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Social network analysis and the internationalization of SMEs: Towards a different methodological approach

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Towards a different methodological approach

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Abstract

Purpose – This paper highlights the relevance of using social network analysis (SNA) as a different methodological approach to understand the numerous complex interactions that take place within the internationalization process.

Design/methodology/approach – The paper is divided into three major sections: First, it identifies relevant articles on social networks published in appropriate academic journals; second, the process leading to SNA is presented; third, an illustrative case is described to show the relevance of SNA within the context of international business.

Findings – Drawing on relevant literature, the authors found that most studies in the field of social networks and internationalization rely on conventional research methods based on qualitative (e.g. multiple case studies) or quantitative studies (e.g. surveys). Without questioning the relevance of these methods, the authors claim that very few studies have used the SNA methodology, which is based on a sociometric approach addressing the interactional dynamics embedded in international relationships.

Originality/value – Specifically, this paper attempts to analyze the major advantages and shortcomings of the SNA methodology, which may be useful to understand interactional (or relational) effects associated with an internationalization strategy.

Keywords SMEs, Social network analysis, Internationalisation, Interactional dynamics

Paper type Conceptual paper

Introduction

In recent years, there has been an increase in the amount of social network research in international business (Coviello and Munro, 1995; Tsai and Ghoshal, 1998; Ellis, 2000; Chetty and Agndal, 2007; Harris and Wheeler, 2005; Coviello, 2006; Agndal *et al.*, 2008, among others). This is not surprising, because social exchanges (or social networks) are an increasingly central concept to understand both inter-personal and inter-organizational dynamics. This is because international firms cannot be viewed as islands but rather as actors embedded in a complex network of national and international business interactions. In the view of O'Toole (2006, p. 3), organizations are "part of large social systems, interconnected one to the other and thus, in action, are constrained, enabled, changed through their interaction rather than as independent actors or recipients". Håkansson and Snehota (1995), in turn, offered a similar argument in the foundational research leading to the IMP research stream.

The debate on business networks has triggered particular attention in the specific fields of management, strategy, marketing and corporate governance in the past few decades (Gulati, 1998; Gulati and Gargiulo, 1999; Möller and Rajala, 2007). Network arrangements are viewed as "organic structures" (Nohria and Eccles, 1992) which are

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changed by economic cycles and environmental complexity; thus, organizations that value networking are better prepared to face intense competition in international markets. Few firms have the capacity to develop an internationalization strategy on its own; success often requires cooperation and commitment between actors and organizations. As a single firm is rarely proficient in generating enough resources to be successful in foreign markets, business networks are crucial in providing strategic information, knowledge and resources (Gulati and Gargiulo, 1999). This relies on the assumption that a firm, particularly a small- or medium-sized enterprise (SME), is often dependent on resources and information controlled by others, whereby, depending on the type and nature of its relationships, the firm may better access valuable resources at earlier stages, in the domestic market, and use these resources (usually connections) to gradually increase its involvement in international markets (Johanson and Mattson, 1988). Firms obtain access to these external resources through the structural position they occupy in business networks.

According to Johanson and Vahlne (2011, p. 13), a firm is:

> Embedded in an enabling, and at the same time constraining, business network that includes actors engaged in a wide variety of interdependent relationships. Internationalization is seen as the outcome of firm actions to strengthen network positions by what is traditionally referred to as improving or protecting their position in the market.

Thus, the major strength of the network view is the fact that internationalization is the result of processes embedded within networks of interdependent actors that can provide access to relevant resources (Ellis, 2008).

Although several studies suggest the relevance of using social networks in international business (Ellis, 2000; Agndal *et al.*, 2008; Chetty and Agndal, 2007), very few articles have offered specific guidelines about how to use this particular methodology, that is the social network analysis (SNA). It has been ascertained that the typical research problems associated with using SNA in international business have not been properly addressed, the exception being the approach taken by Coviello (2006), in which she examined the network as the dependent variable.

Consistent with Webster and Morrison (2004), the general avoidance of quantitative SNA within international business is most likely due to three major reasons:

(1) the special data requirements needed to perform SNA;

(2) the terminology used to define the network analytic models; and

(3) the 'not-so-user-friendly' computer programs that were first used.

Moreover, to analyze relational data, very high survey response rates are required, which, depending on the analysis to be performed, may need to be upwards of 70% (Knoke and Yang, 2008; Kossinets, 2006). Wasserman and Faust (1994) described SNA as quite distinct from other methodologies, in the sense that it uses interactions and relational information to test theories.

As acknowledged by Coviello (2006), most of our understanding on the networks of international new ventures (INV) addresses the initial foreign market entry and post-internationalization activities. As she notes, a common feature across several studies led to the conclusion that, in this particular field, the focus has mainly been on the different patterns of internationalization instead of understanding the interactions

developed among different actors, both locally and internationally. Therefore, the purpose of this study is:

- to synthesize how past research in international business has approached social networks; and
- to introduce SNA as a relevant methodological tool to understand the dynamics of the internationalization process.

