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Economic intelligence index and trade flow analysis

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Abstract. The aim of the research is to explore the natural predisposition of the world's nations to implement an effective and efficient Economic Intelligence strategy, through the calculation of an index that measures the country's position in the network of international relations. Economic Intelligence is a new discipline introduced by scholars in order to support the national governments through new information bases designed to succeed in the complex economic environment following the development of globalization. Given that a central role in the international economic relations' network provides a privileged position for acquiring information useful for supporting the logical aspects of strategic planning, a country with such a role has a natural predisposition to develop a successful Economic Intelligence strategy. Thus, the subject of the research focuses on analysing that predisposition by measuring the significance of the position occupied by a country in the global trade network. For that purpose, the methodology of the Social Network Analysis is used. The assumption is that by calculating the Economic Intelligence Index, that is a weighted average of the main centrality indexes related to each country within the global trade network, it is possible to measure a national entity's inclination to developing a sound Economic Intelligence strategy. The basic conclusion of the

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article highlights that, notwithstanding the fact that a prominent role in the global trade network is occupied by the major countries in terms of commercial importing value, other countries characterized by a significant Economic Intelligence Index could be in a position to develop a successful Economic Intelligence strategy.

Keywords: economic intelligence, international relations, social network analysis, global trade, globalization, regionalism.

JEL Classification: F02

1. INTRODUCTION

In the last decades, and particularly after the fall of the Berlin Wall in the 1989, the expansion of the globalization phenomenon has started to revolutionize the world economy, making the different national economies more interconnected and, in the process, increasing the complexity of the external environment (Starostina and Adami, 2016). The international relations among countries have become more pronounced, raising the need for a new strategic approach to interactions in the multifaceted world. Economic Intelligence (EI) is a new discipline introduced by scholars and practitioners, in order to support the national governments with new information bases and theoretical approaches designed to succeed in a complex environment. The significance of the discipline is further increasing thanks to the development of information and communication technologies, through which the better part of the national intelligence needs can be satisfied by open-source intelligence (OSINT), that is appropriate less expensive legal methods. In fact, the informatic evolution and the growth of the Internet have increased the volume of data and intelligence generated from public or open-source information, such as articles published in the media, governmental agencies' reports, and any other piece of knowledge provided by public studies, websites, thesis, books, maps, and satellite images.

As a consequence, each national entity, with its own culture, traditions, resources, and history, has adopted a specific model of EI aimed at obtaining a competitive advantage over other states. Thus, different approaches to EI can be individuated by analysing the behaviours and the dissimilar political and economic strategies approved by countries: each one is in part the result of a deliberate choice adopted by the country on the basis of the level of awareness about the importance of EI and, to some extent, and more significantly for this article, the unintentional consequences of the specific position occupied within the network of international economic relations.

The purpose of this article lies precisely in measuring the predisposition of the world's nations to implementing an effective and efficient EI strategy, designed to influence the economics of the rest of the world, by quantifying the importance of the position of each national entity in the system of the global relations by means of an Economic Intelligence Index (EII), computed as a weighted average of the main centrality indexes of the network. A significant position of a country in the network constitutes potential advantages versus other states, in terms of information asymmetry, which means a major capacity to support the national governments with new information bases and theoretical approaches designed to succeed in the more complex economic environment following the development of globalization. Thus, the hypothesis adopted in the present article consists in the assumption that by calculating and measuring the main centrality indexes related to each country within a network representing the world linkages, it is possible to evaluate the stance of a national entity in the international economic relations' system and, in the process, its inclination to develop a sound and proper EI strategy. Different types of webs of relations can be used

for measuring the EII. Those networks could be organized in the following macro-categories: i) transportation networks, such as the street network, the international naval routes, the air transport intercity linkages; ii) information and technology networks, for example the internet backbone network, or the web of international digital standards and protocols; iii) resources networks, like global trade network, raw material networks, international gas pipeline, energy commercial partnerships; iv) cultural networks, established on the basis of similar traditions, same spoken language, common religion, etc.; v) legal and political networks, deriving from bilateral or multilateral agreements, or from belonging to the same international organization or within the same regional area. Due to the importance of the commercial flows among countries in establishing a valuable network of liaisons to be used as a channel for exploiting EI strategies, in the present article the network of world trade network is going to be analysed.

Thus, the present article displays the potential level of predisposition of the main national entities to take advantage of informative asymmetries towards the rest of the world. More specifically, the following three aspects are illustrated in the article: (i) the theoretical background of globalization, regionalization and EI; (ii) the specific methodology of the Social Network Analysis (SNA) used to measure the country's capability to develop EI strategies, represented by the EII; (iii) the conclusions of the study.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Theoretical background

The expansion of the globalization phenomenon in the last decades has had an extraordinarily strong impact in the design of the system of the international economic relations. In fact, in a global world, the nations have started to see an erosion of their traditional central position, and due also to the associated development of the information technology and the Internet, the states' concerns have shifted, from a geopolitical logic of territorial expansion, to a geo-economic strategy of research and occupation of privileged positions in the world economics. However, in order to support the logical process of strategic planning, aimed to conquer new economic areas and to further increase the economic power of nations, there is the need of qualitatively new channels to collect information, and new methods to use them. Economic Intelligence, the most important component of geo-economics, has been developed for that purpose. The main aim of EI consists, in fact, in the development of networks for the search and the use of information, in order to support the decision-maker in the more complex international relationships resulting from the globalization.

