NETWORKING AS A DRIVER OF INNOVATIVENESS AND INTERNATIONALIZATION OF FIRMS

ABSTRACT

Literature studies in the field of business networks, innovativeness and internationalisation of firms indicate that business networks and networking are nowadays perceived as means of improving business performance in many aspects. In particular, they are mentioned as drivers of innovativeness and internationalisation of firms. There are many studies confirming the positive relationship between the pairs of these phenomena but there is a lack of studies on interconnections between the three of them simultaneously and the research results presented in the paper fill in that gap.

The survey is based on direct interviews carried out in 274 companies located in Poland. The collected empirical data made it possible to assess the degree of networking (NET), innovativeness (INN) and internationalisation (INT) of the surveyed firms. The statistical analysis of relationships between the NET, INN and INT indices proved a positive though weak correlation. The cluster analysis carried out by the Kohonen network showed that the most innovative and internationalised firms were highly networked while the least innovative and internationalised firms were poorly networked. Research results may therefore support the thesis that a high degree of networking "pushes up" both innovativeness and internationalisation of firms while a low degree of networking "pulls down" both dimensions of the firms' performance.

keywords: networking, innovativeness, internationalisation, measurement and interconnections

competitive paper

A firm's relationships within business networks are nowadays perceived as sources of a competitive advantage resulting from a better use of the firm's distinctive resources, access to the resources of network partners, enhanced process of learning and knowledge sharing within networks etc. (Häkansson, 1982; Hamel, Doz and Prahalad 1989; Häkansson and Snehota, 1993; Anderson, Häkansson and Johanson, 1994; Jarillo, 1993; Dyer and Singh, 1998; Gulitai, Nohria and Zaheer, 2000; Ford *et al.*, 2006; Häkansson *et al.*, 2009). Participation in business networks and networking is therefore considered as a way leading to increased profits, higher innovativeness and internationalisation of firms. The consequence of these assumptions is the presence of the network approach in contemporary models of innovation and in the internationalisation theory.

The innovation model dominating in advanced economies beginning from the late 90s is described as an integrated, networked model of innovation (Rothwell, 1992). It is characterized by an increasing degree of networking, manifesting itself in various forms of innovative cooperation between multiple, geographically dispersed entities. It is assumed that innovation is nowadays created within networks of different stakeholders engaged in innovation processes conducted on an international scale. It is agreed that networking stimulates innovation and creativity by shared learning, leading to creation of new knowledge, as well as configuration and adoption of ideas developed elsewhere. Thanks to the dispersion of risk inherent to innovation processes and an improved utilization of rare knowledge resources, the participation in emerging innovation networks began to stimulate the appearance of new ideas and the creativity of participating entities (Rothwell, 1992; Ahmed, 2000; Pyka and Kuppers, 2002; Häkansson and Waluszewski, 2003; Tidd, Bessant and Pavitt, 2005; O'Sulivan and Dooley, 2009).

The parallel development of the network approach in the theory of firm internationalisation confirms that the internationalisation of a firm may result from its commitment to international business networks and be expressed in the network forms of internationalisation. The network forms of internationalisation are dynamically developing nowadays together with new forms of internationalisation, i.e. non-equity modes (NEMs), which supplement conventional ones like exports or direct investment (World Investment Report 2011). The network approach has been present in the internationalisation theory since the 1970s confirming that relationships established by a firm within an international business network may help to speed up the process of learning needed to increase that firm's international commitment (Johanson and Mattsson, 1988; Forsgren and Johanson, 1994; Häkansson and Johanson, 2001; Mathews, 2002; Sharma and Blomstremo, 2003; Zuchella, Scabini, 2007; Johanson and Vahlne, 2009). While recognising the two theoretical frameworks mentioned above and combining their basic assumptions, one may presume that networking serves as means of enhancing both innovativeness and internationalisation of contemporary firms.

THEORETICAL FRAMEWORK

Networking is the key concept appearing in this paper. Networking as a term is used interchangeably with the network, and frequently not precisely defined and differently understood by individual authors within varied theoretical approaches. This is result of the fact noticed by Ebers and Grandori who say that "the field of network research is characterized by a high degree of theoretical and conceptual heterogeneity" (2001, p. 265).

The variety of perspectives and theoretical concepts has a single common assumption that the networking refers to the creation and utilization of connections between organizations. According to Ebers and Grandori „networking is about establishing and exploiting ties that link organizations, leading to the formation of inter-organizational networks" (2001, p.266), while networks constitute a special type of an organization of the economic exchange in addition to such traditional forms as markets and hierarchies (Thomson *et al.*, 1991). The economic literature, in particular, the transaction cost theory (Hennart, 1991; Inkpen and Currall, 2004; Anand and Khanna, 2000; Kale and Singh, 2007), perceives networks rather widely as an intermediate or hybrid organizational form – a regulation structure having both the features of the market and the hierarchy (Bradach and Eccles, 1989; Osborn and Baugh, 1990, McKechnie, 1994). A slightly narrower approach prevails in the management literature referring more widely to the social exchange theory (Andreson and Narus, 1984 and 1990; Das and Teng, 2002; Young-Yabara and Wiersema, 1999). According to that approach, networks or inter-firm networking are treated as a separate, third organizational form having its characteristic features making it essentially different both from markets and the hierarchy (Häkansson and Snehota, 1995; Powell 1990). In both theoretical perspectives, the inter-organizational networking research focuses on relationships or ties among firms, in particular, on the flow of resources, information and activities as well as interdependencies between them and on different forms of networking (e.g. Alter and Hage, 1993; Larson, 1992; Pisano, 1989).