In doing so, it sets out to examine the following objectives:

- assess the extent to which SNA has been previously used to study the internationalization of SMEs; and
- provide an illustrative example, based on a fictional import/export network showing the importance of the SNA methodology to explain the internationalization dynamics.

The remainder of the paper is structured as follows: the author addresses the literature review related to the role of social networks in international business followed by an analysis, using examples in this field, of the SNA methodology and its potential applications to international marketing and business.

Conceptual framework

Social networks and internationalization

It is apparent from the literature review performed for this study that the interest in the role of social ties in the internationalization process has been increasing over the past two decades (see works of Coviello and Munro, 1995; Tsai and Ghoshal, 1998; Ellis, 2000; Chetty and Agndal, 2007; Harris and Wheeler, 2005; Coviello, 2006; Agndal *et al.*, 2008, among others). Indeed, Styles and Ambler (2000) acknowledged that the progressive evolution of information acquisition, learning and knowledge of opportunities is essentially a social phenomenon, particularly in the early stages of the internationalization process. Previous studies (Table I) established a connection between social/network ties and internationalization of small business.

To fully understand the applications of social networks toward international business and entrepreneurship, the authors conducted a comprehensive literature review of articles published between 1995 and 2014. To identify relevant articles, multiple query searches were performed on an important academic publishing database (SCOPUS®), which also allowed for the retrieval of data on the prevalence of references to social networks in internationalization studies (Figure 1).

Figure 1 depicts that in the past 20 years, the amount of research on internationalization processes (Query 1, lighter grey area) has grown at a rate very close to a positive quadratic function. While the trending line was purposely not displayed on the graph, the second-degree term is 1.94 with a R^2 of 96 per cent. The number of publications addressing social constructs in internationalization processes (Query 2, darker grey) is also growing, albeit at a slower rate. With regard to Query 3 (black area), publications explicitly referring to SNA in any of the SCOPUS® database fields are yet few, and the ones specifically addressing the internationalization process of SME's can be found in Table I, along with other publications focused on social capital and networks.

Authors	Country of study	Sample size	Research method	Unit of analysis	Statistical analysis
Coviello and Munro (1995)	New Zealand	25	Multiple in-depth interviews	SMEs	Content analysis
Coviello and Munro (1997)	New Zealand	4	In-depth interviews, documents	SMEs	Content analysis
Chen and Chen (1998)	Taiwan	146	Survey	Large and SMEs	Manova
Tsai and Ghoshal (1998)	Multinational corporation	15	Survey	Relational data	LISREL and UCINET
Chetty and Holm (2000)	New Zealand	4	Structured interviews	SMEs	Content analysis
Ellis (2000)	Hong-Kong	52	Structured interviews	Manufacturing firms	Descriptive statistics
Ellis and Pecotich (2001)	Not clear	31	Case study	SMEs	NUD*IST
Yli-Renko *et al.* (2002)	Finland	134	Longitudinal study	SMEs	SEM
Chen (2003)	Taiwan	10	Case study	Large and SMEs	Content analysis
Chetty and Wilson (2003)	New Zealand	61	Survey and case study	SMEs	ANOVA
Hadley and Wilson (2003)	Several countries	79	Survey	All sizes	Regression analysis
Oviatt and McDougall (2005)	–	–	Conceptual nature	–	–
Harris and Wheeler (2005)	Scotland	11	Case studies	SMEs	Content analysis
Mort and Weerawardena (2006)	Australia	6	Case study	Born-Globals	Content analysis
Han (2006)	–	–	Conceptual in nature	–	–
Coviello (2006)	New Zealand	8	Case studies	SMES	UCINET
Zhou *et al.* (2007)	China	163	Survey	SMEs	SEM
Agndal and Chetty (2007)	New Zealand and Sweden	20	Case study	SMEs	Content analysis
Zhao and Hsu (2007)	Taiwan	173	Survey	SMEs	Hierarchical regression
Chetty and Agndal (2007)	New Zealand and Sweden	20	Case study	SMEs	Content analysis
Zettinig and Benson-Rea (2008)	–	–	Conceptual in nature	–	–
Gregorio *et al.* (2008)	–	–	Conceptual in nature	–	–
Sasi and Arenius (2008)	Finland	10	Case study	Born-Globals	Content analysis
Agndal *et al.* (2008)	New Zealand and Sweden	24	Case study	SMEs	Descriptive statistics
Prashantham and Dhanaraj (2010)	India	4	Case study	SMEs	Nvivo
Kontinen and Ojala (2011)	Finland	10	Case study	SMEs	Content analysis
Lindstrand *et al.* (2011)	Sweden	14	Case study	SMEs	Content analysis
Torkkeli *et al.* (2012)	Finland	298	Survey	SMEs	Regression models
Piva *et al.* (2013)	Italian	264	Survey	Small Firms	Econometric analysis
Lew *et al.* (2013)	Several nationalities	110	Survey	IT firms	SEM
Chung and Tung (2013)	EU and China	394	Survey	–	PLS-SEM
Eberhard and Craig (2013)	Australian SMEs	1,304	Survey	–	Regression models
Pruthi (2014)	India	20	Case study	–	Content analysis