The globalization is not a new aspect in the human history, in consideration to the fact that multiple stages of this event can be found in the past. For example, between the '800 and the '900, there was a huge development of social interactions, associated to the spread of new methods of communication (such as the telegraph), and new means of transport (like ships and railways, which used the power of the steam engine). More relevant, at the end of the second post-war period, the national entities began to reinforce their relations according to a more stable and formalized approach, which gave to the birth of the United Nations (political aspect), and the Bretton Woods conference (economic side).

Nevertheless, there are two factors that makes the recent wave of this phenomenon so specific, requiring a different approach of analysis of the problem. First of all, the new form of globalization is characterised by a greater multidisciplinary and a larger size. In fact, the latter is not assumed, in a restrictive sense, as a simple economic integration between states and intensification in trade among different countries, but as expansion in international mobility of capitals, means of production, and people. Secondly, notwithstanding the fact that the globalization has recently growth under the aegis of the liberal economic principles and the revamping of the original theories about the free trade by Francois Quesnay and Adam

Smiths, the multiplication of the economic, commercial, political, and socio-cultural interactions between the different national entities has promoted the creation of a variety of pathways of regionalization. That represents a contradictory and controversial aspect of the globalization. In fact, from one side globalization plays the role of catalyst for the integration of the international economic relations among different countries, and diffuser of liberal economic theories; from the other it is the cause of the developing of new regionalisms, which will represent a significant challenge to the traditional nation-state actors (Breslin et al., 2002).

It is interesting that the dynamics of regionalisation started to play a more significant role just after the 1989, coherently with the imaginary watershed of the evolution of the international economic relations in a more complex environment, due to the acceleration of the globalization processes, individuated in the present article with the fall of the Berlin Wall. It is, in fact, in 1989 that a regional economic forum encompassing 21 members, the Asia-Pacific Economic Cooperation (APEC), was established in order to create greater prosperity for the people of the region by promoting balanced, inclusive, sustainable, innovative and secure growth and by accelerating regional economic integration. In South America, in 1991, MERCOSUR was created among Argentina, Brazil, Paraguay, Uruguay (and subsequently Bolivia, Chile, Peru, Colombia, Ecuador, Venezuela) with the purpose to design a common market without duties. In 1992 the Southern African Development Community (SADC), a regional economic community comprising 15 member states (Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe), was established to promote the regional integration and the poverty eradication through economic development and ensuring peace and security. On February 1992, the Treaty on European Union (Treaty of Maastricht) was signed by the members of the European Community in Maastricht, Netherlands, to further reinforce the European integration, forming the constitutional basis of the European Union (EU) and creating the three pillars structure of the common market, common foreign and security policy, and cooperation in the fields of justice and home affairs. On January 1994, the NAFTA (North Atlantic Free Trade Area), a treaty among the United States, Canada, and Mexico, with the purpose of progressively eliminating tariffs, duties, and quantitative restrictions, entered into force. Again, in the 1990s, the Association of Southeast Asian Nations (ASEAN), originally established in 1967 in Bangkok, Thailand, with the aim to accelerate the economic growth, the social progress and the cultural development in the region, increased the number of its partners to ten members (Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei Darussalam, Viet Nam, Lao PDR, Myanmar, and Cambodia). In Table 1, the most important forms of regionalisms are described.

As a consequence of the multiplication of interactions among countries, and due to the creation of new regional entities, the new global environment turns out to be represented by a multi-layered outcome, resulting from the conflict of globalisation and regionalisation processes. The American political scientist Samuel P. Huntington (Huntington, 1997) describes the contemporary scenario as the clash of civilizations. The erosion of national borders and the diffusion of principles of liberal democracy following the globalization contribute to the consolidation of the regional dimension and, as a consequence, to the partial loss of power of traditional national entities in favour of new emerging actors, which are more effective and capable to operate in the current competitive landscape: big corporations; financial intermediaries; supranational and transnational organizations; regional entities. For those reasons, in order to avoid disappearing among the various levels of the world system, each nation should learn to interact in the new scenario by developing new methods of collection and analysis of information, and to create and use informative asymmetries with the purpose of conquering new spaces in the international relation system.

