RESEARCH ARTICLE
https://doi.org/10.17059/ekon.reg.2021-2-18
UDC: 332.1; 339.5

Roberta Sisto [a], *Alba Marseglia* [b], *Edgardo Sica* [c]
[a, c] University of Foggia, Foggia, Italy
[b] Foggia Chamber of Commerce, Foggia, Italy
[a] http://orcid.org/0000-0002-1112-0919
[c] http://orcid.org/0000-0001-9054-8309, e-mail: edgardo.sica@unifg.it

Agri-food Exports and Challenges of Foreign Markets for a Small region: a Network Approach [1]

Over the last decades, the agri-food sector has been involved in a substantial process of internationalisation. For many agri-food firms, internationalisation has become a significant element of competitiveness and an essential condition for their survival and success in spite of the possible initial difficulties in competing and organising activities in uncertain and complex environments. These challenges concern mainly agri-food small and medium enterprises (SMEs) that, due to their size, are in a more vulnerable position in relation to trade barriers compared to larger firms. Based on these premises, we investigated the structure of the agri-food exports of a small region by exploring its characteristics and evolution over time. While this research is relevant per sé, it can also explain the macroeconomic dynamics of the whole area and determine the further development of agri-food exports of a small region to non-EU countries. The analysis concentrates on exports to extra-EU countries from agri-food firms located in the province of Foggia (the south-east of Italy), a small area characterised by a large presence of SMEs and micro firms that are mainly devoted to agricultural production and food processing. To answer the research question, we employ the social network analysis, a method increasingly used for analysing international trade patterns. The use of this methodology has allowed us to conduct an in-depth analysis of firms and countries that occupy a strategic position in the network. These actors are crucial for the network's survival since their removal could make the network more fragmented and disconnected. The analysis has been conducted in a dynamic way by exploring the characteristics of the network in 2014–2019, allowing us to assess its evolution over time. The results show that the structural properties of the analysed network have remarkably enhanced over time. However, the current network structure is not satisfactory yet since it relies, for the most part, on the connections among a few leading firms and a limited number of destination countries.

Keywords: trade flows, small region, Social Network Analysis, agri-food sector, exports, foreign markets, small and medium enterprises, two-mode networks, Chamber of Commerce, Foggia, Italy

For citation: Sisto, R., Marseglia, A. & Sica, E. (2021). Agri-food Exports and Challenges of Foreign Markets for a Small region: a Network Approach. Ekonomika regiona [Economy of region], 17(2), 607-618, https://doi.org/10.17059/ekon.reg.2021-2-18

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ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

Р. Систо [а], А. Марселья [б], Э. Сика [в]
[а, в] Университет Фоджи, Фоджа, Италия
[б] Торговая палата Фоджи, Фоджа, Италия
[а] http://orcid.org/0000-0002-1112-0919
[в] http://orcid.org/0000-0001-9054-8309, e-mail: edgardo.sica@unifg.it

Сетевой подход к региональному экспорту агропродовольственных товаров на зарубежные рынки

В последние десятилетия агропродовольственный сектор активно вовлечен в процесс интернационализации. Интернационализация обеспечила конкурентоспособность многих агропродовольственных компаний и стала условием их выживания и успешности, несмотря на возможные трудности, связанные с конкуренцией и организацией производственной деятельности в неопределенных и сложных условиях. Подобные проблемы актуальны в основном для малых и средних агропродовольственных предприятий (МСП), которые больше, чем крупные компании, подвержены влиянию торговых барьеров. Проанализирована структура агропродовольственного экспорта небольшого региона с учетом его характеристик. Экспортируемые товары производятся в небольшой провинции Фоджа (юго-восток Италии), небольшой территории, на которой расположено большое количество средних, малых и микропредприятий агропродовольственного сектора. Актуальность данного исследования обусловлена также и возможностью анализа макроэкономической динамики всего региона и определения путей дальнейшего развития агропродовольственного экспорта из небольшого региона в страны, не входящие в Европейский союз. В работе применен метод анализа социальных сообществ, который все чаще используется для изучения моделей международной торговли. Данная методология позволила нам провести углубленный анализ фирм и стран, занимающих стратегическое положение, поскольку их исчезновение может привести к фрагментации и разобщенности социальных сообществ. Динамический анализ проводился с учетом характеристик социальных сообществ в 2014–2019 гг., что позволило нам оценить их эволюцию во времени. Результаты исследования показывают, что структурные свойства анализируемых социальных сообществ со временем существенно улучшились. Однако нынешняя сетевая структура неидеальна, поскольку в ее основе лежит взаимосвязь между несколькими ведущими фирмами и ограниченным числом стран назначения.