Table I.
Major research methods of the studies reviewed

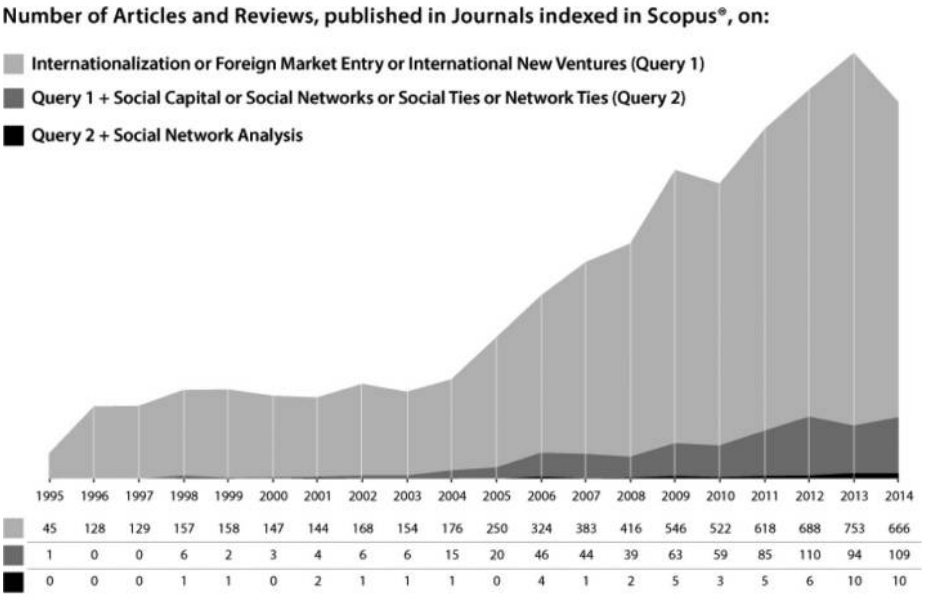

Figure 1.
Number of articles and reviews published in journals indexed in SCOPUS® on the topic of internationalization, over the past 20 years

Notes: Each column below the area graphs represents the yearly sum of articles found using each of the search queries:

Query 1: (DOCTYPE (ar) OR DOCTYPE (re)) AND PUBYEAR > 1994 AND SRCTYPE (j) AND (TITLE-ABS-KEY (internationalization) OR TITLE-ABS-KEY (internationalisation) OR TITLE-ABS-KEY ("International new venture") OR TITLE-ABS-KEY ("Foreign market entry")) — a total of 6572 publications
Query 2: Query 1 text + AND (ALL ("social capital") OR ALL ("social network") OR ALL ("network ties") OR ALL ("social ties")) — a total of 712 publications
Query 3: Query 2 text + AND ALL("social network analysis") — a total of 53 publications

Beyond the aforementioned articles retrieved with the different query strings, a review was made of the leading peer-reviewed journals in international business and management, namely, *the Journal of International Business Studies*, *the International Business Review*, *the Management International Review*, *the Journal of International Marketing*, *the International Marketing Review* and *the Journal of International Entrepreneurship*, among others. Articles published in conference proceedings were not considered because not all these sources are widely accessible and peer reviewed. The choice of SCOPUS was based on the broader range of scientific titles available when compared to Web of Science (Falagas *et al.*, 2008). Articles identified as relevant for the purpose of this study were further assessed in relation to five categories: country of study; sample size; research method; unit of analysis; and statistical analysis. It was found that a small proportion of these studies use SNA in the context of international business (see Table I for the list of reviewed studies).

As Table I illustrates, there is a predominance of Anglophone countries, although a number of studies were also conducted in other geographical contexts, such as

Scandinavian countries. Few studies were carried out in other geographical regions. It is also interesting to notice that among the studies reviewed, a common conceptual definition of social networks was lacking, as was a lack of agreement regarding the measurement of the construct.

Regarding the chronological order of studies presented in Table I, Coviello and Munro (1997) were the first authors to link social networks and internationalization. Their work examined how firms use network relationships to take advantage of foreign market opportunities to internationalize. Later on, the same authors analyzed how the internationalization process of software firms was influenced by formal and informal network relationships (Coviello and Munro, 1997).

During the first decade of the twentieth century, a large number of studies were conducted in different countries. For instance, Chetty and Holm (2000), based on a multiple case methodology, analyzed the dynamics of how firms use business networks when they internationalize, a topic also studied by Ellis (2000), who analyzed the social dynamics that precede international exchange. As he pointed out, the first export moves are between buyers and suppliers that have developed social relationships. In a further study, Ellis and Pecotich (2001), also with a multiple cases study, analyzed the influence of pre-existing social ties on export behavior in an exploratory cross-case study of SMEs from different industries. As they observed, social networks are crucial to the identification of new market opportunities. Other authors argued that informal social networks serve as the initial basis from which formal networks of business linkages are developed in new markets (Chen and Chen, 1998; Chen, 2003), as well as for location choice in foreign direct investment (Chen, 2003). Chetty and Wilson (2003) explored the types of network that better support internationalization and resource acquisition. The same authors saw the importance and ability of firms to leverage resources from other partner organizations as an important driving factor in international engagement. Even in circumstances in which the industry forces the internationalization process, firms are prepared to cooperate with competitors to acquire resources (Chetty and Wilson, 2003).

