Baier & Bergstrand, 2007; De Benedictis & Taglioni, 2011; Leamer & Levinsohn, 1995). This equation empirically analyses the trade between countries, given some explanation about the reason behind why some countries trade more, similar to the homonymous physical law, the gravity equation applied to international economy states that countries trade in proportion to their market size and proximity (Yotov, Piermartini, Monteiro, & Larch, 2016).

While long-distance commerce evolved in tandem with economic progress, the relationship between the two was complicated. One cannot claim that the effects were unidirectional (i.e., that economic development caused trade expansion), because long-distance trade influenced economic development and trade influenced economic development. Furthermore, trade's impact on economic development was felt through a variety of channels, including institutional and political ones (Helpman, 2011).

Nowadays, countries trade with each other when the recipient country is unable to produce goods provide the services in question, or when they do not have the necessary resources to do so (Sherlock & Reuvid, 2004). The world economy is characterized by international interconnectedness, with evidence showing the impact of internet on increasing the international trade (Freund & Weinhold, 2004). Trade, foreign direct investment, and financial capital flows all have a role in a country's economic fortunes. Because production networks span nations and continents, a country's product supply is largely reliant on economic activity in several other countries (Helpman, 2011). Also, a large interconnection between countries and a solid and diverse international trade structure can benefit other areas, improving company productivity and the quality of life of the national citizens (Bernard & Bradford Jensen, 1999; Torres Mazzi, Foster-McGregor, & Estefânia de Sousa Ferreira, Glaucia, 2021).

The importance of studying international commerce is growing as global trade outpaces global output. Over time, the share of international commerce in GDP rises. Foreign commerce is also widely known to take place more between developed states and surrounding countries than between faraway countries (Farmer & Schelnast, 2013).

Network Analysis

Frigyes Karinthy, a Hungarian author, suggested in 1929 that everyone on the planet is separated from others by no more than six degrees of separation. Afterwards, American psychologist Stanley Milgram (1967) put this theory to the test by asking individuals to send items to persons they didn't know via individuals they knew at first basis. Milgram found that 80 percent of the goods sent were received with four or fewer intermediates. This experiment illustrates that it is the links and relationships between the individuals that matter, not their characteristics. Jacob Moreno (1937) conceptualized the science that examines these linkages and connections in the 1930s (Hassan, 2009). He was the first to propose that social structure be represented as a network diagram. Since then, Social Network Analysis (SNA) has evolved into a diverse study field with unique theoretical principles and data-analytic methods (Korom, 2015).

SNA can be defined as the mapping and measurement of interactions and flows between individuals, groups, companies, machines, and other information processing units is referred to as. SNA is the mathematical application of the theory in which individuals, groups and organizations are represented by points and their interactions are represented by lines (Hanneman & Riddle, 2011). The groups are represented by the nodes in the network, while the links depict connections or flow between them. SNA analyses interactions in two ways: visually and mathematically (Zhu, Liu, Hu, & Fang, 2009). Other names for these two parts might emerge in the SNA applied to social relationships, such as junctions for the first and edges, linkages, or connections for the latter. These additional names might help to clarify and reinforce each one's function in the network theory. The nodes represent the actors, while the ties reflect their relationship (Popp, Balogh, Oláh, Kot, Harangi Rákos, & Lengyel 2018; Wasserman & Faust, 1994).

From the visual analysis of network connectivity, it is possible to do a panoramic analysis. From the mathematical approach, it is possible to figure out the density of a network and the relative centrality of the points in that network. SNA usually generates information such as level of power, influence, popularity, and prestige (Scott & Carrington, 2011).

SNA has been utilized successfully in a variety of disciplines, not only to comprehend the connections among the actors but also as an alternative to discover the core actors and understand the social relationships among the nodes (Scott, 1988). The application of network analysis in economics spans a wide variety of study topics. These applications include anything from labor market outcomes to systemic risk and financial stability, interfirm connections, and interbank market functioning (Acemoglu, Ozdaglar, & Tahbaz-Salehi, 2015; Bargigli, di Iasio, Infante, Lillo, & Pierobon, 2015; Calvó-Armengol & Jackson, 2004; Saito, Watanabe, & Iwamura, 2007).