A conceptualisation of networking and the network is crucial for a researcher interested in the evaluation or forecasting of relations between the networking or the network and their economic, social or technological outcomes or, in particular, as in this paper, the innovativeness or internationalisation of firms involved in the networking and networks. Referring to the transaction costs or resource-dependence theory (Pfeffer and Nowak, 1976; Buchanan, 1992; Finkelstein, 1997), one could define the networking as creating and making use of intermediate or hybrid organisational forms standing for the regulatory structures between markets and hierarchies responsible for the coordination of activities carried out by many actors having control over different and distinctive resources of network partners. This way of conceptualization of the networking dominates in the strategic management literature (e.g. Contractor and Lorange, 1988; Jarillo, 1993) and represents a rather aggregated level of an analysis of ties linking organizations, i.e. inter-organizational networking (Ebers and Grandori, 2001, p.269). Another research perspective is present in the theory of industrial networks developed by the IMP Group. The networking is understood here as conscious, intended attempts of managers to affect interactions between organizations i.e. business partners of a firm (Häkansson *et al*, 2009, p. 196-199). Networking may therefore be defined as a managerial and social process of establishing, maintaining, exploiting and terminating interactions involving activities, resources and actors – the firm and its business partners in a network. The need for networking occurs when the activities of different actors are interdependent and their resources are heterogeneous (Häkansson *et al*, 2009, p. 205). Networking leads then to a better use of the distinctive or scarce resources in interdependent activities conducted by the multiple actors constituting a network. This approach to the conceptualization of the networking allows for a better understanding of the lower level ties explaining what goes on between the organizations in a network (Ebers and Grandori, 2001, p.269). Summing up the differences between the two approaches to the conceptualisation of the networking and networks, both of them show that a more individualistic, actor-centric and process approach is employed when defining the networking while the analysis of the network concept focuses rather on the entire business network and its structure.

When taking up the research of relations between the network or networking phenomena and the innovativeness and internationalisation of firms, one should clearly define the research perspective from which they are approached. It is possible to concentrate the research on the networking of an individual firm and the firm's innovativeness and internationalisation or analyse the entire network. In the latter case, we can study connections between the structure and links within a network, and the innovativeness or internationalisation of the whole network. The individualistic and network approaches can also be combined as, e.g. done by Johanson and Mattsson (1988) who analyse the internationalisation of the firm and the internationalisation of the network at the same time and use them as a basis for the building of an interdependency matrix presenting different patterns of firms' internationalisation within networks. However, such a combined method of analysis is possible while studying a single phenomenon e.g. internationalisation, it cannot be applied in a research of a wider range of phenomena as in the study presented here.

Concluding, the theoretical framework for the understanding of the networking employed in this research tends towards the one present in the transaction cost theory and strategic management literature, i.e. for the purpose of the study a more aggregated level of analysis has been employed, than that developed by IMP Group researchers. The approach to the networking is individualistic, i.e. the subject of the study is a firm as an actor in a business network. While studying relations between the networking and the innovativeness and internationalisation of firms, the first question was: what networking forms and features of relationships between firms and their partners in the network promote the innovativeness and internationalisation of enterprises? It was assumed that it is not competition but rather the cooperation within a network with multiple partners, including foreign ones, that promotes the development of the innovativeness and internationalisation of firms. The cooperation should not be loose and occasional but permanent and contractual or capital one, based not only on economic ties but also on informational or structural ones. These forms of coordination of the activities carried out by business partners and types of linkages within a network – called the networking here – may provide an access to distinctive or rare resources of network partners on an international scale. Networking allows for a more efficient use of these resources in interdependent activities conducted individually or jointly by firms constituting a network. The importance of the networking in the stimulation of innovativeness and internationalisation arises also from the shared learning, leading to the creation of new knowledge, both technological and market one, essential to compete in local and international markets.

METHODOLOGICAL ASSUMPTIONS

The engagement of a firm in the networking results in the establishment of different types of relationships, linkages or ties with network partners and reflects a varied level or degree of networking of a firm. It may be assumed that the higher the degree of the networking activity the stronger may be its influence on innovativeness and internationalisation degree of a firm. Here comes a question: how to measure the degree of networking in which a firm is involved. In the relevant literature on business networks, there are no studies concerning the concept of measurement of the degree of networking – at least the author does not know them. What usually is subjected to the measurement covers the characteristics of the relationships themselves connecting the firm with partners in the network such as: relationship strength (e.g. Hallén, Johanson and Mohamed, 1987; Liljander and Strandvik, 1995; Donaldson and O'Toole 2000; Barry, Dion and Johnson 2008), relationship quality (e.g. Ford, 1984; Wray,

Palmer and Bejou, 1994) and relationship closeness (e.g. Goodwin and Gremler, 1996; Barnes, 1997). The measurement of the strength, quality and closeness of relationships most frequently uses relational variables of social nature, e.g. commitment, mutuality, trust and satisfaction. Relational variables of an economic nature are used much less frequently for that purpose (price, participation in buyer's purchases, commercial skills, technical skills, etc.) or both types of variables are combined as a part of a single measure.