Hadley and Wilson (2003), for their part, conducted a survey of 79 firms and operationalized the network model testing the association between experiential knowledge, firm degree of internationalization and market degree of internationalization. These authors found that knowledge concerning internationalization is significantly related to the firm's market diversity. Additionally, a firm's exposure to culturally dissimilar markets facilitates its capacity to conduct international operations. In their multiple cases study, Harris and Wheeler (2005) stressed the importance of inter-personal relationships in the internationalization process. With a similar method, Mort and Weerawardena (2006) argued that international entrepreneurship plays a central role in rapid internationalization, specifically in developing both knowledge-intensive products and market performance. They emphasized that networking activity must take the form of competitive capability complemented by entrepreneurial opportunity-seeking behavior.

A complementary stream of internationalization research can be associated with the notion of social capital and its influence on changes in the internationalization entry mode. Social capital broadly consists of the value derived from networks based on socialization and sociability, and the social obligations and trust that these social links rely upon (Putnam, 2000; Coleman, 1988). This concept has been applied in a wide range of organization studies, both in the context of inter- and intra-organizational

relationships (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). For instance, Yli-Renko *et al.* (2002) used Structural Equation Modelling (SEM) to develop a research model based on survey data and analyzed the international growth of technology-based new firms, incorporating the social capital theory and the knowledge-based theory. Also, using the social capital lens, Han (2006) proposed a conceptual framework for analyzing the strategies of start-ups in the context of building social capital to achieve superior performance in internationalization. In turn, Zhao and Hsu (2007) conducted a survey to 173 firms and documented the influence of social ties on two critical areas of foreign market entry decisions by SMEs, specifically: timing and resource commitment. In the same line, Agndal and Chetty (2007) studied multiple cases to analyze how existing relationships influence changes in SME's internationalization strategies. Relying on 36 internationalization mode changes in 10 New Zealand and 10 Swedish SMEs, they found that business relationships are more influential in internationalization strategy changes than social relationships. This is especially important in relation to strategic entry mode changes, which are mostly the result of reactive actions instead of a proactive attitude. However, Agndal and Chetty (2007) recognized that there should be a balance between proactive and reactive mode changes.

In a later work, Agndal *et al.* (2008), again with multi-case methodology, explored the dynamics of social capital in 121 new foreign market entries of 24 Swedish and New Zealand SMEs in the earlier and later phases of their internationalization. Zhou *et al.* (2007) argued that home-based social networks play a mediating role in the relationship between inward and outward internationalization and firm performance. With a similar methodology, Sasi and Arenius (2008) studied the internationalization process of ten Finish ICTs firms focusing on access to specific resources through established long-term relationships, in line with network theory of internationalization.

Using four longitudinal case studies in the software industry, Prashantham and Dhanaraj (2010) analyzed the origin, evolution and appropriation of social capital of new venture internationalization. In turn, Chung and Tung (2013) conducted a survey to examine the linkages between social networking and foreign entry mode (FME) strategies for firms operating in the EU and the Chinese region. They found that immigrants play a key role in influencing the choice of FMEs. Also, Eberhard and Craig (2013), in a survey to 1,304 Australian manufacturing industry SMEs, researched the relationships among networking, international market venturing and family ownership. A recent study undertaken by Pruthi (2014) examined the role of social ties in venture creation by returnee entrepreneurs. This author found that not only are local ties essential for venture creation and for the generation of ideas for their venture but also that heterogeneity in the way returnee entrepreneurs leverage social ties across the host and home countries is contingent on the location of their intention to start-up. As in prior studies, Pruthi (2014) applied a qualitative methodology based on 20 cases.

When considering the above review of literature, it is important to emphasize that from a methodological stance, multi-case studies are the predominant methodology. While these studies portray an increasing awareness of the importance of social ties in the process of internationalization of SMEs, studies that have applied the SNA techniques are almost non-existent. It is quite surprising that the only studies that have used relational data and used the SNA methodology were the work undertaken by Coviello (2006) in her study entitled "the network dynamics of international new ventures" and Tsai and Ghoshal (1998), focusing on multi-national corporations.

It is worth noting that classic studies in international business have valued conventional methodologies to study the internationalization process, focusing mainly on companies' financial resources, production capability, managers' education and experience, among others (Leonidou *et al.*, 2007). Through case study or multi-company survey, researchers have come to a conclusion that the traits of managers appear to be correlated with desired internationalization outcomes. These traits are attributes of the actors (either the companies or the managers) and are the cornerstone of classic research methodologies.

As a different methodological perspective, the SNA focuses on the content and nature of interactions between actors (personal and organizational) to understand the resource pooling and social exchanges that could foster internationalization opportunities. The focus is not so much on the company's own capabilities or its attributes but rather on the relationships that may include both the focal company (its employees included) and individuals that may trigger or ease the internationalization process. Inter-organizational relationships between employees of partnering companies are embedded with tacit and explicit knowledge that is crucial for international expansion and there is a pattern of connections that helps understand the role of each actor in the network. Taking this point of view, Marin and Wellman (2011) claimed that this pattern of interactions between organizations, in which each organization is tied through its employees (or actors) to multiple stakeholders, allows each actor to draw on diverse sources of knowledge and, subsequently, allows the organization to explore new market opportunities. The SNA will be analyzed in the next section.