Table 1

Regionalisms in the World

International Agreement	Countries Involved	Agreement Purposes	Date/Year of Entry into Force
NAFTA *North American Free Trade Agreement*	Canada Mexico United States	Elimination of barriers to trade and to investments among member countries in order to strengthen economic growth and create new jobs.	January 1, 1994
GATT *General Agreement on Tariffs and Trade*	Some of the first signatories: Australia, Belgium, Brazil, Canada, Czechoslovakia, Chile, China, Cuba, France, India, Italy, Luxembourg, Norway, New Zealand, Netherlands, Pakistan, United Kingdom, Syria, United States, South Africa	International trade in goods. The peculiarities of this agreement are "*the principle of the most favored nation*" and "*the principle of non-discrimination*"	Between 1947 and 1994, in various sessions called "Rounds"
MERCOSUR *Mercado Común del Sur (Southern Common Market)*	Brazil, Argentina, Venezuela, Paraguay, Uruguay	Promote free trade and the fluid movement of goods, people, and currency. It is now a full customs union and a trading bloc.	March 26, 1991
EU *European Union*	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK	Ensure the free movement of people, goods, services, and capital within the internal market, enact legislation in justice and home affairs, and maintain common policies on trade, agriculture, fisheries, and regional development.	From January 1, 1958
ECOWAS *Economic Community of West African States*	Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo	Promote economic integration across the region for "collective self-sufficiency" for its members by creating a single trade bloc by building a full economic and trading union.	July, 1995
AFTA *ASEAN (Association of Southeast Asian Nations) Free Trade Area*	Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Myanmar, Cambodia, Laos, Vietnam	Increase ASEAN's competitive edge as a production base in the world market through the elimination, within ASEAN, of tariffs and non-tariff barriers; and attract more foreign direct investment to ASEAN.	1992
APEC *Asia-Pacific Economic Cooperation*	Australia, Brunei, Canada, Chile, China, South Korea, Philippines, Japan, Hong Kong, Indonesia, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Russia, Singapore, United States, Taiwan, Thailand, Vietnam	Promotes free trade throughout the Asia-Pacific region. It is based on the three pillars: trade and investment liberalization, business facilitation, and economic and technical cooperation.	1993
SADC *Southern African Development Community*	Angola, Botswana, Comoros, Democratic Republic of the Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe	Further socio-economic cooperation and integration as well as political and security cooperation among 16 southern African states.	1992

Source: Author's owner

EI is a new subject proposed by academics and professionals with the purpose to provide the national governments with new information bases necessary to conquer a competitive advantage towards other states in the new complex environment of global markets and regional economies. The adoption of specific

approaches of EI to take advantage against foreign countries are in part the result of a deliberate choice adopted by the country, on the basis of its own culture, traditions, resources, history, and awareness about the importance of EI, and to some extent, and more significant for this article, the unintentional consequence of the specific position occupied within the network of international economic relations.

The purpose of this article consists precisely in measuring the predisposition of the world's nations to implement an effective and efficient EI strategy, by quantifying the importance of the position of each national entity in the system of the global relations. In order to do that, various types of existing networks of relations among countries can be used as base to measure the position, and in the process, the inclination of the national entity to play an active role in term of EI approach. Thus, for example, based on the different objects of analysis we can identify a network of the world Internet backbone, which shows the most significant actors (countries) in the growth and development of the information and communication technologies; or a network of the air transport intercity linkages, which could be used as a proxy for individuating the states that have a major control on the people-flow movements. In this article, instead, in order to measure the potentiality of a national entity to influence the economy of other countries in the world, an analysis of the international trade network is conducted.

2.2. Literature review

Notwithstanding the fact it is generally accepted that the development of the EI studies started rather recently, following the fall of the Berlin Wall, numerous analyses have been conducted both by academics and practitioners, especially in the last decade. The theoretical investigations carried on by scholars, in fact, have been subsequently examined, monitored, and operationally implemented by governments.

Different disciplines offered their contributes to the development of a theory of EI, or to the intelligence study more in general. In particular, the subjects of history, thanks to the work of Robert C. Knight (Hinsley et al., 1979), Ernest R. May (May, 1985), Chrisopher Andrew (Andrew, 1986), and the field of international relations, due to the influence of Lock K. Johnson (Johnson, 2009), Umberto Gori (Gori, 2016), Jennifer Sims (Sims, 2009), have played the most significant role in developing a body of doctrine and elaborating techniques of analysis. Interesting contributes have been also provided by the sociology, with the studies conducted by James Sheptycky (Sheptycky, 2009), and by the organizational theory, due to the results of Harold L. Wilensky (Wilensky, 2015), Glenn Hastedt and B. Douglas Skelley (Hastedt and Skelley, 2009).

Numerous other disciplines, such as political science (Johnson, 2007), criminology (Sidoti, 2016), pedagogic (Spadafora, 2016), juridical science (Mosca, 2016), ICT studies (Iovane, 2016), economics (Davies, 2009), ethnography (Johnston, 2005), anthropology (Price, 2011), and psychology (Agostini and Galmonte, 2016) have started to take place using their own methodological approaches and models to conduct analyses in the field of intelligence studies. A significant part of the academic literature, in particular, has started to focus on the open-source intelligence (Norton, 2011), due to the increase in its use by national entities (Bazzell, 2015), military organizations (Nacci, 2017), private corporations and international organizations. Thus, for example, some studies have paid attention to the limits of the OSINT techniques (Hulnick, 2002 and Miller, 2018); others, instead, have analysed the evolution of the OSINT (Schaurer, 2021) and its role in the cyberspace (Teti, 2015).

More significant, for the purpose of this article, , it is worth to mention as more representative among the various and important contributes: Carlo Jean (Jean, 2012), for having introduced the concept of Geoeconomics; Paolo Savona (Jean and Savona, 2011) and his philosophical approach to EI; Philippe Clerc (Clerc, 1997) and his macroeconomic view of EI; Mauro Morbidelli (Morbidelli, 2005) and Evan Potter

(Potter, 1998) for their comparative analysis of national EI systems; Henry Martre (Gagliano, 2013), who has raised the issue of the importance of the national EI awareness.