For the purpose of this research, an own concept of measurement of the networking degree was developed by the author. It refers partly to results of prior studies undertaken by Polish researchers in the field of relationships and forms of operations' control in a firm's value chain (Gołębiowski *et. al* 2008), and the cooperation's scope and time, combined with the type and origin of business partners of a firm (Fonfara 2012, Strzyżewska 2011). The adopted assumption was that the networking degree consists of the following variables that should become the basis for the construction of a composite index of the networking degree of a firm:

- Dominating nature of business relations (pure competition, competition with elements of the cooperation, cooperation with elements of the competition, pure cooperation);
- The nature of relations in the supply chain (single transactions, recurrent transactions, long-term relationship, contractual cooperation, capital cooperation);
- Forms of cooperation in a business network (loose and occasional; permanent and non-contractual; permanent and contractual; strategic and contractual; strategic and capital)
- Forms of the coordination of primary and supporting activities in the firm's value chain (conducted within the firm, conducted within a capital group, outsourced to a partner firm);
- Type of linkages with business partners (economic, informational, structural)

A similar approach was applied in the concept of measurement of the degree of innovativeness of firms. The assumption was that the degree of innovativeness of an enterprise consists of the number of product, process, marketing and organizational innovations implemented by a firm, the degree of newness of the implemented innovations, the share of new product sales in the total sales, and the expenditure on product and process innovations as well as their share in the total expenditure. The concept of innovativeness degree measurement referred to a large extent to the innovation research methodology described in the Oslo Manual (Oslo Manual, 2005) and widely employed in the European statistics concerning innovativeness (e.g. European Innovation Scoreboard 2009, 2010; Innovation Union Scoreboard 2011, 2012). The methodology used by EU Commission includes a practise of the calculation of synthetic indicators of the level of innovativeness applied for the EU economies. The innovativeness indicator comprises several factors related to innovation in the field of inputs, firm activities and outputs (e.g. Innovation Union Scoreboard 2011, 2012, p.12.). It was assumed that, for the research presented in the paper, such a composite index might also be developed for measuring the degree of innovativeness of a particular firm.

As regards the degree of a firm's internationalisation measurement concept, it was assumed that both outward and inward forms of internationalisation implemented by a firm should be studied along with the number of markets to which this activity is connected. The next variable important for the degree of internationalisation was the share of imports and exports in the sales value with reference to the distance to markets in which they are generated. The last issue was the international business experience of a firm measured by the number of years of the firm's activities in specific markets. In the construction of the internationalisation degree index a reference was made to the most commonly used simple and composite indices of internationalisation degree of a firm (Sullivan, 1994; Ietto-Gillies, 1998; Dörrenbächer,

2000) as well as the theoretical assumptions derived from conventional models of firm internationalisation (the Uppsala Model – e.g. Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1977 and Finnish models – e.g. Luostarinen and Hellman, 1994) and the network approach to internationalisation indicating the cumulative nature of the internationalisation process (e.g. Johanson and Vahlne, 2009).

RESEARCH OBJECTIVES AND HYPOTHESIS

The study presented here is a part of a larger research project funded by the Polish National Science Centre (NCN). The findings presented here are results of the first stage of empirical research having two aims: the assessment of the degree of networking NET, innovativeness INN and internationalisation INT of the surveyed firms and the description of basic relationships and interconnections between the NET, INN and INT degrees.

As stated in the introduction, basic assumptions for the research were based on literature studies in the field of networking, internationalisation and innovativeness of firms. These studies have revealed that contemporary innovation processes are characterized by an increasing degree of networking manifesting itself in various forms of innovative cooperation between multiple geographically dispersed entities. They have also indicated that the internationalisation of a firm may be a result of its commitment to international business networks and expressed in network forms of internationalisation. These two assumptions resulted in the general research hypothesis formulation as follows:

H1: There is a positive relationship between the degrees of networking, innovativeness and internationalisation of firms

Studies of literature on firms' innovativeness describe different modes of innovation activity of firms, differentiating e.g. autonomous innovation conducted independently by a firm *versus* systemic innovation that requires close cooperation with multiple entities comprising the network (Child, Faulkner and Tallmanm, 2005) or presenting a model of an open innovation based on loose ties of firms within open innovation networks, as opposite to a "closed" innovation model (Chesbrough, 2003). In addition to that, the network approach in internationalisation theory studies proves that there are different types of firms' behaviour in respect to their internationalisation and participation in networks, e.g. lonely international or international among others (Johanson and Mattsson, 1988) or international and active in creating network *versus* international and independent from a network (Fonfara, 2012). The above-mentioned assumptions justified the development of more specific hypotheses concerning the interconnections between networking, innovativeness and internationalisation of firms:

H2: There are different modes of interconnections between the degree of networking, innovativeness and internationalisation of firms

and particularly:

H2a: The most innovative and internationalised firms are highly networked

H2b: The least innovative and internationalised firms are poorly networked

RESEARCH METHODOLOGY

The accomplishment of research objectives and the testing of the above hypotheses required the prior realization of the following specific research aims:

− development of composite indices of the degree of networking, innovativeness and internationalisation with regard to the relevant theoretical and methodological assumptions as well as to existing practices and experience related to their measurement;
− assessment of the degree of networking, innovativeness and internationalisation of the surveyed firms with the use of designed indices;
− determining the nature and strength of relations between the degrees of internationalisation, networking and innovativeness of firms by means of the correlation analysis;
− conducting a typology of firms based on their degree of networking, innovativeness and internationalisation with the use of a selected method of clusters analysis.

DATA COLLECTION, RESEARCH INSTRUMENT AND SAMPLING

The surveys the results of which are presented here were carried out at the beginning of 2012. Empirical data were collected by way of a direct interview conducted by a specialist research agency. The instrument used in this study was a structured questionnaire containing 22 questions of varying degrees of complexity relating to three areas of activity of the surveyed companies: networking, innovativeness and internationalisation. In a significant number of questions, particularly those related to networking and innovativeness, simple and complex scales were used, mostly Likert-type in the range of 1-7. In addition to those questions, 13 questions related to the firm itself were also included. They concerned the type of a business sector and industry, size of the enterprise measured as the number of employees and the level of revenue, form of ownership, the origins of the capital, capital group affiliation, as well as the international experience of the firm's management staff and the position and tenure of respondents participating in the survey.