Ключевые слова: торговые потоки, малый регион, анализ социальных сообществ, агропродовольственный сектор, экспорт, зарубежные рынки, малые и средние предприятия, двухмодальные сети, торговая палата, Фоджа, Италия

Для цитирования: Систо Р., Марселья А., Сика Э. Сетевой подход к экспорту на зарубежные рынки агропродовольственных товаров, произведенных в небольшом регионе // Экономика региона. 2021. Т. 17, вып. 2. С. 607-618. https://doi.org/10.17059/ekon.reg.2021-2-18

1. Introduction

The agri-food sector represents one of the most contributing industries in the European Union (EU) in terms of employment and economic output [1]. Over the last decades, the sector has been involved in a substantial process of internationalisation, turning to be much more globalised and interconnected than in the past [2]. Indeed, for many agri-food firms, internationalisation has become a significant element of competitiveness and an essential condition for their survival in spite of the possible initial difficulties in competing in more uncertain environments [3]. Consequently, international trade flows in the agribusiness sector have increased and agri-food firms are ever more exposed to the challenges and opportunities of international business activities [4]. These challenges concern mainly small and medium enterprises (SMEs) that, due to their size, are in a more vulnerable position in relation to trade barriers compared to larger firms [5]. Indeed, agri-food SMEs have an advantage in terms of quick and flexible decision-making processes, economies of scale and scope, financial and technological resources, etc., which are typical of larger firms [6]. Moreover, additional threats may arise for those agri-food firms exporting outside the EU due to different legislative frameworks of countries and potentially larger differences in consumer preferences and tastes [7].

For agri-food SMEs, therefore, exporting involves paying the initial costs of the internationalisation process and then managing an international business in a more demanding environment

than the local market [8]. Nevertheless, success in exports to extra EU-countries may significantly increase the competitive advantage of such firms, thus raising the overall competitiveness of regions where they are sited [9, 10]. Indeed, from an economic point of view, the relevance of these particular characteristics depends on the fact that trade relationships affect the dependency of some countries or regions on other countries or other regions [2]. The same consideration can be extended to the study of trade between companies in the same country or region or in different ones. However, despite the relevant contribution of the agri-food sector to the EU economy, research on international trade of EU agri-food companies is still insufficient compared to studies covering other sectors [3, 8].

Based on these premises, the present study aims to investigate the structure of agri-food exports of a small region by exploring its characteristics and evolution over time.

While this research question is relevant per sé, it can also explain the macroeconomic dynamics of the whole area and determine the further development of agri-food exports of a small region to non-EU countries, providing policy suggestions.

The analysis focuses on exports to extra-EU countries from agri-food firms located in the province of Foggia (the south-east of Italy), which is an area characterised by a large presence of SMEs and micro firms that are mainly devoted to agricultural production and food processing. Due to the extensive production of durum wheat, the province of Foggia is also known as the "Italy's granary", leads in terms of value added in agriculture and value of production at the national level. The tomato industry is also the core manufacturing activity, making this small region one of the national leaders.

To answer our research question, we employ the Social Network Analysis (SNA). Starting from the seminal work of Casella and Rauch [11], this method has been increasingly used for analysing international trade patterns as, compared to traditional methods of analysis, it depicts the visual and topological representation of firms' position in the network of international trade flows [12]. As argued by De Benedictis et al. [13], the use of the SNA allows researchers to obtain relevant information that descriptive statistics generally used in applied international trade analysis are not able to gather. More specifically, the fundamental part of information in any network analysis is represented by the relationship between two nodes i (e. g., an agri-food firm) and j (e. g., a destination country). The i-j relationship is not analysed in isolation, but it is studied focusing on its structural dimension, considering the role and position that this relationship has with respect to other nodes and relationships forming the network [13]. The result of this structural view is that the i-j relation cannot be considered independent from other relations between nodes; the characteristic of interdependence is the hinge of networks. For instance, measuring the centrality of an agri-food firm within the network allows determining the likelihood for a given company to occupy a relevant position in the trade network. Therefore, high centrality suggests that the region where the firm is located may be particularly competitive and, at the same time, that trade flows rely significantly on the presence of such a company.

Similar considerations can be extended to the whole structure of the trade network. Indeed, as it will be explained in detail later in the paper, a dense network represents a vital network made of many ties, where agri-food firms and destination countries are strictly interconnected; this stricture reduces the dependence of the network itself from unforeseeable shocks that could affect a specific company [2]. Therefore, investigation of the topological properties of this network is important for describing the food trade between firms and countries, as well as examining the macroeconomic dynamics occurring at the regional level.

The paper presents a number of new approaches. The most relevant is that it investigates exports from firms to countries following a micro to macro level analysis. This is made possible by the use of the SNA applied to a multirelational network, which is a network made by two subsets (namely, exporting firms and destination countries). In addition, the study has been conducted in a dynamic way by exploring the characteristics of the network in 2014–2019, allowing us to investigate its evolution over time. Finally, to the best of our knowledge, this is one of the very first studies using the SNA approach to analyse specifically the dynamics of the agri-food sector.

The rest of the paper is organised as follows. Section 2 reports materials and methods by discussing the context of analysis, the data used and the SNA methodology. Section 3 presents the empirical findings. Finally, section 4 concludes with a discussion about the results achieved.

2. Materials and methods

2.1. The Context of Analysis

The province of Foggia (also known as Daunia or Capitanata) is located in the south-east of Italy (Figure 1) and represents a small area of about

Fig. 1. *Location of the case study*

7,000 km² with 625,000 inhabitants in 2019 [14]. The territory can be ideally divided into three parts: the first (Tavoliere) is a completely flat land centred in the city of Foggia; the second (Daunian Mountains) is sided along the Apennines; and the third (Gargano) represents the spur of the boot-shaped Italian peninsula.