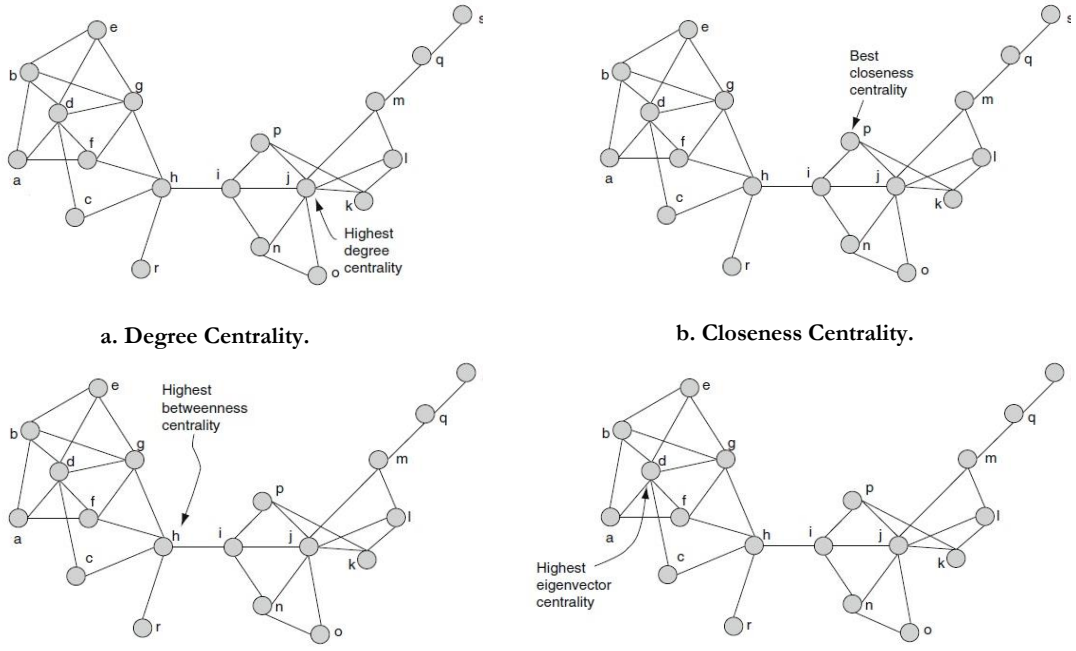
3. METHODOLOGY

The specific methodology used to measure the significance of the position occupied by a country in the global trade network is based on the Social Network Analysis (SNA) (Wasserman and Faust, 1994). The SNA is a modern instrument used for the study of social relationships, and it is applied in different sectors of the social sciences: sociology, anthropology, psychology, and economics. In particular, the SNA focuses on the network of ties and liaisons within a set of social actors, which could be a conceptualization of people, groups of people, companies, other organizations, or even nations (more interesting for the purpose of this study), and their relationships. Generally, it is possible to say that social networks are social structures composed of individuals or organizations (national entities, for the purpose of this study), which form the nodes of the network, and which are linked one to each another by one or more interrelations of different types (values, ideas, agreements, interactions, friendships, affinities, trade flows etc.). The result is a complex web of relationships and bonds that supports various entities and which, from a graphical point of view, takes the form of a "network". The principle underlying the SNA concerns the analysis of that network, which can be observed through the use of specific technical methods and explicit indexes able to break it down and to classify its parts: actors (nodes) and relationships (links). In this way it is possible to study the social relationships and their dynamics by focusing on limited elements of the system.

In this article, the specific network of relations chosen for quantifying the importance of the position of the countries is represented by the flows of bilateral trade among the first fifty world exporters in the year 2018, and the factors taken into consideration for measuring the value of the stance of a national entity in the system are epitomised by centrality indexes, which describe the most central, most important or pre-eminent actors (in our case countries) in a social network (global trade). In particular, four different centrality indexes are examined for the purpose of the analysis: the degree centrality (fig. 1.a), the closeness centrality (fig. 1.b), the betweenness centrality (fig. 1.c) and the eigonvector centrality (fig. 1.d). The first index refers to the number of nodes adjacent to each other. In the international trade network that index measures the direct trade flows between each country with the rest of the world. According to the meaning generally attributed to this index, the national entity that has a higher degree of centrality is also the one that can rely on a greater number of reciprocal relationships with the rest of the world. The index, which is easy to calculate, represents the popularity of an actor in the network. The more a country has a high degree centrality, the more it has direct trade flows with a bigger number of states and, in the process, opportunities to adopt an extensive and proactive EI approach. The closeness centrality is, instead, based on the distance between the nodes and focuses attention on the proximity that exists between a country and all the others within the network in question. It consists in the average of the distances of a node from all the others. Thus, it provides a measure of the ability of a country to enter in contact with all the other states through the fewest possible intermediaries. Consequently, if a national entity has a high value of this index, it will certainly be in a good position to influence indirectly the international relation system. The main different between the degree and the closeness centrality consists on the fact that the latter takes into consideration also indirect (but short) contacts, that is, in the trade flow network, countries that have a significant commercial volume with direct trading partners. Therefore, the closeness centrality makes it possible to identify the centrality of a node even when it does not immediately appear evident. The betweenness centrality is another important measure of centrality, which allows to identify those countries that act as a bridge between two or more regional trade subnetworks, maintaining a connection with peripheral geographical areas otherwise completely isolated. The betweenness centrality, in fact, allows to highlight the

function of the countries that behave as intermediators and that, consequently, play an important role as points of contact among, for example, different groups of nations involved in dissimilar international trade agreements. Finally, the eigenvector centrality measures the capacity of a country to have a significant influence in the global trade. The idea behind the last index of centrality consists on the fact that a national entity that possess a strong direct trade flow with states characterized by a high degree centrality should have a stronger ability to have a significant impact with its actions in the surrounding environment.