The method used for the selection of firms for the research was non-probability purposive sampling. According to the research objectives, firms chosen for the survey were involved in the international markets both in a passive (e.g. imports – inward internationalisation) and active way (e.g. exports – outward internationalisation). Irrespectively of or simultaneously with their international commitment, the firms were expected to demonstrate an innovative activity. Firstly, the basis for the creation of a list of surveyed firms were the rankings of the largest exporters and the most innovative firms published in Poland as well as lists of firms operating in special economic zones, mostly foreign companies from various countries. As a result, one third of the sample consisted of firms recognized in Poland as those most innovative and active on the international market. The rest of the sample included firms from beyond these ranking lists perceived as having at least one of the two studied characteristics, i.e. internationalisation and innovativeness.

The choice of firms to the survey was based on the principle that they should belong to both sectors, i.e. manufacturing and services, and various industries. There should be both large, medium-sized and small firms representing the public, private and mixed ownership with only Polish, foreign or mixed capital. As a result, the firms subjected to the study (N = 274) varied in size assessed as the number of employees so that small enterprises constituted 36.9% of the sample, medium ones constituted 41.2% and large ones – 21.9%. As much as 96% of the surveyed firms were private companies and the public ownership was represented by mere

2.2% of firms. When it comes to the ownership of capital, firms with the Polish capital only constituted 67.5%, 12.8% of the firms represented foreign capital only and the rest of the companies - i.e. 19.6% - had mixed capital. Summing up, the obtained sample appeared as internally diverse in most essential dimensions and well suited to the research objectives.

<div align="center">DATA ANALYSIS</div>

The collected empirical material made it possible, in the first place, to define the basic forms of networking, innovativeness, and internationalisation of the surveyed firms and the scope and intensity of those phenomena. This was reflected in the detailed descriptive statistics showing the mean values and frequencies of the variables in the entire sample as well as in its division by sector, industry, company size, ownership, origin of capital and affiliation with capital groups.

The next step of the analyses was to draw up methodological assumptions concerning the construction of synthetic indices of the firm's networking, innovativeness, and internationalisation degrees and, after that, to calculate their value for individual firms. The final value of each index was then normalised to take the value from 0 to 1. This method of calculation of the networking, innovativeness, and internationalisation indices allowed for their relatively simple interpretation consisting in the assumption that the higher the index, the higher the degree of networking, innovativeness, and internationalisation of a firm. It has also enabled the comparison of the three indices among one other and across different sections of the sample within intended value range. On the basis of the achieved study results, values of those indices were conventionally regarded as low - within the range 0.0 - 0.19, moderate - (0.2 - 0.39), high - (0.4-0.59), and very high - above 0.6.

- Networking index NET

In order to design the networking index NET the following variables were employed:

- Dominant Nature of a Business Relationship – DNBR;
- Nature of Relations in Supply Chain – NRSC;
- Forms of Cooperation in a Business Network – FCBN;
- Forms of Coordination of Primary Activities – FCPA;
- Forms of Coordination of Support Activities – FCSA;
- Type of Linkages with Business Partners – TLBS.

It was assumed that the networking degree of a firm depends jointly on the dominant nature of business relationships (DNBR) (competition – cooperation), the nature of relations in supply chain (NRSC) (single transactions – capital cooperation), forms of cooperation in a business network (FCBN) (loose and occasional – strategic and capital), forms of coordination of primary and support activities in the value chain (FCPA, FCSA) (integration within a firm - outsourcing to partner firms) and the type of linkages with business partners (TLBS) (economic, informational, structural). The assumption underlying the calculation of the NET index was that the more often the firm establishes privileged business relationships based on network forms of coordination of activities conducted by the firm and its business partners, customers and even competitors, the higher the degree of networking of the firm. The above assumption was then reflected in different weights given to particular forms of networking employed by a firm. The above-mentioned six variables were tested towards a correlation between them. The use of the Pearson correlation coefficient (r) showed positive moderate correlations between them as presented in Table 1.

Table 1. Correlation between variables composing the NET index (N = 274), p < 0.001

|	DNBR	NRSC	FCBN	FCPA	FCSA	TLBS
DNBR	1.					
NRSC	.715	1.				
FCBN	.730	.716	1.			
FCPA	.600	.613	.638	1.		
FCSA	.627	.606	.642	.837	1.	
TLBS	.619	.598	.648	.528	.579	1.

Legend:
DNBR - Dominant Nature of Business Relationship
NRSC - Nature of Relations in a Supply Chain
FCBN - Forms of Cooperation in a Business Network
FCPA - Forms of Coordination of Primary Activities
FCSA - Forms of Coordination of Support Activities
TLBS - Type of Linkages with Business Partners

The data presented in Table 1 show that research variables constituting the networking index NET are strongly correlated in the case of forms of coordination of primary activities in a value chain (FCPA) and forms of coordination of support activities (FCPS) – (0.837), the dominant nature of business relationships (DNBR) and forms of cooperation in a business network (FCBN) – (0.730) and the nature of relations in supply chain (NRSC) with forms of cooperation in business network (FCBN) – (0.716). All correlation coefficients between the research variables are statistically significant (p <0.001).