The value-added structure of the area is principally based on agriculture (primarily in Tavoliere and Daunian Mountains) with the tourism industry (beach resorts), which is particularly developed in Gargano. Although less important than in the past, agriculture remains the mainstay of the local economy: the province of Foggia exhibits approximately 500,000 hectares of land devoted to the primary cultivation and has more than 61,000 farms. The typical Mediterranean climate characterising the area (with winter days generally between 11–13°C and very hot summers with temperatures often reaching 33–38°C) makes cereals (above all, durum wheat) and tomato the main crops produced. Indeed, the province of Foggia is also known as the "Italy's granary" and represents an important reference point for all nearby rural areas. At the national level, it is among the leaders both in terms of value added in agriculture (950 million euros in 2018) and value of production (1.7 billion in 2018) [14]. The tomato industry is also the core manufacturing activity in the area, meaning that this province is among national leaders. Indeed, other than the ranking of crops (with 1.3 billion euros in 2018), the province of Foggia led the ranking of related activities, in particular, the first processing of products [14]. Moreover, the few other industries that operate in the area are mostly devoted to food processing. However, these suffer from endemic problems typical of the southern Italian regions, such as inefficiency and surplus of small businesses, particularly in marketing the prosperous agricultural production, a state of affairs that affects the earning power of farmers.

The province of Foggia is quite open to international trade: the trade balance in 2018 showed a surplus of approximately 109 million euro with exports that amounted to about 779 million euro and imports to 670 million euro. The EU-28 represents the most relevant market firms in terms of total trade (imports plus exports) followed by Asia and North America (Table 1). This heterogeneity in the access to foreign markets of individual firms has dramatic implications for the patterns of international trade.

While we are aware that EU countries play an important role of an outlet market for local agri-food production, we concentrate specifically on exports to extra-EU countries. In this case, the total export contract value has increased significantly in the recent years, moving from 4,604,282 euro in 2014 to 54,213,190 euro in 2019. As discussed in the introductory section, the reason for this stems from the fact that extra-EU markets are undoubtedly more challenging than the EU market. In particular, one of the most relevant prob-

Table 1

Trade partners for the province of Foggia in 2019 (thousand €)

Area	Import	Export	Net exports	Total trade
EU–28	515,604,633	439,680,335	–75,924,298	955,284,968
Asia	71,128,117	174,841,599	+103,713,482	245,969,716
North America	46,991,689	106,485,613	+59,493,924	153,477,302
European countries not belonging to the EU	14,817,749	28,962,389	+14,144,640	43,780,138
Africa	19,071,970	20,951,846	+1,879,876	40,023,816
South and Central America	2,225,596	4,563,530	+2,337,934	6,789,126
Oceania	146,643	4,027,449	+3,880,806	4,174,092
Extra EU–28	154,381,764	339,832,426	+185,450,662	494,214,190
Tot.	669,986,397	779,512,761	+109,526,364	1,449,499,158

Source: Foggia Chamber of Commerce, 2019.

lems faced by exporters is not just traditional import tariffs or quotas but discriminatory or disproportionate regulations or standards. Moreover, due to different legislative frameworks, cultural and taste barriers, higher transport and labelling costs, etc., success in exports to these extra-EU countries may considerably increase the competitiveness of local agri-food firms.

2.2. Data Description

Data used for our empirical analysis were provided by the Internationalisation Desk of the Foggia Chamber of Commerce and concern all local agri-food firms that have obtained a certificate of origin to sell their goods outside the EU from 2014 to 2019. Such certificates contain information regarding the product, its destination, and the country of export. They also attest that goods for export shipments have been produced, manufactured, or processed in a specific country; therefore, they essential in international trade transactions to certify the origin of the product and define the tariffs and other trade measures. Based on certificates of origin, we could obtain yearly information about destinations, type and amount of goods exported and export contract value (in euro) for any exporting firm from the province of Foggia. Thus, our final dataset included two distinct subsets: (i) the subset of the agri-food exporting firms and (ii) the subset of extra-EU destination countries.

The total number of firms in subset (i) was 117. All of them are micro firms (i. e., with less than 9 employees) and SMEs (i. e., with 10 to 250 employees) and belong to the following sectors: wine-must and table wine production; pasta factories; fruit and vegetable processing; oil mills; canning fruit and vegetables; canning fish and molluscs'; canning tomato.

Since some firms have exported to extra-EU countries only in specific years (and not continuously from 2014 to 2019), the yearly number of firms in the subset (i) has changed over time, ranging from a minimum of 48 in 2017 to a maximum of 60 in 2015. Similarly, the number of destination countries in the subset (ii) (72 in total) has changed over time, ranging from a minimum of 41 in 2015 to a maximum of 47 in 2019 and covering all five continents. Table 2 reports how many times the same exporting firm and the same destination country are present in the dataset across years.

Table 2

Frequency distribution of firms and countries in the dataset across years

No. of years	No. of exporting firms	No. of countries
1	45	16
2	25	12
3	12	5
4	7	3
5	7	16
6	21	20
TOT	117	72

Source: our elaboration based on data from the Foggia Chamber of Commerce.