The complex network theory is currently a common tool for analyzing the international commerce problem (An, Zhong, Chen, Li, & Gao, 2014; Geng, Ji, & Fan, 2014; Kim & Shin, 2002; Mahutga, 2006; Vidmer, Zeng, Medo, & Zhang, 2015; Zhang, Ji, & Fan, 2014). Complex network theory is a scientific and effective way for assessing cross-national trade flows, and measures like network density, clustering coefficients, and average distance may be employed to investigate the magnitude and nature of commerce relationships (Duan, Nie, Wang, Yan, & Xiong, 2022).

Complex systems necessitate methods to analyse and comprehend the system's interaction and behaviour, and international trade is no exception. As a result, network analysis appears to be a good fit (Popp, Kiss, Oláh, Máté, Bai, Lakner, 2018). In this way, researchers have been using SNA as a tool to analyse the behaviour of products in the international trade scenario.

METHODOLOGY

A structured review of the literature was conducted to summarize the current state of academic research on International Trade using Network Analysis. The following subsections outline the approach adopted for sourcing, screening, analysing the articles and sample characteristics.

Sourcing the articles
Since we were interested in observing the methodology network analysis related to the broad international trade field, the keywords selected to query the results were "international trade", and "network analysis".

Google Scholar, Scopus, and the Web of Science are the three most important abstract and citation databases. We didn't include Google Scholar because of its poor data quality, which raises concerns about its appropriateness for research. Scopus, on the other hand, offers greater coverage than Web of Science, although the latter allows access to older sources. Because we're looking into a new phenomenon, the Web of Science database's access to earlier sources isn't really useful. As a result, we concentrated on the Scopus platform to perform the present study.

To maintain the quality of content and to keep the selected articles to manageable, the search query was restricted to retrieve only documents belonging to the "Articles" category and labelled as the final publication stage. This first stage resulted in 293 documents. Additionally, to keep consistency among all the team members we select only articles written in the English. The results were subsequently filtered by journal's quality, keeping only articles published in ranked journals by Scimago in either four categories (Q1, Q2, Q3 or Q4). The Figure 1 shows the number of articles excluded by each applied filter described above.

After applying filters regarding keywords, language, document type, stage, and Scimago classification, 204 articles remained in the research. These articles were used in the screening stage, which will be aborded in the next section.

Screening the articles
The articles selected at the sourcing stage were imported to CADIMA, which is a tool to do a Systematic Literature Review. Through CADIMA, the abstract of each article was read and analysed, irrelevant articles were excluded from this study.

This led to a reduction of 103 articles, so only 101 articles were kept. In this phase, 50% of articles were eliminated, as illustrated in Figure 2.

The reduction percentage is higher at the abstract screening, given that there were articles in which contained the keywords but did not present a connection with the aim of the our study on the title or on abstract. This might be explained by the fact that these terms, 'international trade' and 'network analysis' are broadly applied in several studies, especially in more recent times.

VOSviwer was used to see the keywords networks of the selected articles. Figure 3 shows the connections. As was expected the main search terms used appeared more frequently and are well connected with the other keywords. Another interesting pattern is the presence of some country names, this might be explained by the fact that some studies applied the network analysis tools on the international trade of these countries instead of focusing on a single product, or the studies focused more on the highlighted nations, China, Germany, Japan, United States and India when analysing the trade data. Also, some synonyms and keywords closely related with the queried keywords appeared, this was the case for example of global trade, globalization, trade flow and commerce, words that are sometimes associated with international trade, and social network analysis and social network, which are, as the words already suggest, usually more related to the network analysis.

Analysing the articles

This stage involved extracting and documenting information from the 101 articles. The objectives of this analysis are:

1. find out the trend of studies in international trade through network analysis over the years.
2. find out which databases and tools researchers have been using.
3. find out the journals across which the articles were published.
4. find out which segments have been approached from the perspective of international trade.

This analysis will allow a better understanding of the direction that the scientific community have been taking in international trade and network analysis.

Trend

The trend is a relevant indicator to understand the growth level of studies done in this field. Figure 3 shows the number of articles published per year.

The literature of international trade with network analysis started in 1992 and has increased significantly over the years. This implies a rising research interest in this sector, reinforcing the necessity for this in-depth analysis (Figure 4).

Journals

Table 1 presents the distribution of journals across which the articles were published. The sample contains articles from a broad set of journals.

It was found that 47 journals have published just one paper on the topic. Moreover, the leading journals in the field that head the list with the highest contribution of relevant articles are the Resources Policy, Applied Energy and Plos One.