The networking index NET was calculated on the basis of the above-mentioned six variables. The reliability of the NET index measured with the Cronbach alpha coefficient was 0.91. The mean value of the networking index in the entire research sample (N = 274) stood at 0.443, which represents a relatively high level of the networking index NET with the standard deviation equal to 0.185 and the range of 0.812. The histogram in presented Figure 1 shows a left asymmetric distribution of the NET index that, in this case, indicates that the majority of examined firms were relatively highly networked.

Figure 1. Distribution of the NET index in the research sample (N = 274)
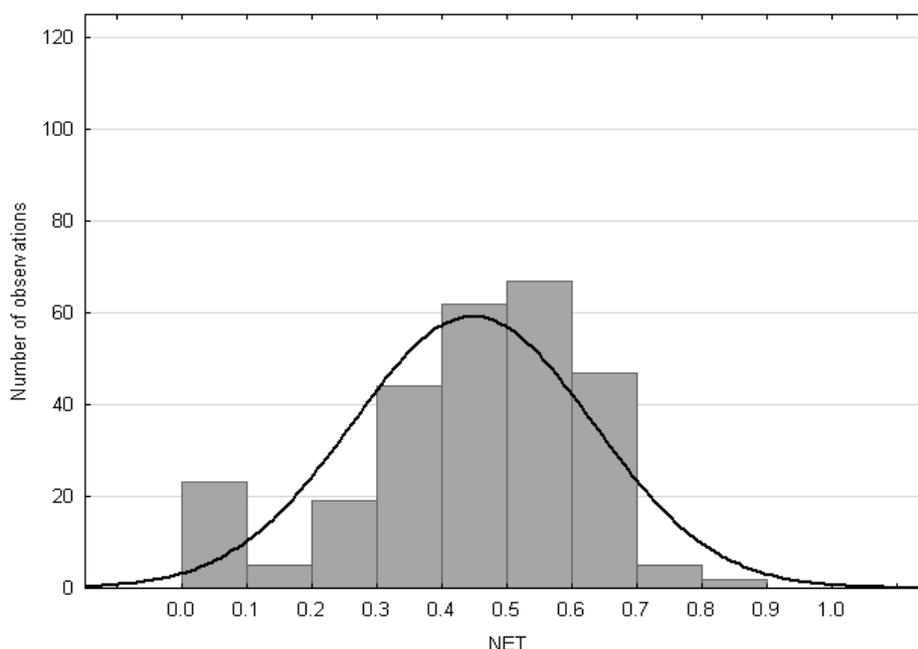
- Innovativeness index INN

In order to design the innovativeness index INN, the following variables were employed:

− Number of Innovations against Competitors (by innovation type) - NIC
− Degree of Newness of an Innovation (by innovation type) - DNI
− Share of Revenues from the New Product Sales (by degree of newness) - SRNPS
− Innovation Expenditure against Competitors (by innovation type) - IEC
− Share of Innovation Expenditure in Total Expenditure (by innovation type) – SIETE

It was assumed that the firm's degree of innovativeness depends on the number of implemented product, process, marketing and organizational innovations (NIC) and on the related innovation expenditure (IEC). Because of the potential impact of the industry specificity on the number of innovations and innovation expenditure, the variables were referred to competitors. It was also presumed that the innovativeness of a firm should be assessed by the degree of innovation newness (new to a firm, new to a domestic market or new to an international market) (DNI), the share of revenues from the new product sales (SRNPS) and the share of the innovation expenditure in the total firm's expenditure (SIETE). After calculating the research variables based on those assumptions, the next step of the study was to examine the correlation between them with the use of the Pearson correlation coefficient (r). Results are presented in Table 2.

Table 2. Correlation between variables composing the INN index (N = 274), p < 0.001

|	NIC	DNI	SRNPS	IEC	SIETE
NIC	1.				
DNI	.208	1.			
SRNPS	.354	.170	1.		
IEC	.590	.214	.348	1.	
SIETE	.615	.162	.400	.550	1.

Legend:
NIC   - Number of Innovations against Competitors (by innovation type);
DNI   - Degree of Newness of an Innovation (by innovation type);
SRNPS - Share of Revenues from the New Product Sales (by degree of newness);
IEC   - Innovation Expenditure against Competitors (by innovation type);
SIETE   - Share of Innovation Expenditure in Total Expenditure (by innovation type);

The data presented in Table 2 show that the correlation between research variables adopted for the innovativeness index INN design is positive but usually low. The strongest correlation (0.615) is observed in variables representing the number of implemented innovations (NIC) and the innovation expenditure to the total expenditure (SIETE) as well as to those concerning the innovation expenditure to the total expenditure (SIETE) and the innovation expenditure against competitors (IEC) - (0.550). All correlation coefficients between the studied variables are statistically significant (p <0.001).

The next step of the study was to calculate the value of the innovativeness index INN for individual firms on the basis of those five research variables. Reliability of the INN index measured by means of the Cronbach's alpha coefficient was 0.75. The mean value of the innovativeness index INN reached 0.284, which represents a moderate level of innovativeness with a standard deviation equal to 0.130 and the range of 0.808. The distribution of the innovativeness index in the entire sample is shown in the histogram in Figure 2. If the extremely high values of the index (more than 0.7) were ignored the innovativeness index distribution could be regarded as similar to the normal distribution.