Table 2 shows that 28 firms exported every year from 2014 to 2019, 31 firms in 2–5 years, 45 firms only in 1 year. Similarly, the number of countries that represented destination markets in all 6 years amounted to 20, in 2–5 years amounted to 36, while in only 1 year amounted to 16. These preliminary figures indicate a dynamism in the number of exporting agri-food firms: indeed, along with a number of firms regularly exporting to extra-EU markets (24 % of the total), most of local agri-food enterprises have exported goods only periodically. In contrast, the distribution of extra-EU destinations looks a bit more regular over time, since 50 % of countries in the dataset (36 out of 72) represent the same destination market in 5 or 6 years.

Subsets (i) and (ii) were combined into two different adjacency matrices that, in turn, were built for each year analysed. The first was a 0–1 matrix accounting for exports occurred from firm i to country j (= 1 if exports occurred; = 0 otherwise) and was used to define export relations. The second matrix accounted for the total amount of export contract value from firm i to country j and was used to weight the links among firms and countries.

2.3. SNA and Trade Flow

The empirical analysis was conducedconducted by using the SNA approach. In the last decades, this tool has emerged as a key technique in social sciences to investigate relationships in terms of nodes (individual actors in the network) and ties (relationships between actors). Hence, the emphasis lies on relationships and ties between actors in the network: in SNA, the quality of relations and the network architecture represent the main determinants of its usefulness to its participating individuals.

In this kind of analysis, the core unit of analysis is the social network defined as "a specific set of linkages among a defined set of persons with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the persons involved' [15, p. 2]. The following are some of the most relevant concepts of network analysis [16]:

— Actors and their actions are seen as interdependent rather than independent units.

— Relational ties between actors are channels for transfer or flow of resources (exports, in our case).

— Network models focusing on individuals view the network structural environment as a source of opportunities for, or constraints on, individual actions.

— Network models conceptualise structure as lasting patterns of relations among actors.

Therefore, the SNA method introduces an explicit formal way of measuring social structural properties (or actors in a given set). In other words, it models the relationships among a set of actors, describing the structure of the network. In light of this, this tool has been extensively used to visually investigate trade flows due to its flexibility and ability to represent trade relations among actors and countries, enabling the exploration of the entire pattern of connections [17]. Some studies (for instance, [2, 18, 19]) argue that gains from trade in terms of competitiveness for a region depend not only on the degree of trade openness, but also on the number of trading partners and the characteristics of trade itself. More specifically, for some authors [20] the number of trading partners is positively associated with higher growth rates and this positive economic trend is the result of exposure to better technologies, expanded market access, and higher levels of competition. Compared to the standard international trade statistical methods of investigation, the SNA allows exploring not only first-order phenomena associated with import-export patterns of any given country (e. g., the degree of trade openness) but also second- and higher-order empirical facts concerning, for instance, the extent to which highly connected countries tend to trade with poorly connected ones [2]. Moreover, when networks are composed of two subsets of actors (as occurs in our case where we deal with the subset of the agri-food exporting firms and the subset of destination countries), it is possible to yield insights in terms of heterogeneity among firms and countries in trade flows [20]. This kind of networks, also known as "two-mode", "affiliation", or "bipartite" networks [21, 22, 23], indeed, enables the identification of relationships between nodes that belong to different sets, i.e., all possible firms-countries links.

In this way, the use of the SNA allowed us to gather information about the network of exporting firms and its evolution over time that cannot be identified from aggregate export data and descriptive statistics alone. In particular, we could explore how the structural characteristics of the network have evolved by calculating a number of relevant networking indexes for each year from 2014 to 2019.

The research on complex networks has developed a rich set of quantitative metrics aimed at describing their main structural characteristics. Tracking of such aggregate metrics over time can also shed light on the dynamics of patterns of network formation. More precisely, we started from the network size by looking at the total number of nodes and links where nodes are defined by the agri-food exporting firms and the extra-EU destination countries, while links are represented by the existence or not of underlying trade relations among them. In this way, we could identify whether the network is small (i. e., if it has up to ten nodes), middle sized (i. e., if it includes hundred nodes) or large (i. e., if it contains thousands or millions of nodes) [24]. Additionally, we checked for network density, looking at the ratio between the number of realised links and the number of maximum possible links.

We then measured network centrality by looking at the position of each vertex i with respect to

the whole network or its neighbourhood. In this way, we could capture a node's structural importance by evaluating its involvement in the network's walk structure [25]. It is worth noting that in case of two-mode networks, centrality measures of both actors and events should be investigated [26]. In other words, it is important to measure centrality either of the firms or of the countries based on the ties between them. For the aims of this study, we calculated two indexes. The first is the average distance or the length of the shortest path between two nodes that shows how easily a node can reach other nodes [25]. Starting from the average distance, the average geodesic distance is simply its average over all nodes. It is a measure of how close nodes are to each other in a network and could be seen as a measure of economic integration. The second is the centrality degree (how connected a node is) to quantify an individual node's prominence within the network by summarising structural relations among the nodes. Centrality degree, which is also designated as the node degree, is the simplest form of centrality. Despite its simplicity, this index in trade networks allows for the identification of the most important target countries of agri-food exports from a specific company or territory in each period.