SNA methodology

The study of social networks grows from the assumption that actors are interdependent in their activities and environments, thus influencing each other's access to information and other resources. Furthermore, the exchange of resources is assumed to occur through different types of links (or relationships) among actors. SNA also assumes that the network structure provides its members with both opportunities and constraints (Wasserman and Faust, 1994). These dependent relations lead to the assumption that the social structure among actors is a key for the outcomes of a network, more so than the actors' individual attributes. As an example, in the case of international business, companies may not realize the power of their agents or merchants in both negotiation and information provision. These agents usually work with several competing companies, giving them a profound knowledge of both home and foreign markets, as well as strategies to enter new markets. The importance of studying the network of these key actors is clear, as they are involved in connections that can foster greater internationalization.

To convey the main opportunities for SNA in this area, we will explain the process of conducting research, collecting, analyzing and presenting data. We will start by presenting different types of approaches to social network data and then discuss the following issues: the unit of analysis, the relationship contents, the data collection methods, the measurement and the data analysis, concluding with the conventional forms of presenting network data. The following sections are based on the contribution of authoritative authors (Wasserman and Faust, 1994; Carrington *et al.*, 2005; Scott, 2000).

Types of analysis in social networks

In SNA, the primary decision a researcher has to make is the type of networks and relationships he/she intends to study. Network relationships might be varied, but there are two crucial dimensions for the definition of the study's boundaries: ego versus whole networks and one-mode versus two-mode networks.

Ego-network versus whole network

Ego-network analysis focuses on the relationships from the perspective of a focal actor, that is the direct connections (also called alters) of an individual. The connections between alters can also be studied and may be relevant to assess relational constraints. It is not frequent to study beyond direct connections but it is possible (e.g. relationships, such as "friend-of-a-friend"). In this approach, the goal is to study the number of links and the types of relationships that each focal actor has. No attempt is made to connect different ego networks. This approach is useful when the network is too vast or its boundaries are not clearly defined. In international business, this procedure could be used to understand the product diversity (and possible overlap) of competing or non-competing companies working with the same distributor. Although companies might be competing parties, it does not mean their products are not compatible or complementary, thus making exploitation of further commercial opportunities possible. According to Marin and Wellman (2011, p. 20), "ego-network data can be extracted from whole network data by choosing a focal node and examining only nodes connected to this ego". This adaptation allows localized studies to further understand a given cluster, for example, within a larger network of actors.

Whole network data, on the other hand, focuses on all the relationships within a given network with defined boundaries; in such cases, all members should be contacted to participate in the study. This approach is very useful to understand the flow of resources among several network members as well as to assess the indirect access that actors might have to each other. These actors potentially have different relationships among them (such as representation, lending equipment, sending samples, giving advice on product enhancement, etc.), and this approach helps determine which type of relationship is associated with distinctive types of individuals (e.g. company senior manager, customer representative, export agent, etc.). In international business, this methodology could be used, for example, to compare the flow behind exporting similar products from two or more competing companies to understand brokerage points (where distribution might funnel through a single entity) and to find which company is the most vulnerable.

One-mode versus two-mode networks

A 'mode' is a set of actors. A one-mode network is composed of a single set of actors, such as companies. In one-mode networks, the analysis could be focused, for example, on which actors are linked through supplier-customer relationships and the strength of that tie, such as frequency of interaction. A two-mode network is composed of two sets of actors and it is possible that actors in one of the modes do not have relations with members of its own mode. An example would be companies that share a presence in foreign markets; companies do not control how other companies might choose their foreign markets (unless they own each other), and foreign markets are geographically excluded from each other, so they have no relations among themselves from the

perspective of company presence. So within this type of relationship, countries neither control other countries nor do companies control each other.

One-mode networks can originate from two-mode networks by using relationships that consist of co-presence in foreign markets, co-exporting, collaboration with a common agent or others.

Units of analysis in SNA

According to Wasserman and Faust (1994), SNA has three units of analysis, with the main one being the dyad (the tie level). The data collected at this level are relational in nature and reflect the content shared between pairs. The variables selected for this analysis are properties of relationships among network pairs; in the case of an internationalization study, those could be resources shared between cooperating companies throughout their supply chain network, joint participation in business fairs or any number of products that have similar functions in competing companies' catalogues. All these variables are a function of the dyad and are not exclusive to a single actor. Thus, each dyadic variable is presented in an actor-by-actor matrix of values, with cells representing the relationship value for each pair. The analyses performed on these data have to consider the dependence of observations between actors.

The second unit of analysis is the monadic level (the actor level). The data collected at this level have similar organization to other social sciences but may also depict network data. As such, variables are represented in an actor-by-attribute matrix, where each actor is a case and the measurement of individual variables is presented along a vector (usually a row vector). Examples of variables can be number of years in each foreign market, number of commercial products or services available internationally, but there can also be network variables, such as number of ties to import/export partners or amount of raw material imported from each supplying region or country.