Database

Table 2 present the database used to collect data to analyse international trade. It is important to know the main database in this field, in order to build a detailed dataset in future research. Some articles used more than one database, therefore the number of data sources is higher than the number of articles.

The data source more used among the analysed articles is the database regarding global trade kept by the United Nations, the UN Comtrade. Almost half of articles (47%) used this data source and explicitly mentioned it. Given this number, this source can be considered a very important database when this kind of work is being done, this database therefore allows accessing extensive global trade statistics for free.

Packages

The authors also investigated the main tools used to develop the studies on this area, as is possible to observe, most of the articles did not present the tools used, this an interesting fact, the reason behind that most of the authors might not want to disclose their tools might be deeper studied (Table 3).

Segments

Table 4 shows the field of the study approached by the articles. The main area of study is crude materials, inedible, except fuels and food and live animals, representing 24% of the total.

It is possible to see that, in addition to the main topics mentioned in Table 4, there is a growing concern with international trade in other segments, in order that several segments have been addressed in this area of study.

CONCLUSIONS

This study was conducted to understand the literature about international network trade. To that, a Systematic Literature Review was done. Articles were carefully selected, and objectives were set.

The first analysis was the trend. The trend indicates a crescent use of network analysis in international trade, therefore, it is possible to conclude that Network Analysis is a considerable tool for

economic studies, as it is becoming increasingly popular in this area.

The most important journals and databases were found, and patterns were identified. Most of the articles have obtained data from the UN Comtrade database, which has extensive amounts of data regarding International Trade.

The main segments were identified, which study are crude materials, inedible, except fuels and food and live animals, representing 24% of the total. Several segments have been approached, nevertheless, there are numerous fields to be investigated.

This systematic literature review is an important study, as it investigated the approaches adopted by the relevant studies in the area. It allowed to build a base for future research, and this study has clarified how the main articles have been made.

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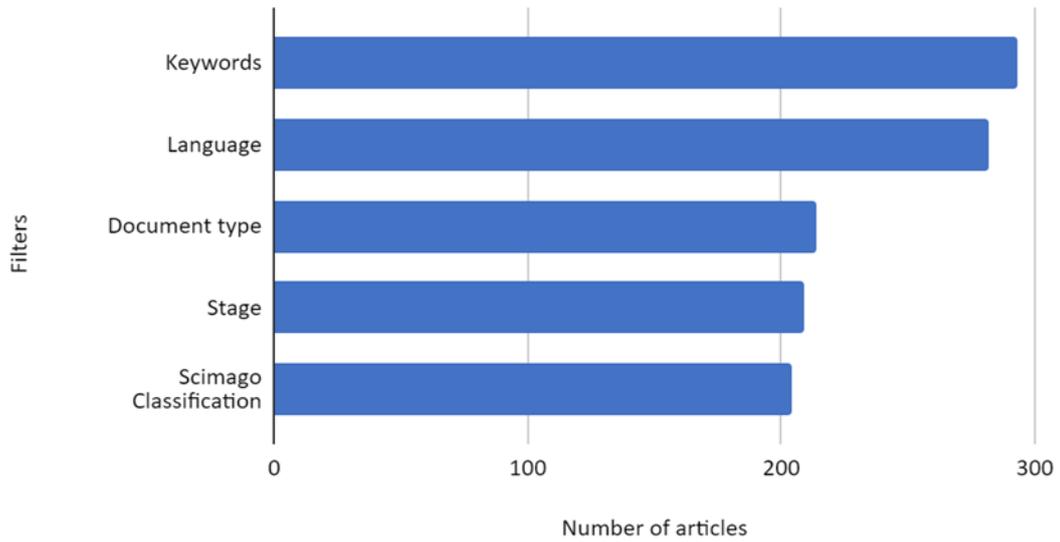
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Figure 1
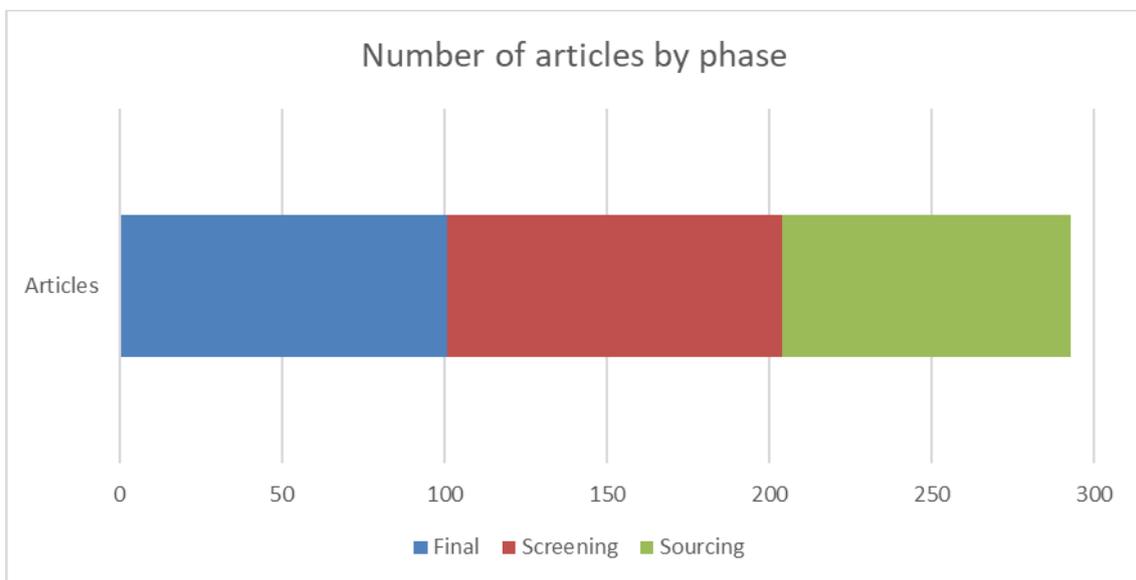**Number of articles versus Filters.**
Source: authors