To examine the proximity of pairs of actors, we also measured the network diameter, which indicates how far two nodes are. Diameter is a metric of particular interest in case of dynamic analysis like ours: sparser networks should have generally greater diameter compared to full matrices; hence, diameter should decrease over time despite the increase in the number of nodes [27].

Finally, since networks (besides having a complex structure) may present large heterogeneity in the capacity of relations, we weighted the network to assess the possible difference in the intensity of links [17]. In other words, we considered not only the existence of links among nodes (binary relation), but also the strength of connections among them, measured through the export contract value. This allowed us to present more detailed insights on the topological structure of the network. A relevant problem in assessing changes in the network structure is that the dataset is unbalanced since, as discussed in the previous section, the number of nodes and the exports value have changed over time. This might have been the consequence of firms' strategic decisions about exporting and, in this case, about the destination country. On the one hand, the change in the number of vertices is per se a relevant change in the network structure; on the other end, the consideration of countries that were present over the entire time period analysed could artificially limit the network by introducing an additional bias.

3. Results

Once organised in adjacency matrixes, the data on the agri-food firms and the extra-EU destination countries were elaborated through UCINET 6, the software package developed by Borgatti et al. [28] that allowed us to calculate network indexes and draw sociograms. We started from identifying the main structural characteristics of the network over time, as reported in Table 3.

Table 3

Structural properties of the network over time

	Number of ties	Density	Average distance	Diameter
2014	113	0.049	4.377	10.00
2015	124	0.050	3.991	9.00
2016	136	0.055	3.408	8.00
2017	133	0.064	3.366	6.00
2018	126	0.055	3.737	8.00
2019	164	0.065	3.285	8.00

Source: our elaboration based on data from the Foggia Chamber of Commerce.

According to our findings, the network can be classified as middle sized due to the existence of 133 ties on average, with the number of ties that has significantly raised in 2019 (+23 % compared to 2017; +30 % compared to 2018). In contrast, density seems small (0.06 on average) suggesting the existence of a sparse network with many still exploitable trade links. However, the network seems to have improved its structure over time since the average distance among actors (3.7 on average) has reduced from 4.4 in 2014 to 3.3 in 2019. This improvement is supported also by the reduction in the diameter that has reduced from 10.00 to 8.00 in the same period. However, the diameter still looks too large, suggesting that overall the network is not compact and requires many steps to get from one side of it to the other.

Tables 4 and 5 report the prominence evolution in the network of the firms and countries respectively by listing the ten nodes with the highest centrality degree.

Table 4 demonstrates that three firms (specifically No. 103, No. 81, and No. 66) have remained the most central within the network over time. Therefore, these companies play a key role in fostering the agri-food exports of the province of Foggia towards extra-EU countries. Along with them, we may observe the presence of some relevant enterprises (e. g., No. 24, No. 27, No. 53) that have significantly contributed to the local agri-food exports having occupied a central po-

Table 4

Centrality degree of firms

No.	2014		2015		2016		2017		2018		2019	
	Firm	Centr. degree	Firm	Centr. degree	Firm	Centr. degree	Firm	Centr. degree	Firm	Centr. degree	Firm	Centr. degree
1	103	0.227	103	0.317	103	0.326	103	0.372	103	0.378	92	0.404
2	32	0.182	108	0.171	66	0.217	81	0.233	81	0.222	103	0.340
3	53	0.159	81	0.146	81	0.196	66	0.209	66	0.222	66	0.255
4	81	0.136	27	0.146	27	0.152	27	0.209	27	0.133	27	0.149
5	65	0.136	75	0.122	54	0.109	54	0.186	33	0.111	81	0.149
6	24	0.136	66	0.122	108	0.109	75	0.140	54	0.111	45	0.128
7	119	0.091	24	0.098	18	0.087	54	0.186	75	0.111	89	0.128
8	96	0.091	45	0.098	24	0.087	33	0.116	89	0.089	118	0.128
9	66	0.091	53	0.098	65	0.087	18	0.093	108	0.089	53	0.106
10	20	0.068	18	0.073	107	0.087	24	0.093	118	0.089	119	0.106

Source: our elaboration based on data from the Foggia Chamber of Commerce.

Table 5

Centrality degree of countries

No.	2014		2015		2016		2017		2018		2019	
	Country	Centr. degree	Country	Centr. degree	Country	Centr. degree	Country	Centr. degree	Country	Centr. degree	Country	Centr. degree
1	China	0.327	China	0.333	China	0.426	China	0.313	China	0.314	China	0.407
2	UAE	0.212	UAE	0.283	UAE	0.241	UAE	0.292	Russia	0.196	UAE	0.278
3	Russia	0.135	Brazil	0.117	Japan	0.167	Russia	0.271	Japan	0.137	Russia	0.204
4	Brazil	0.135	Ukraine	0.100	Russia	0.148	Ukraine	0.167	UAE	0.137	Brazil	0.167
5	Hong Kong	0.096	Russia	0.100	Brazil	0.148	Brazil	0.167	Brazil	0.137	Saudi Arabia	0.167
6	Colombia	0.096	Saudi Arabia	0.083	Hong Kong	0.130	USA	0.104	Colombia	0.118	Japan	0.148
7	USA	0.077	Taiwan	0.067	Colombia	0.093	Japan	0.104	Albania	0.118	Colombia	0.111
8	Ukraine	0.077	Hong Kong	0.067	Saudi Arabia	0.074	Egypt	0.104	Ukraine	0.078	Albania	0.111
9	Japan	0.077	Japan	0.067	USA	0.056	Colombia	0.104	Taiwan	0.078	Hong Kong	0.093
10	Egypt	0.077	Colombia	0.067	Israel	0.056	Saudi Arabia	0.104	Singapore	0.059	India	0.093

Source: our elaboration based on data from the Foggia Chamber of Commerce.