The use of the above presented metrics, offered by the social network analysis in order to individuate the position of a country in the network of international economic relations (in this article focused, in particular, in the international trade flow), allows to provide an index (or a system of indexes) to quantitatively measure the grade of potential economic intelligence capacity of a nation. In fact, remembering that the core essence of EI is the activity of searching, creating and using situations of information asymmetry aimed to achieve a competitive advantage, and taking into the account that a position of higher centrality creates a competitive advantage versus other actors, the social network analysis metrics turn out to result particularly significant measurement tools to understand the role of a country in the international context, as result of its domestic and foreign national commercial policy, its economic priorities and its areas of influence and intervention.



a. Degree Centrality. **b. Closeness Centrality.**

c. Betweenness Centrality. **d. Eigenvector Centrality.**

Figure 1. Centrality Indexes

Source: https://ultrabpm.wordpress.com/2013/03/25/social-network-analysis-part-two/

The calculation of the four different centrality indexes above illustrated has been conducted by means of "Social Network Visualizer (SocNetV)", that is a cross-platform software application for social network analysis and visualization. In particular, the flows of bilateral trade among the first fifty world exporter countries have been converted in a social network by means of the creation of an adjacency matrix, where each element a(x;y) is equal to 1 in case of existing edge from node x to y (that is the country x has an exports volume versus the country y above a well specified threshold), or equal to 0 if nodes are not connected (the trade flow from country x to country y is below a well defined threshold). The adjacency

matrix is then imported in the SocNetV and drawn as graph, where vertices depict the national entities and edges represent the commercial trades characterized by a volume above the specified threshold

4. EMPIRICAL RESULTS AND DISCUSSION

As above stated, the research conducted in this article is focused on the network of international trades among the first fifty exporting countries (all products traded are token in consideration) in the year 2018. The choice of such specific network has the advantage to provide a general information about the position of a country and its specific sphere of influence in a well-defined substrate (the global trade) of the system of international relations. However, different other webs of relations, belonging to dissimilar substrates of the world economy (migration flows; foreign investments; transnational transfers of technology; global financial markets; international regulations) can be used for measuring the centrality indexes of a national entity. Thus, the result of the present research should be considered only partially and limited to the global trade substrate.

From the figure 2, it appears clear that three countries, the United States, China and Germany, play a pivotal role in the global trade. Consequently, it is possible to forecast a high value of degree centrality for those national entities, due to a strong central position in the international trade network. In fact, the United States, China and Germany have important shares in world imports, respectively equal to 13,3%, 10,9% and 6,5%, which turn out to double all the other countries (Fig. 2).

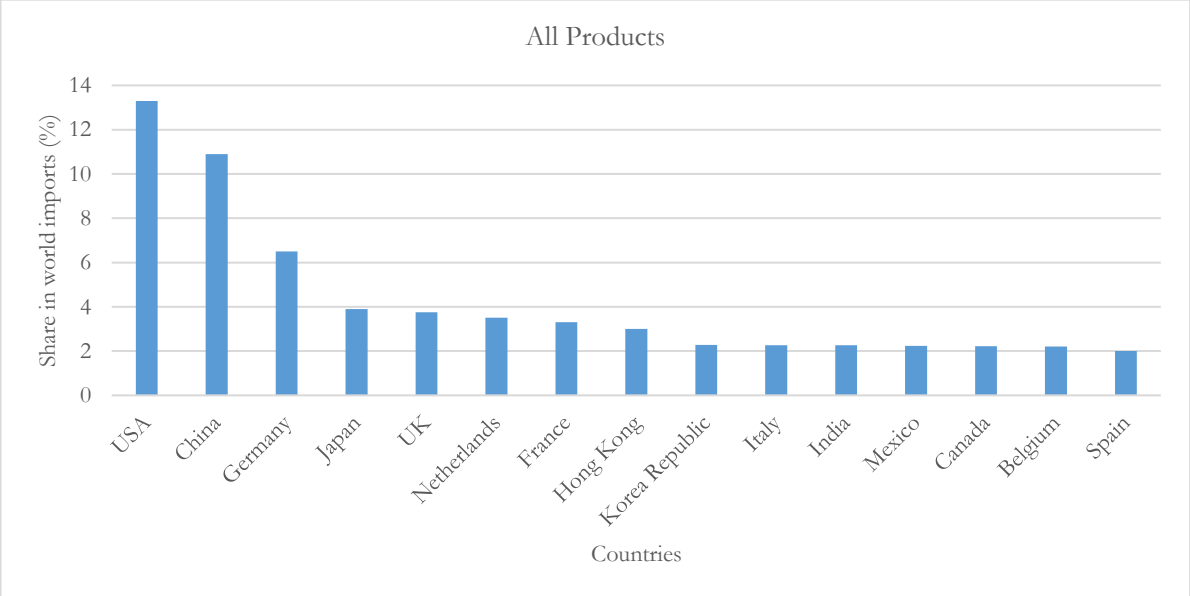
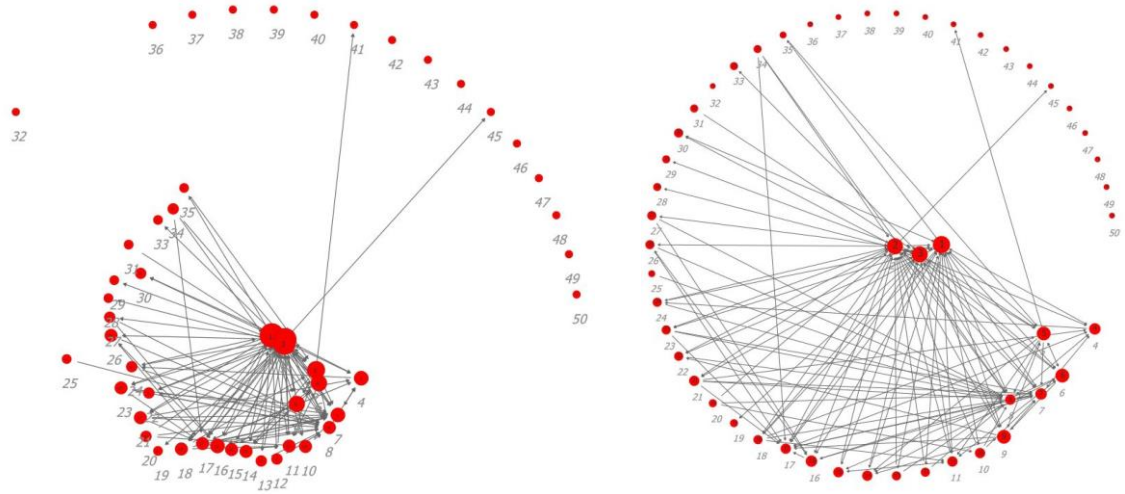