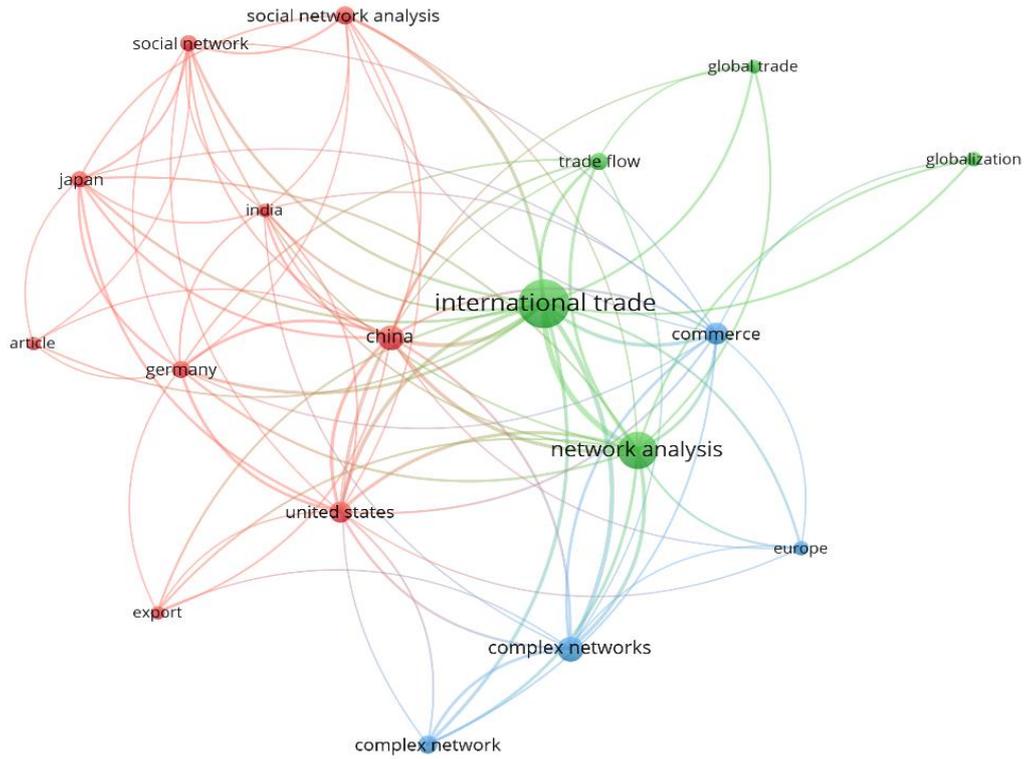

Figure 2
Reduction by each phase.
Source: authors

Figure 3
Keywords co-occurrence network.
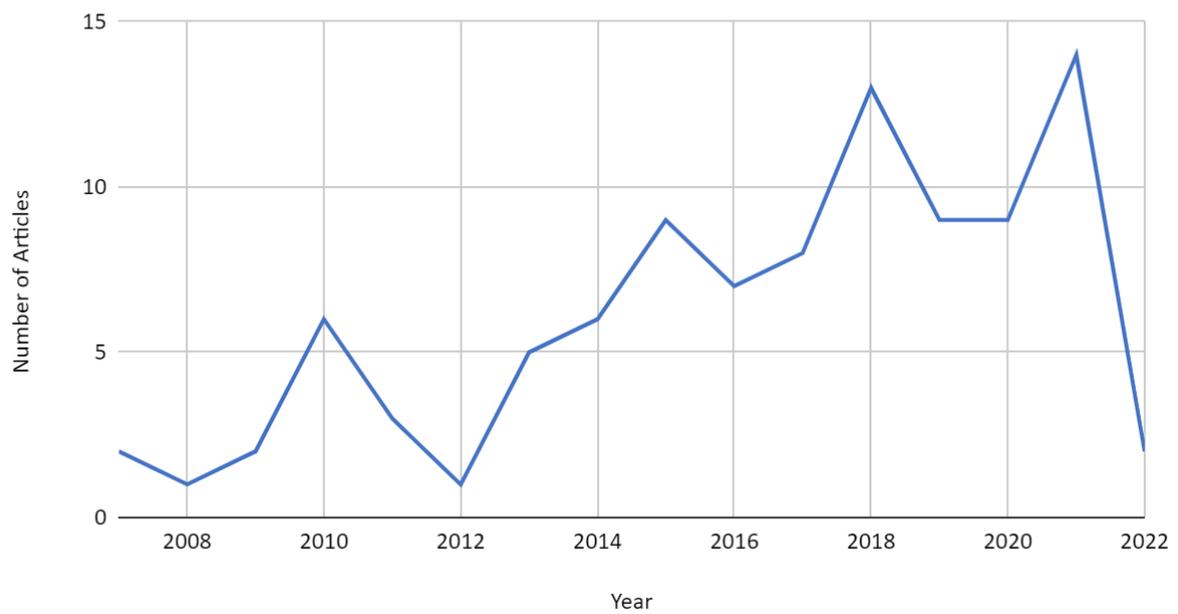*Source: authors*

Figure 4
Number of Articles versus Year.
Source: authors

LIST OF TABLES

Table 1
Distribution of journals

Source	Number of Articles	%
Resources Policy	7	7%
Applied Energy	6	6%
PLoS ONE	5	5%
Energy	4	4%
Environmental Research Letters	4	4%
Energy Policy	3	3%
Journal of International Trade and Economic Development	3	3%
Physica A: Statistical Mechanics and its Applications	3	3%
Resources, Conservation and Recycling	3	3%
Sustainability (Switzerland)	3	3%
World Economy	3	3%
Forest Policy and Economics	2	2%
Journal of Economic Interaction and Coordination	2	2%
Journal of Transport Geography	2	2%
Scientometrics	2	2%
Social Networks	2	2%
Others	47	47%
Total	**101**	**100%**

Source: Authors

Table 2
Databases

Database	Count of Database	%
UN Comtrade database	47	47%
No information	11	11%
World Input Output Data set	7	7%
Eora database	6	6%
IMF Trade Statistics	4	4%
Baci trade database	3	3%
FAOSTAT	3	3%
International Trade Center	3	3%
Land Matrix	3	3%
Eurostat	2	2%
Global Trade Information	2	2%
NBER database	2	2%
World Bank database	2	2%
Others	21	21%

Source: Authors

Table 3
Packages

Tools	Number of Articles	%
No Information	74	73%
UCINET	12	12%
R language	6	6%
Gephi	3	3%
Python	3	3%
Others	12	12%

Source: Authors

Table 4
Field of study

Field of Study	Number of Articles	%
Crude materials, inedible, except fuels	15	15%
Food and live animals	9	9%
Chemicals and related products	5	5%
Miscellaneous manufactured articles	4	4%
Energy	3	3%
Land	3	3%
Machinery and transport equipment	3	3%
Mineral fuels, lubricants, and related materials	3	3%
Mixed	3	3%
Transport	3	3%
Gas emission	2	2%
Technology	2	2%
Beverages and tobacco	1	1%
Manufactured goods	1	1%
Services	1	1%
Others	43	43%
Total	**101**	**100%**

Source: Authors