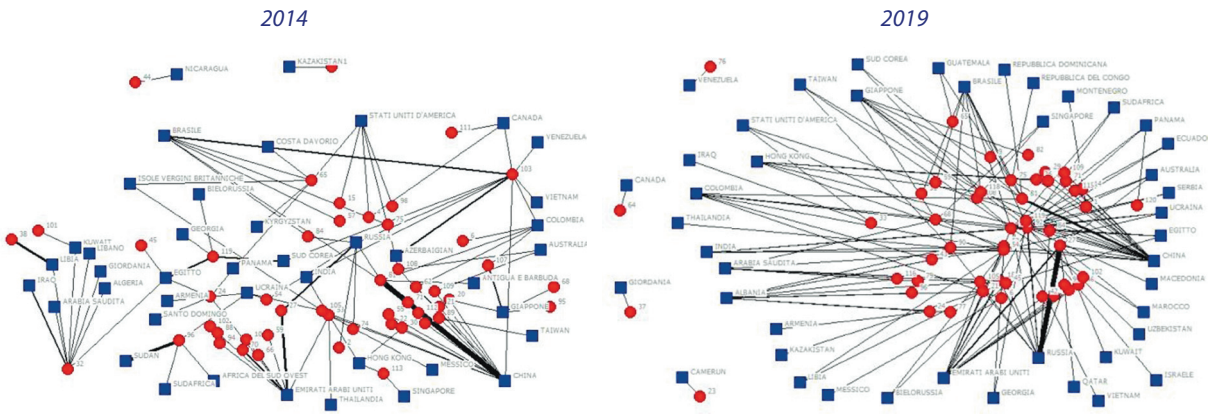

Fig. 2. *Evolution of the network weighted through export contract value*
Source: our elaboration based on data from the Foggia Chamber of Commerce

sition in the network although only periodically. Similar considerations can be made for the countries. Table 5 shows that the most relevant extra-EU markets for the local agri-food exporters are China, United Arab Emirates, Russia, and Brazil.

Finally, Figure 2 compares the sociograms for 2014 and 2019, showing that the network has evolved when the strength of connections among nodes (measured in terms of export contract value) has been taken into account.[1]

Based on Figure 2, most of export value in 2014 was addressed to China while, in 2019, it mainly reached Russia. More notably, it is clear that the network structure has improved over time since the export contract value is more evenly distributed among firms and countries. However, despite such general improvement, we can observe that many firms rely mainly on a single market, especially the most relevant countries in the network in terms of export contract value like China, Russia, United Arab Emirates, Brazil, and Japan. This means that the application of import tariffs/quotas or the implementation of any discriminatory or disproportionate regulation or standard in one of the aforementioned countries may severely affect the network. It can cause a general decrease in the export values as well as lead to disconnection of local firms: indeed, after removing these markets from the network, a significant number of firms will be isolated and the network will become more fragmented with a further weakening of the local economy.

4. Discussion and concluding remarks

The analysis of the two-mode network (agri-food companies/extra-EU destination countries) has highlighted a number of relevant outcomes.

Firstly, we have found that the structural properties of the network under investigation have remarkably enhanced over time. However, while the average number of trade relationships has increased, their average intensity has remained unchanged. The higher density indicates an increase in the number of links and, hence, in the number of exports towards extra-EU destination countries. This suggests the existence in the network of more competitive-minded entrepreneurs whose willingness to accept the challenges arising from extra-EU markets has raised over time. Moreover, the use of the SNA has allowed us to identify the firms and countries that occupy a strategic position within the network. These actors are crucial for the network's survival since their removal could make the network more fragmented and disconnected.

The analysis has revealed other interesting findings. In particular, five most central enterprises have improved their export flows from 2014 to 2019 suggesting that firms producing typical "Made in Italy" agri-food goods (especially pasta and wine) are creating new opportunities overseas, further improving their position in the network. Despite their smaller size compared to most of their northern Italian competitors, these firms are export leaders at the local level and are among the few enterprises to sustain large costs associated with exports towards extra-EU economies.