Figure 2. Distribution of the INN index in the research sample (N = 274)
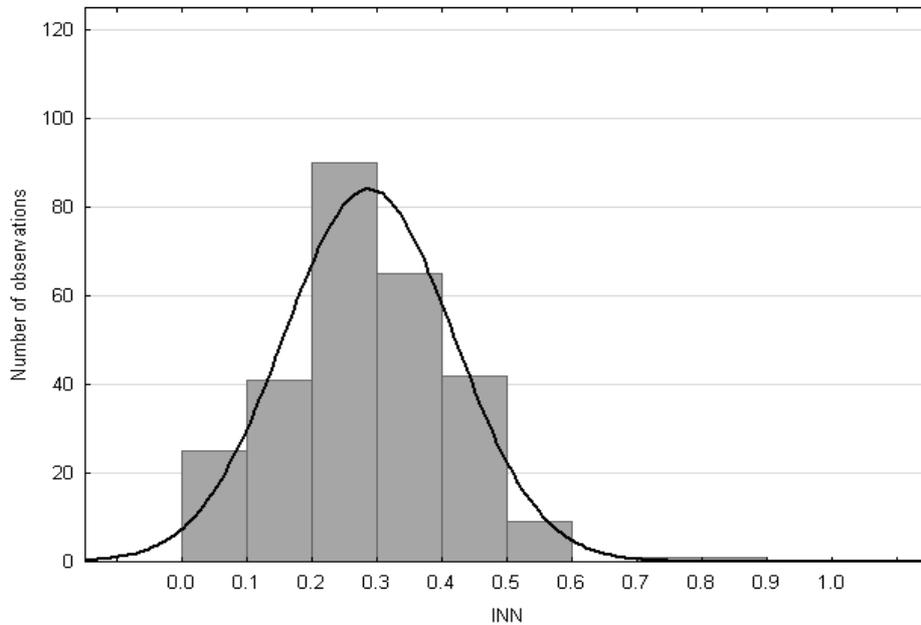
- Internationalisation index INT

In order to design the internationalisation (INT) index, the following variables were employed:

- Outward Internationalisation Forms and Markets – OIFM;
- Inward Internationalisation Forms and Markets – IIFM;
- Export Share in Sales and Markets – EXSM;
- Import Share in Sales and Markets – IMSM;
- Firm's International Experience and Markets – FIEM.

It was assumed that the internationalisation degree of a firm increases with the evolution towards more advanced forms of the firm's commitment to foreign markets: beginning with the international exchange to intermediate forms of inward and outward internationalisation based on cooperation to direct foreign investment (OIFM, IIFM). Other components of the index included the share of exports/imports in total sales and the firm's experience on international markets (EXSM, IMSM and FIEM). When calculating the value of the INT index, greater weight was given to outward internationalisation forms than to inward ones. It was also presumed that the internationalisation degree of a firm grows with the physical and psychic distance separating foreign markets from the home market in Poland. It was assumed that the closest markets in this respect are the EU ones, then - other European markets outside the EU and, finally, the non-European markets. Using the Pearson correlation coefficient (r), the correlation between the above variables was subsequently examined providing the results shown below (Table 3).

Table 3. Correlation between variables composing the INT index (N = 274), p < 0.001

	OIFM	IIFM	EXSM	IMSM	FIEM
OIFM	1.00				
IIFM	.487	1.00			
EXSM	.329	.278	1.00		
IMSM	.179	.286	.347	1.00	
FIEM	.324	.229	.534	.293	1.00

Legend:
OIFM - Outward Internationalisation Forms and Markets
IIFM   - Inward Internationalisation Forms and Markets
EXSM - Export Share in Sales and Markets
IMSM - Import Share in Sales and Markets
FIEM - Firm's International Experience and Markets

Data presented in Table 1 show that there is a positive, moderate correlation between the research variables, in particular, between the firm's international experience FIEM and the share of exports in the sales EXSM (0.534); between the firm's outward forms of internationalisation OIFM and inward forms of internationalisation IIFM (0.487) – stronger than between exports EXSM and imports IMSM themselves (0.347). All correlation coefficients between the studied variables are statistically significant (p <0.001).

The next step of the study was to calculate the internationalisation index INT based on those five variables. Its mean value for the entire research sample (N = 274) amounts to 0.128 and represents a low level of the internationalisation index INT with the standard deviation equal to 0.111 while the range amounts to 0.644. The reliability of the INT index measured by the Cronbach alpha coefficient is 0.63. The analysis of the distribution of the internationalisation index INT shows the right asymmetry, which means that most of the surveyed firms are characterized by a relatively low degree of internationalisation as illustrated in the histogram (Figure 3).