Figure 2. List of the Importing Countries (>2%) in the World in 2018

Source: www.trademap.org

A first representation of the international commercial network of the chosen fifty countries is conducted by considering all the bilateral trades among all the considered national entities, excluding those with an amount below a threshold of US dollars 50 billion. The choice of that amount is due to avoid a resulting network in which each country is connected with all the other states. In fact, by defining a minimum level of trade, it is possible to depict only the most significant economic relationships among commercial partners. In fig. 3 the illustration of the international trade flow network according to the conditions above specified is represented.



a. Closeness (Radial) and Degree (Size) Centrality **b. Betweenness (Radial) and Eigonvector (Size) Centrality**

Figure 3. International Trade Flow Network of the First 50 Countries (Threshold > US Dollar 50 Bn)

Source: Author's analysis

In the specific, fig. 3.a shows the layout of the network constructed in order to display both the closeness centrality (countries with a high value of that index are positioned in the centre of the radial network) and the degree centrality (countries with bigger sizes are characterized by a prominent value of that index). In fig. 3.b, instead, the design of the network is based on the betweenness centrality (radial explosion of nodes) and the eigonvector centrality (size of nodes). The number associated to each node identifies a specific country, following the order in the list of the importing countries in the world in 2018 (annex 1). Thus, for example, the nodes number 1, 2 and 3 represent respectively the United States, China and Germany, whereas the nodes number 48, 49, and 50 epitomise correspondingly Pakistan, Ukraine and Bangladesh.