Regarding destinations, the most relevant export markets in the six years analysed have been China, United Arab Emirates, Russia, Brazil, and Japan. It is worth noting that the export contract value of local firms towards these countries has improved over time despite cultural and religious differences that can make export flows more difficult. However, the aforementioned countries represent the only destination market for many firms in the network, above all, for the most relevant

[1] Sociograms for years 2015–2018 are available on request.

ones in terms of export contract value. This fact indicates a serious shortcoming since the adoption of trade barriers in some of these markets may significantly affect the network architecture by disconnecting the most important local enterprises. From this point of view, the current network structure is not satisfactory yet since it relies for the most part on the connections among a few leading firms towards a limited number of relevant countries. In contrast, the diversification of export markets could significantly reduce the trading risk associated with exports to extra-EU countries. Similarly, the diversification in the export contract value across a larger number of local firms might contribute to limiting the possibility of a network's collapse due to a leading firm's dropout. In this perspective, a winning strategy for local firms may consist in creating producers' consortia to lower the costs associated with the internationalisation process and enter foreign markets with higher production quantities to meet local demand. Indeed, as highlighted in the introduction section, the saturation in the domestic market, along with the considerable attention paid by foreign consumers towards "made in Italy" food and wellness, encouraged many Italian enterprises to look for profitable foreign markets. In this context, prices represent a key factor: if the price is too high, the presence of Italian products could drive enterprises with the highest prices to exit the market and lead cause a reputation loss in that market. Very small firms such as those located in the province of Foggia risk to bear very high costs of entering these markets, which could not be accompanied by revenues. In this framework, the creation of producers' consortia may therefore significantly reduce costs and risks related to the internationalisation. Moreover, the concentration of firms in a particular geographic region may lead to the creation of externalities (e. g., easier access to information, knowledge shared among companies, collaboration between companies and scientific institutions) and positively affect firms' location in the neighbouring regions and their business results and export competitiveness. On this ground, local institutions like the Chamber of Commerce play a significant role, as they promote a continuous flow of information exchange among local entrepreneurs in terms of certifications and consumer tastes that other local companies should try to satisfy, or in terms of countries with which preferential trade links should be strengthened.

Even though we focused on a small region with a strong agri-food and export vocation, our investigation does is particularly relevant not because of the results achieved from the specific case study (which may have a limited territorial interest) but because of some presented methodological aspects. Indeed, the SNA has allowed us to investigate the structural properties of trade relations and the interdependence among exporting firms and destination countries as well as to highlight the evolution of such structural properties over time. Therefore, the real value-added stemming from our research concerns the use of the SNA indexes and properties to investigate the trade network; it is valuable as a complementary method to other traditional empirical tools. In this way, it represents an innovative approach for investigating trade flows and studying the economic performance of specific regions.

Further research could focus on different strategies that could be implemented at the national and local levels to enhance the trade network's sustainability and resilience to sudden external shocks.

More specifically, a first step in this direction could be the analysis of the impact of the current pandemic on trade flows exploring how the analysed network has evolved after the implementation of different restrictive measures that countries around the world have taken to prevent the COVID-19 spread and that have negatively affected international trade.

References

1. Zouaghi, F. & Sánchez, M. (2016). Has the global financial crisis has different effects on innovation performance in the agri-food sector by comparison to the rest of the economy? *Trends in Food Science & Technology, 50,* 230–242.

2. Fagiolo, G., Reyes, J. & Schiavo, S. (2010). The Evolution of the World Trade Web. A Weighted-Network Analysis. *Journal of Evolutionary Economics, 20(4),* 479–514.

3. Serrano, R., Fernández-Olmos, M. & Pinilla, V. (2018). Internationalization and performance in agri-food firms. *Spanish Journal of Agricultural Research, 16(2),* 459–470. DOI: https://doi.org/10.5424/sjar/2018162–12206

4. Heyder, M. & Theuvsen, L. (2011). Strategies and Challenges of Internationalisation in BRIC-Countries: Empirical Results from the German Agribusiness. In: *Will the "BRICs Decade" continue? — Prospects for trade and growth" 23–24 June 2011.* Halle (Saale), Germany

5. Fliess, B. & Busquets C. (2006). *The Role of Trade Barriers in SME Internationalisation.* OECD Trade Policy Papers, No. 45, OECD Publishing, Paris, 21. DOI: https://doi.org/10.1787/246707602042.

6. Paul, J., Parthasarathy, S. & Gupta, P. (2017). Exporting challenges of SMEs: A review and future research agenda. *Journal of World Business, 52,* 327–342.

7. Roudsari, A. H., Vedadhir, A., Amiri, P., Kalantari, N., Omidvar, N., …, Hani Sadati, S. M. (2017). Psycho-Socio-Cultural Determinants of Food Choice: A Qualitative Study on Adults in Social and Cultural Context of Iran. *Iran Journal of Psychiatry, 12(4),* 241–250.

8. Serrano, R., Acero, I. & Fernandez-Olmos, M. (2016). Networks and export performance of agri-food firms: New evidence linking micro and macro determinants. *Agricultural Economics, 62(10),* 459–470. DOI: 10.17221/71/2015-AGRICECON.

9. Porter, M. (1990). *The Competitive Advantage of Nations* (First Free Press Edition 1990). New York: Free Press, 906. DOI: https://doi.org/10.1007/978–1-349–11336–1.

10. Coltorti, F. & Venanzi, D. (2017). Productivity, Competitiveness, and Territories of the Italian Medium-Size Companies. *International Journal of Economics and Finance, 9(12),* 1–17.

11. Casella, A. & Rauch, J. E. (2002). Anonymous Market and Group Ties in International Trade. *Journal of International Economics, 58(1),* 19–47.

12. Lovric, M., Da Re, R., Vidale, E., Pettenella, D. & Mavsar, R. (2018). Social network analysis as a tool for the analysis of international trade of wood and non-wood forest products. *Forest Policy and Economics, 86,* 45–66.