Figure 3. Distribution of the INT index in the research sample (N = 274)
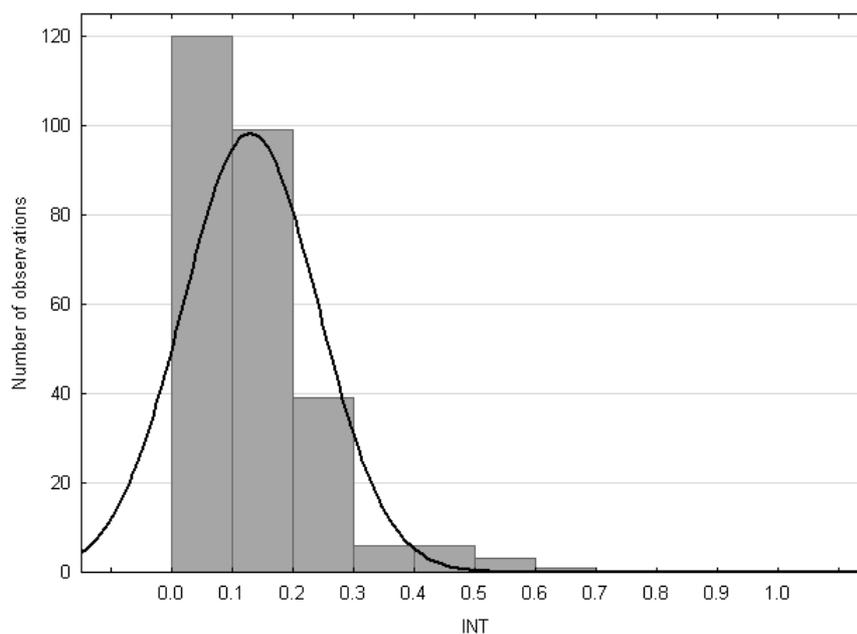
Summing up, the mean value of the networking index NET (0.443) has a relatively high value within the range of (0.4 - 0.6). Since there are few comparable studies of the phenomenon in Poland, it is difficult to state whether the mean value of the index corresponds with the average degree of networking of Polish firms. As the value of this index is still below the achievable mean (0.5), it can be assumed that it properly measures the degree of networking of the surveyed firms, most of them Polish, generally perceived as reluctant to cooperate (e.g. Strzyżewska, 2011). The innovativeness index INN (0.284) is at the moderate level (0.2 - 0.4) and the internationalisation index INT (0.128) of surveyed firms is low, located in the range of (0.0 - 0.2). The mean value of these indices corresponds to many research and analyses in the field of innovativeness and internationalisation of Polish firms both at macro economic level (e.g. Szymura-Tyc, 2011; Gorynia, 2012) and micro economic one (e.g. Innowacyjność 2010; Witek-Hajduk, 2008; Cieślik, 2010) and the general belief in the low/moderate innovativeness and low level of internationalisation of these firms. The above-mentioned considerations may justify the principles employed to design the NET, INN and INT indices used to measure the degree of networking, innovativeness and internationalisation of the surveyed firms. Mean values of the networking, innovativeness and internationalisation indices are shown in Table 4.

Table 4. Descriptive statistics for INT, NET and INN indices (N=274)

	Mean	**Median**	**Range**	**Standard deviation**
NET	0.443	0.475	0.812	0.185
INN	0.284	0.281	0.808	0.130
INT	0.128	0.118	0.644	0.111

Legend:
NET – Networking index
INN – Innovativeness index
INT – Internationalisation index

- Relationships between the degrees of networking, innovativeness and internationalisation

The following aim of the statistical analysis was to determine the relationship between the indices of networking NET, innovativeness INN, and internationalisation INT of the surveyed firms. Firstly, this analysis was performed employing the Pearson correlation coefficient *r* and showed a positive, though weak correlation between pairs of the three indices. All correlation coefficients in the sample are statistically significant ($p < 0.001$) and the correlation matrix is shown in Table 5.

Table 5. Correlation matrix for INT, NET, INN indices (N=274), $p < 0.001$

	NET	**INN**	**INT**
NET	1.		
INN	.299	1.	
INT	.251	.302	1.

Legend:
NET – Networking index
INN – Innovativeness index
INT – Internationalisation index

Summarising, the correlation analyses results presented in table 5 make it possible to confirm the hypothesis H1 stating that:

H1: ***There is a positive relationship between the degrees of networking, innovativeness and internationalisation of firms.***

Further analysis of these results indicates that the correlation between the networking degree NET of surveyed firms is stronger for the innovativeness degree INN (0.299) than for the internationalisation degree INT (0.251) while the strongest correlation exists between the internationalisation index INT and the innovativeness index INN (0.302). Due to slight differences between values of the *r* correlation coefficient for individual pairs of variables, the interpretation of obtained results should be prudent. However, we can assume that the networking is more supportive to the innovativeness of a firm than to the internationalisation. High innovativeness in comparison with competitors on a local market can be insufficient to compete on a foreign market; hence, it may not be reflected in the degree of internationalisation of an enterprise. More precise answer to the question about the interconnections between all three phenomena measured by NET, INN and INT indices of individual firms may be probably given by a cluster analysis used for the typology of firms' behaviour in the field of networking, innovativeness and internationalisation.

- Typology of firms based on their networking, innovativeness and internationalisation degree