Table 2

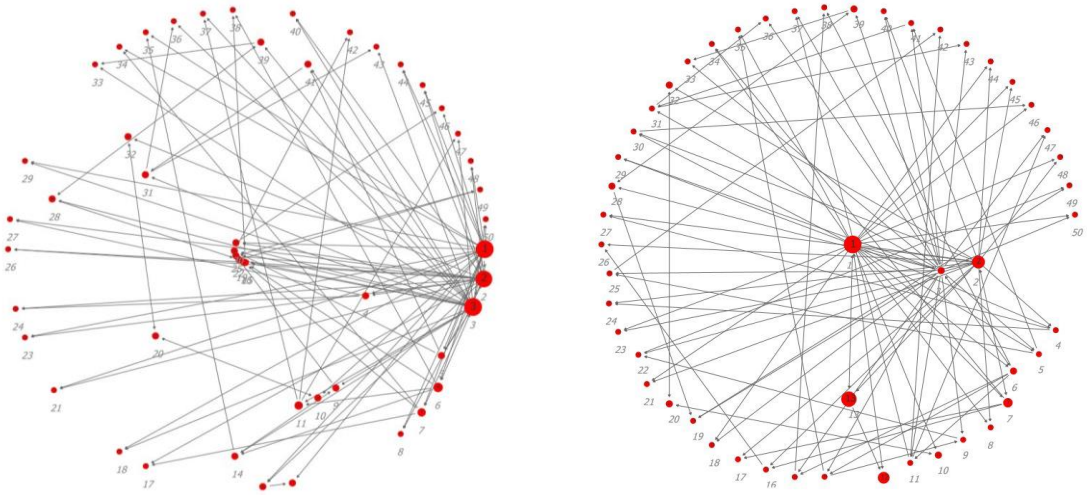
Legend of the Country/Node

1	US	14	Belgium	27	Indonesia	40	South Africa
2	China	15	Spain	28	CzechRepublic	41	Norway
3	Germany	16	Singapore	29	Austria	42	Egypt
4	Japan	17	Taipei	30	Brazil	43	Finland
5	UK	18	Switzerland	31	Sweden	44	Israel
6	France	19	Poland	32	SaudiArabia	45	Chile
7	Hong Kong	20	UAE	33	Hungary	46	Argentina
8	Korea	21	Thailand	34	Philippines	47	Greece
9	Netherlands	22	Russia	35	Ireland	48	Pakistan
10	India	23	VietNam	36	Denmark	49	Ukraine
11	Italy	24	Australia	37	Romania	50	Bangladesh
12	Mexico	25	Turkey	38	Portugal		
13	Canada	26	Malaysia	39	Slovakia		

Source: Author's owner

As anticipated, fig. 2 confirms that the highest values of centrality for all the four indexes are relative to the major countries in terms of importing value, that are the United States (1), China (2) and Germany (3). In fact, taking into the account the pivotal role in the international trade of those national entities, it

appears clear that they are in a strong position to implement a proactive EI strategy aimed to influence the world economy. Nevertheless, by focusing with more attention on fig. 3.a, important positions in terms of closeness centrality of the United Kingdom (5), France (6) and the Netherlands (9) emerge. Notwithstanding the fact they present a lower level of share in the world import with respect to Japan, their positions in the network appear more dominant. Those countries, according to the results, are more capable to influence the network. About the other centrality indexes, instead, no more information seems to be offered by the representation of the international trade flow system, due to the fact the very strong centrality of the first three countries, in terms of share of world import, overshadows the relations of the other countries in the network. In order to overcome the limit, a solution is proposed in the present article. It consists in representing the international trade flow network by computing, for each country, only the two first significant trade partners, instead of taking into consideration all the trade flows above the threshold of US dollar 50 bn. Consequently, the strong centrality character of the first three states deriving from the huge value of import will be limited. In fig. 4, the values of centrality for all the four indexes relative to the international trade flow network, constructed by considering the first two trade partners for each country, are graphically represented.



a. Closeness (Radial) and Degree (Size) Centrality

b. Betweenness (Radial) and Eigonvector (Size) Centrality

Figure 4. International Trade Flow Network of the First 50 Countries (First Two Partners)

Source: Author's analysis

Fig. 4.a confirms the preeminent position of the United States (1), China (2) and Germany (3) in terms of degree centrality (bigger size of nodes). However, the value of the closeness centrality index results more favourable for other countries: Spain (15), Singapore (16), Poland (19), Russian Federation (22), Turkey (25) and Brazil (30). Those nations, according to the result, are in a preferred position for creating a commercial partnership with the rest of the world. Furthermore, by observing fig. 4.b, Canada (13) emerges as potential bridge for international trade, together with the usual first three import countries, due to its quite high betweenness centrality index. In the same figure, Mexico (12) appears as outlier in terms of eigonvector centrality, as a consequence of its direct trade relationship with two significant importers: the United States and Canada.

At this point, it is possible to summari the significant findings obtained as outcome of the investigation on the inclination of the world's nations to implement an effective and efficient economic intelligence strategy in a unique index: the Economic Intelligence Index. The EII is obtained following a well-defined

algorithm, which takes into consideration each one of the four centrality indexes used to quantify the position of each national entity within the international trade flow network. In particular, the EII is a weighted sum of the all centrality indexes, in which: (i) the degree centrality and the eigonvector centrality contribute for a 50% of their values, in order to mitigate the influence of the higher volume of trade related to major countries; (ii) the closeness centrality and the betweenness centrality, which describe the national ability to be in contact with each national entity of the global network and to be a bridge among eventual sub networks, wholly contribute with their values; (iii) the highest centrality index among the four one, is additionally added to the partial weighted sum resulting from (i) and (ii), in order to attribute a more relevant weight to the most significant centrality index for each country. Furthermore, in order to avoid that the very strong centrality of the first three countries, deriving from their specific high percentages of the whole global volume of trade, the international trade flow network used for the analysis is the one represented in figure 4 (a) and (b), which results from the computation, for each country, of only the two first significant trade partners (instead of taking into consideration all the trade flows above the threshold of US dollar 50 bn).

In table 3, the specific value (expressed as percentage of the whole value in the network) of the degree centrality, the closeness centrality, the betweenness centrality, the eigonvector centrality and the relative economic intelligence index (calculated according to the above described algorithm) for the first 25 countries in terms of import are illustrated. The choice to show only the data relative to part of the countries is a consequence of the fact that the EII is a relative index, and thus half of the national entities turn out to have very low number (close to zero) with respect to the centrality indexes.