13. De Benedictis, L., Nenci, S., Santoni, G., Tajoli, L. & Vicarelli, C. (2013). *Network Analysis of World Trade using the BACI-CEPII dataset.* Working Papers 2013–24, CEPII research center, 60.

14. ISTAT (Italian National Statistics Institute). (2020). *Trend in the Agricultural Economy-Year 2019.* Retrieved from: https://www.istat.it/it/files//2020/06/Trend-agricultural-economy.pdf (Date of access: 10.12.2020).

15. Mitchell, J. C (1969). *Social Network in Urban Situations.* Manchester: Manchester University Press, 378.

16. Wasserman, S. & Faust, K. (1994). *Social Network Analysis: Methods and Applications.* Cambridge: Cambridge University Press, 852.

17. de Andrade, R. L. & Rêgo, L. C. (2018). The use of nodes attributes in social network analysis with an application to an international trade network. *Physica A: Statistical Mechanics and its Applications, 491,* 249–270.

18. Arora, V. & Vamvakidis, A. (2005). How Much Do Trading Partners Matter for Economic Growth? *IMF Staff Papers, 52,* 25–40.

19. Kali, R., Mendez, F. & Reyes, J. (2007). Trade structure and economic growth. *Journal of International Trade and Economic Development, 16,* 245- 270.

20. De Benedictis, L. & Tajoli, L. (2016). Comparative Advantage and Centrality in the World Network of Trade and Value Added: An Analysis of the Italian Position. *Rivista di Politica Economica, 66(3),* 1–36.

21. Borgatti, S. P. & Everett, M. G. (1997). Network analysis of 2-mode data. *Social networks, 19,* 243–269.

22. Latapy, M., Magnien, C. & Del Vecchio, N. (2008). Basic notions for the analysis of large two-mode networks. *Social Networks, 30(1),* 31–48.

23. Borgatti, S. & Halgin, D. (2011). Analyzing Affiliation Networks. In: *The Sage Handbook of Social Network Analysis.* SAGE Publications Ltd. 10.4135/9781446294413.n28.

24. Vega Redondo, F. (2007). *Complex Social Networks.* New York: Cambridge University Press, 316.

25. Borgatti, S. P. & Everett, M. G. (2006). A graph-theoretic framework for classifying centrality measures. *Social Networks, 28(4),* 466–484.

26. Faust, K. (1997). Centrality in affiliation networks. *Social networks, 19,* 157–191.

27. Leskovec, J., Kleinberg, J. & Faloutsos, C. (2005). Graphs over time: densification laws, shrinking diameters and possible explanations. In: *Proceedings of the eleventh ACMSIGKDD international conference on Knowledge discovery in data mining* (pp. 177–187). ACM.

28. Borgatti, S. P., Everett, M. G. & Freeman, L. C. (2002). *UCINET for Windows: Software for Social Network Analysis.* Harvard, MA: Analytic Technologies.

About the Authors

Roberta Sisto — PhD in Agricultural Engineerings; Associate Professor of Agricultural Economics, Department of Economics Management and Territory, University of Foggia; Scopus Author ID: 15726903400; http://orcid.org/0000–0002–1112–0919 (11, A. da Zara St., Foggia, 71121, Italy; e-mail: roberta.sisto@unifg.it).

Alba Marseglia — Export Management and International Markets Expert, Cesan, Foggia Chamber of Commerce (7, Michele Protano St., Foggia, 71121, Italy; e-mail: alba.marseglia@fg.camcom.it).

Edgardo Sica — PhD in Economics and Technologies for the Sustainable Development; PhD in Technology and Innovation Management; Assistant Professor of Economics, Department of Economics Management and Territory, University of Foggia; Scopus Author ID: 26039580300; http://orcid.org/0000–0001–9054–8309 (11, A. da Zara St., Foggia, 71121, Italy; e-mail: edgardo.sica@unifg.it).

Информация об авторах

Систо Роберта — PhD в области сельскохозяйственных наук; доцент сельскохозяйственных наук, кафедра экономики и управления территорией, Университет Фоджи; Scopus Author ID: 15726903400; http://orcid.org/0000–0002–1112–0919 (Италия, 71121, г. Фоджа, ул. А. да Зара, 11; e-mail: roberta.sisto@unifg.it).

Марселья Альба — эксперт в области управления экспортом и международными рынкам, Cesan, Торговая палата Фоджи (Италия, 71121, г. Фоджа, ул. Микеле Протано, 7; e-mail: alba.marseglia@fg.camcom.it).

Сика Эдгардо — PhD в области экономических наук и технологий устойчивого развития; PhD в области управления технологиями и инновациями; доцент, кафедра экономики и управления территорией, Университет Фоджи; Scopus Author ID: 26039580300; http://orcid.org/0000–0001–9054–8309 (Италия, 71121, г. Фоджа, ул. А. да Зара, 11; e-mail: edgardo.sica@unifg.it).

Дата поступления рукописи: 14.12.2020.
Прошла рецензирование: 09.01.2020.
Принято решение о публикации: 23.03.2021.
Received: 14 Dec 2020
Reviewed: 09 Jan 2021
Accepted: 23 Mar 2021