Finally, the highest level of analysis is the network (the group level). The data collected at this level represent whole groups of actors and the ties among them. This level is useful to the understanding of, for example, the level of connectedness and coordination between foreign subsidiaries of a multi-national corporation. In this case, variables have one value per network.

Content of network relationships

After dealing with network-level decisions, researchers should focus on tie-level decisions, specifically, questions such as 'what do the links represent?' or 'what is the content of such links?' In their introduction to SNA, Marin and Wellman (2011, p. 19) highlight that "when we study the effects of phenomena on networks, the results are sociologically significant only insofar as the network measures being affected are sociologically significant", thus reminding us of the need to ask the right questions to get relevant data.

The theoretical framework within each study can greatly help the researcher to select the relevant variables to measure in the relationship. Examples of internationalization relationship types might include international communication (e.g. who talks to whom and how frequently), cooperation (e.g. who shares information, who exports to where) and personal relations (e.g. who trusts whom, who is considered trustworthy). For a more in-depth list of relations, see Wasserman and Faust (1994, p. 37). The structure of

the network is determined based on the relations chosen by researchers and all of its concepts must be defined relationally.

Collecting and measuring network data

Network data can be collected using the same instruments of data collection typically used in other research paradigms, such as positivism, constructivism, critical theory and realism (Sobh and Perry, 2006). The choice of the appropriate technique has a lot to do with the access the researcher might have to the data as well as its nature. As an example, the number of transactions with foreign agents can be a type of relation to consider in internationalization as long as the researcher has access to the archive of such data. However, the data that measure the level of collaboration between an exporter and a local intermediary can be captured from a survey or an interview and not in archival documents. Beside, while collecting relational data, researchers can include questions to collect attribute data that can help categorize different types of actors. Examples of attribute data in exporter-intermediary relationships can include the country of origin, size of the companies or years of experience in business.

Just like in other research methods, network data can be measured using relevant scales. Network relations can be measured as directed or undirected, valued or binary. Directed ties go from one actor to the other, unlike undirected ties; as an example, the flow of products or advice-seeking are examples of directed ties, while co-development of products and co-attendance at international business meetings (or international fairs) are considered undirected. If a directed tie exists in both directions (e.g. both actors call each other), then the relation is reciprocated. These directed and undirected ties can be measured as valued or binary relations. Binary represents the existence or absence of a tie (e.g. meeting attendance or money transferring), while value relations represent the strength of a given tie (e.g. the level of collaboration, amount of transactions).

Analyzing network data

After collecting network data, researchers can input the data into software developed specifically to calculate measures of network positions, properties of both dyads and the network. The most popular programs are UCINet (Borgatti *et al.*, 2002) and Pajek (Nooy *et al.*, 2005); a comprehensive list of SNA software can be found in Scott and Carrington (2011). UCINet is very wide-ranging software that includes the most significant and relevant calculations of network measures developed in recent decades.

Notwithstanding the software used, there are a handful of indices that can be calculated to obtain an analytical sense of the network's social structure. Some of those will be explored in the following paragraphs.

Network size (n) represents the number of actors involved in the network. The degree of an actor refers to the number of ties he/she has to other actors. Depending on the number of ties an actor has (degree), he/she may be more prone to receiving (in-degree) and/or spreading (out-degree) information received through the network. Reciprocity of ties is crucial in this situation, as actors with more inward and outward ties tend to be central to the network.

Density reports the number of existing ties over possible ties, that is the sum of all actors' existing ties over $n \times (n-1)$. As resources are limited both in existence and ability to spread, the structure of social relations affects the capacity of actors to build and maintain ties with other actors. From the formula, we can see that possible ties increase exponentially as size

increases linearly. Nonetheless, the capacity for actors to link with others may not increase with network size, so density is usually lower in larger networks. Connectedness presents the number of components (maximal connected sub-group) within a network; structural holes represent actors that connect sub-groups, and if they are removed, then the number of components increases and the sub-networks become disconnected.

Position in a network is critical for the opportunities and constraints placed on members. Differences in the patterns of ties between actors reflect on their network embeddedness. Indices related to position are several, such as centrality, reachability, connectivity and distance.

Centrality measures the prominence of an actor in the network, and it can be defined in terms of degree, closeness and connectedness For the sake of simplicity, only the general concept will be presented, but further detail can be found in Wasserman and Faust (1994, chap. 5). Central actors tend to be "extensively involved in relationships with other actors" (Wasserman and Faust (1994, p. 173), making them more prominent to others. Centrality is usually associated with relation brokerage as well as access to and control of more diverse resources.

Reachability measures the capacity of an actor to reach any other actor, despite the number of links in between. In asymmetric data, it is possible for A to reach B but B cannot reach A.

Connectivity measures the number of nodes that have to be removed for a certain actor to stop being reachable. This is important as it allows realization of dependence and vulnerability in resource access.