Table 3

The Economic Intelligence Indexes of the First 25 Countries in Terms of Import

	Degree	**Closeness**	**Betweenness**	**Eigonvector**	**EII**		**Degree**	**Closeness**	**Betweenness**	**Eigonvector**	**EII**
US	0,220	0,001	0,343	0,333	0,964	Japan	0,020	0,052	0,007	0,000	0,121
Germany	0,210	0,003	0,202	0,000	0,521	UAE	0,020	0,052	0,007	0,000	0,121
Canada	0,020	0,001	0,126	0,250	0,512	France	0,050	0,002	0,034	0,000	0,111
China	0,180	0,001	0,149	0,167	0,503	Italy	0,030	0,034	0,012	0,000	0,096
Mexico	0,010	0,001	0,000	0,167	0,256	Netherlands	0,010	0,034	0,010	0,000	0,084
Poland	0,010	0,103	0,013	0,000	0,225	India	0,010	0,034	0,007	0,000	0,081
Russia	0,010	0,103	0,013	0,000	0,225	SaudiArabia	0,010	0,034	0,007	0,000	0,081
Turkey	0,010	0,103	0,010	0,000	0,221	Norway	0,010	0,021	0,007	0,000	0,054
Brazil	0,010	0,103	0,005	0,000	0,217	UK	0,020	0,009	0,015	0,000	0,054
Spain	0,010	0,103	0,000	0,000	0,212	CzechRepublic	0,020	0,017	0,005	0,000	0,052
Singapore	0,010	0,103	0,000	0,000	0,212	Belgium	0,020	0,015	0,007	0,000	0,052
Hong Kong	0,040	0,001	0,010	0,083	0,155	Slovakia	0,020	0,015	0,002	0,000	0,047
Sweden	0,020	0,052	0,010	0,000	0,123						

Source: Author's owner

According to the results of the investigation, the US, Germany, China, thanks probably to the fact they represent the major countries in terms of importing value, possess high values of EII and, in the process, strong inclinations to implement a sound and valuable national EI strategy. However, among the first positions in terms of high EII countries with a lower value of importing value, such us Mexico, Canada, Poland, Russia, and even Turkey and Brazil, are also present. In such cases, the predisposition to develop an effective and efficient national EI system mainly derives from their ability to occupy a strategic position in the international trade network: (i) Canada and Mexico have high values of eigonvector centrality, due to the fact they have a strong relationship with the US; (ii) Poland, Russia, Turkey and Brazil have relative high values of closeness centrality, which means they are in a good position to influence directly or indirectly the international relation system.

5. CONCLUSION

In the last decades, the globalization increased the complexity of the international economic relation systems. In fact, notwithstanding the fact the globalization carries out several benefits, such as the spread of innovation, the access to new markets, the decreasing of costs of production, and a greater worldwide cooperation associated with higher standards of living, the current phase of the world economy development shows new challenges in the interaction among the subjects of the system of international economic relations: more intricate mechanisms for coordinating international economic relations; increasing in rivalry for occupation of privileged positions in the world economic system; growth of disputes between members of integration unions; intensification of competition among agents operating in international business; increasing in income inequality between rich and poor countries; emergence of new strong agents in the world economy, such as global corporations and emerging countries.

The multiplication of interactions among countries and the creation of new regional entities require new methods of collection and analysis of information aimed to conquer new spaces in the world economy. There is, in fact, the need of a new theoretical approach and innovative methodologies of collection, analysis and dissemination of information based on the study and assessment of the network of interactions within the international economic relation system, and focused on the research of a central and dominant position in the world economy, which allows to play a pivotal role in driving the development of the global economy in a direction that creates benefits and advantages to the national prosperity. In that direction, Economic Intelligence offers a new systematic methodology of information management aimed to discover data, discriminate information, distillate knowledge and disseminate intelligence, which, differently from the traditional approaches of data analysis or information management systems, takes also into account the complex interactions among the main components of international relation systems (national entities; regionalisms; transnational corporations; international organizations; people; levels of integration among the subjects of the international economic relations system; substrates of the system; structures of enforcement of the world economy). Economic Intelligence turns out to result a formidable instrument to support governments in the decision-making process. Each country, consistently with its own culture and resources, has adopted a specific economic intelligence approach. The actual position of a state in the international relations' system represents its inclination to implement an effective and efficient economic intelligence strategy to influence other countries. The analysis conducted in this article, by means of the social network analysis methodology, has showed how it is possible to measure by means of the Economic Intelligence Index the level of predisposition, in terms of economic intelligence, of the main national entities in the world.

The finding is remarkably interesting. In fact, the basic conclusion of the article highlights that, notwithstanding the fact a prominent role in the global trade network is occupied by the major countries in terms of commercial importing value, that is the United States, China, Germany, other countries, such as Russian Federation, Poland, Turkey and Brazil are characterized by a high value of Economic Intelligence Index, and are in a preferred position for creating a commercial partnership with the rest of the world.

Consequently, on the basis of the research conducted, it is possible to assert that the SNA turns out to result a formidable instrument for evaluating the inclination of a country to adopt a successful EI strategy. In fact, by analysing the specific position of a state in the international relations' network, by means of its centrality indexes, useful information, at first sight not understandable, can emerge.

However, further research could be conducted in order to quantify the importance of the position of each national entity in the system of the global relations and its predisposition to implement an efficient and effective EI strategy, by identifying different types of networks. Thus, for example, the SNA applied to the world Internet backbone, would show the countries more active in the information and communication

technologies and, in the process, with a higher inclination to implement cyber intelligence strategies. Again, the analysis of the network of the air transport intercity linkages, would be useful to identify the states with a greater control on the people-flow movements.

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