The connections of actors in networks do not occur solely in adjacent ties, so it is important to analyze the distance that separates any two actors. Longer paths might affect information flow between actors. Also, actors integrated in neighborhoods with more ties will have shorter distances to other actors in the network, as they will likely have a tie to someone much closer or adjacent to the target. The most common distance between two actors is the geodesic distance: the lowest number of ties between any two actors. When geodesic distances are short, information tends to travel relatively fast in the network. Additionally, there may be many routes (not all geodesic) for information to flow from actor A to B. The increase in possible alternatives makes the flow more likely and stronger against vulnerabilities.

Representing network data

The representation of information in SNA can be done in graphs or matrices (Figure 2). The representations of data in SNA come from mathematical foundations, such as graph

Actor	1	2	3	4	5	6
1	-	1	1	1	1	1
2	1	-	1	1	0	0
3	1	1	-	1	0	0
4	1	1	1	-	0	0
5	1	0	0	0	-	0
6	1	0	0	0	0	-

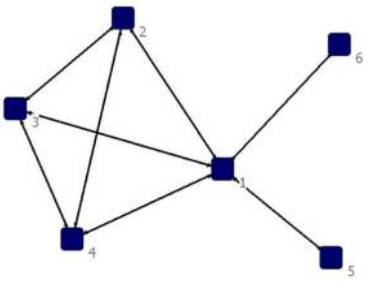

Figure 2. Matrix of one-mode symmetric and binary data (left). Graph representing ties between actors (right)

theory and matrix algebra. Using graphs to represent data reveal an immediate perception of connectedness between actors as well as the embeddedness of certain actors among neighbors. The direction of the ties is also relevant when analyzing links, as it may change the role of the actor in the network.

Representation of data, for visual analysis, might be aided by color/pattern and size of nodes, following analysis, such as degree, centralization or connectivity. Notwithstanding, actors' attributes can also be used for differentiation among nodes. Attributes can be used for partitioning graphs into groups, indicating the group that each node belongs to. In Figure 3, the countries of origin and company type were used to differentiate the nodes.

SNA in international business relationships: an illustrative case

The prime contribution of this study lies in emphasizing the relevant role of the SNA method within international business studies. It follows that this methodology enables the identification of key players, brokers, clusters of high cooperation and actors without access to proper negotiation positions. To clarify this view, the authors devised an illustrative case of a network composed of 7 materials' suppliers, 16 manufacturers and 8 import/export agents (Figure 3). To explore foreign market access situations, the 31 actors (companies) were distributed over 4 different countries. The network represents B2B work ties. While the relationships in the graph are directed based on goods movement, the explanations will assume that an existing tie can be used for resource exchange in both directions. This network will be explored only to point out the

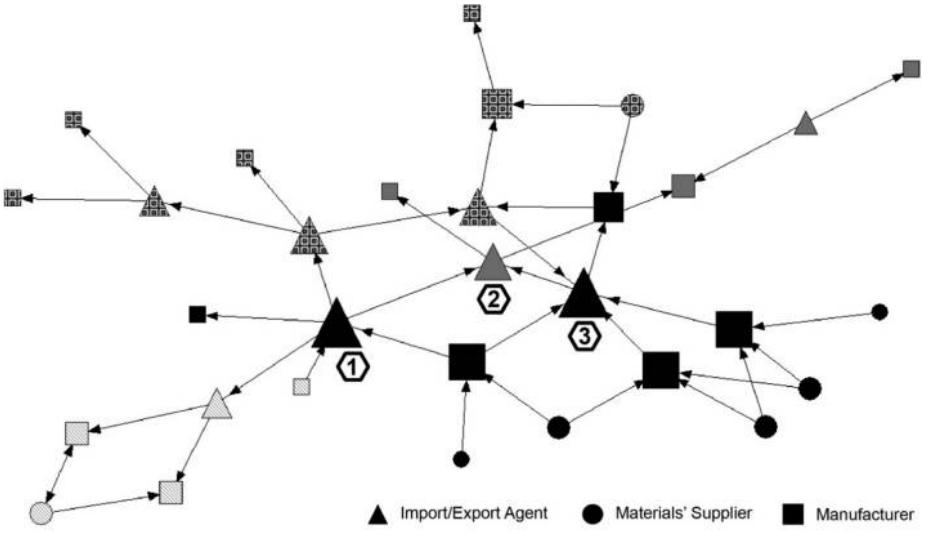

Figure 3.
Network data of supply relationships between manufacturers (squares), material suppliers (circles) and import/export agents (triangles)

Notes: Country of origin is differentiated by color/pattern of the node (black, grey, stripes, square pattern); directionality of arrowheads indicates supplying of materials or products between actors; nodes are sized according to their number of inward and outward links (node degree)

advantages of SNA in an international business context, without detailing real-life explanations of our example.

The network is fairly centered on a core of import/export agents (triangles). This means that these actors have a higher number of links and, thus, are more prominent to other actors in the network. Removing all import/export agents from the current network would result in severely disconnecting the network into ten components, with only one of those components involving international business. Such an extreme case reinforces how (if united or working in association) these import/export agents might effectively control the flow of goods and other strategic resources among actors in four countries.

In this example, material suppliers are portrayed as dealing almost exclusively with domestic manufacturers. In such a case, their contribution to leverage a manufacturer's internationalization processes might be limited, as their market knowledge should relate simply to their regional or national context. However, note that in the upper right part of the network, there is a material supplier (circle) working with a domestic and an international manufacturer. This node is well connected to obtain market information from both countries and could help its manufacturing partners in lowering dependence on their respective import/export agents.

For the sake of brevity, Actors 1, 2 and 3 (Figure 3) were selected to illustrate the SNA argument; these are all import/export agents. Actor 1 is a broker between his/her country and the stripes/bars country. This means that Actor 1 controls the flow of products to this country, as he/she is the only agent working with that market. All actors in the striped country are dependent on Actor 1's capacity/willingness to negotiate product prices and volumes with remaining markets. If the actors in the striped country lose the contract with their agent (Actor 1), then they would be entirely cut off from international business. Actor 2 is also a broker, but with less power than Actor 1, as he/she only connects two markets. Her/his position is good for negotiation, as he/she is the exclusive distributor for the grey country and even the most connected actors (1 and 3) cannot reach the grey country without going through him/her.

Actor 3 is the most prominent actor in the network, with a total of six connections. He/she connects three markets and is very well positioned to increase her/his power, as more actors may choose her/him for future collaborations. Her/his position to negotiate is excellent, as he/she receives products from three different companies in her/his country, making her/him better suited to control both prices and product volumes.

Actors connecting several markets and those who are closer to the network's core control relevant information for foreign access conditions and manufacturers may not be aware of such power when engaging in negotiations with these central actors.

Conclusion

This study contributes to the understanding of the role of the SNA methodology in the specific field of international business. It concludes that most of the previous studies in the area of internationalization rely mainly on surveys and multiple case study methodologies to collect attribute data of their research subjects. This research argues that the focus should be on collecting relational data to analyze their positions in the business network, along with the benefits and constraints imposed by their position. In the presence of complex phenomena, which are frequent in international contexts, social networks may be useful to approach the structural, interactional and attribute

characteristics of different actors, by applying both qualitative and quantitative approaches (Hoang and Antoncic, 2003; Coviello, 2006). Coviello (2006) took a step forward by analyzing whether international new ventures follow a linear evolution path in the process of internationalization. She examined "the network dynamics of INVs in terms of structural and interactional patterns at various stages of evolution" (Coviello, 2006, p. 717). Her study was unique from a methodological stance because the chosen unit of analysis was the network *per se*.

The described illustrative case evidenced that interactions among actors cannot be treated alike and it is believed that SNA has a substantial capacity to further explain network phenomena in the international business context. In particular, structural holes (or brokers) predict the flow of resources and the control each company has over network performance; centrality measures can help predict actors' levels of power in negotiation and information access; strength of ties can be a proxy for amount of resources (financial, equipment, knowledge, advice or others) shared between any pair of actors; and clusters make it possible to perceive highly related actors against the remainder of the network.

Limitations of SNA

A potential limitation of this research lies on its conceptual nature. This limitation can, nevertheless, be explained by the very purpose of this article, which is to review extant literature in the field of international business and marketing over the past two decades, particularly by focusing on the type of methodology, unit of analysis and statistical analysis used by different authors. Moreover, several practical examples were provided to illustrate the potentialities of SNA as the technique was explained.

There are several limitations associated with using SNA that can be addressed. One limitation relates to the timing in which data were collected. It is important to identify the right moment between pre- and post-test to determine the structural relationships, as a single network represents a 'picture' of the relationships at that point in time. One of the latest developments in SNA considers networks not as a static structure but as a changing dynamic structure of interactions that evolves over time.

A further limitation attributed to SNA has to do with the difficulty of collecting relational data, above all from a "complete network" perspective. As Cantner and Graf (2006) recognize, the usual method of taking firm samples is not suitable in SNA. This process is somewhat data intensive and requires extensive surveys and lengthy interviews. Applying this methodology requires a clear definition of the network boundaries, namely, the demarcation of which actors and links should be included. Even if relational data are obtainable, it is possible to overlook important actors that link unconnected parts of the network or even the most central players of the network (Cantner and Graf, 2006). One possible approach to reduce this constraint relates to the use of "ego networks", whose approach is not so data intensive and is centered on the relationships maintained by the focal actor. However, not all possible relations between actors are examined but only those that are within the study's focus, constituting a limitation.

Finally, there is a concern relating the exposure of individuals surveyed. Network data are never anonymous (although it can be anonymized) and may reflect the perceptions and attitudes of an identifiable subject. In that sense, this type of data is usually very sensitive and, as a result, should be treated with particular caution.

Apart from providing a broad overview of studies in international business over the past two decades, the study raises a number of questions, which could be addressed in future research, including the analysis of network governance, network development and network outcomes. In terms of future research, this is particularly important in international business, as most of these relationships rely on trust-commitment mechanisms (Morgan and Hunt, 1994), which are relevant to explain cooperative strategies based on shared resources. Analysis beyond dyadic relationships and into networks, surveying diverse stakeholders, could address the issue.

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