In the next step of the analysis, an attempt was made to create a relatively homogeneous subsets of firms characterized by similar values of internationalization, networking and innovativeness indices. For this purpose, it was decided to use the cluster analysis method. Finally, two out of many available methods were selected: k-means algorithm with v-fold cross validation and SOM (self-organizing maps) called Kohonen networks (Kohonen, 1990). The optimal number of clusters obtained by the k-means method was 4 whereas the subjectively set grid size in the Kohonen network was 2 x 2. The mean values of INT, NET and INN indices in individual clusters obtained with the use of the two methods are shown in Figure 4 and 5.
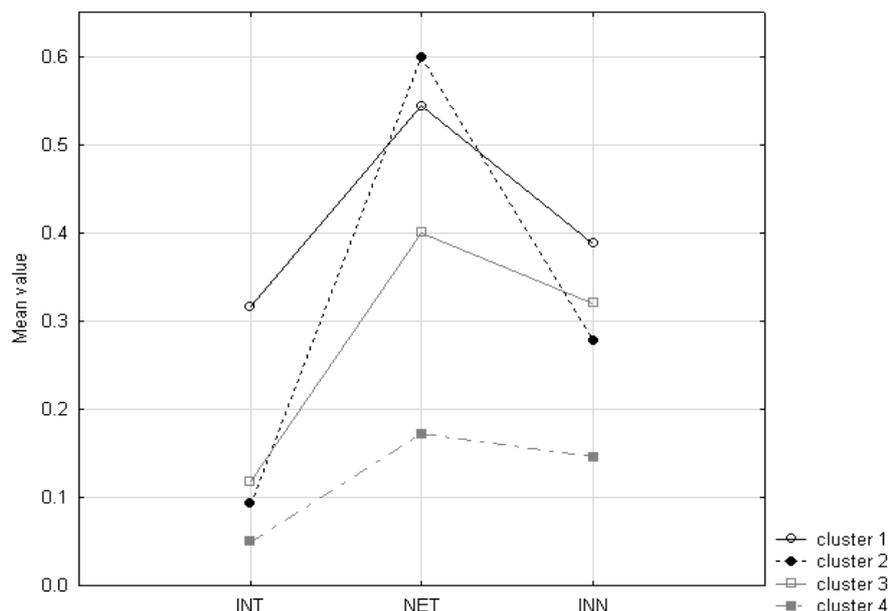
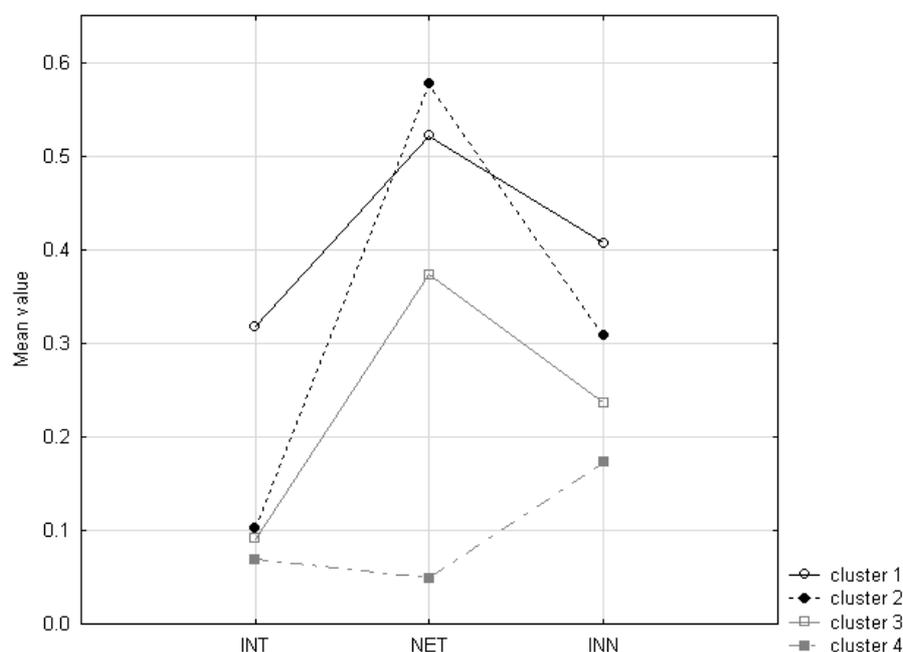Figure 4. Firms clusters in k-means method

Figure 5. Firms clusters in SOM (Kohonen networks) method

The analysis of Figures 4 and 5 shows clearly that the methods yielded very similar results. All four clusters in both methods represent similar characteristic in all three dimensions: internationalisation, networking and innovativeness. The analysis of mean values of INT, INN and NET indices also shows that they are similar in both methods of grouping but the content of individual clusters is not. The comparison of the size of clusters obtained using the two methods is shown in Table 6. The data contained in the table show that the most consistent and comparable clusters are: SOM 1 and k-means 1, SOM 2 and k-means 2. The consistent grouping is singled out with a shade of gray. Overall, only 22.6% of firms were assigned to different clusters according to both methods.

Table 6. Content comparison of k-mean and SOM clusters

	SOM cluster 1	SOM cluster 2	SOM cluster 3	SOM cluster 4	Total k-means
k-means cluster 1	36	5	1	0	42
k-means cluster 2	0	85	3	0	88
k-means cluster 3	5	24	62	2	93
k-means cluster 4	0	0	22	29	51
Total SOM	41	114	88	31	274

The Kohonen network (SOM) was eventually chosen as the clustering method as it provided a greater homogeneity of isolated clusters in terms of other characteristics of firms (such as the sector and industry affiliation, the size of a firm and the origin of the capital) and a relative ease of interpretation of research outcomes. Results obtained were subjected to the ANOVA

(analysis of variance) to determine whether statistically significant differences exist between the distinguished clusters. The p < 0.001 value was indicative of the existence of such differences between at least two groups o firms. The subsequent Scheffe *post hoc* test made it possible to determine the existence of differences between all clusters from the NET and INN perspective and the differences between certain clusters from the INT point of view. Table 7 describes the structure of the four clusters obtained with the use of the SOM method depending on the number of firms in a cluster, mean values and standard deviation of the INN, NET and INN indices.

Table 7. The number of firms, mean values and standard deviation of INT, NET and INN indices in SOM clusters (N=274).

SOM clusters	Number of firms	INT index		NET index		INN index	
		mean	standard deviation	mean	standard deviation	mean	standard deviation
1	41	0.318 (M)	0.110	0.522 (H)	0.113	0.407 (H)	0.138
2	114	0.103 (L)	0.066	0.577 (H)	0.079	0.308 (M)	0.100
3	88	0.091 (L)	0.074	0.373 (M)	0.066	0.237 (M)	0.112
4	31	0.069 (L)	0.072	0.049 (L)	0.076	0.173 (L)	0.012
Total	274	0.128	0.112	0.443	0.185	0.284	0.130

Legend:
L - low level
M - moderate level
H - high level

Thus, the first cluster consisted of 41 enterprises with a moderate degree of internationalisation, high degree of networking and high level of innovativeness. The firms making up this cluster could be called "international network and innovation high-fliers". The second cluster was made up of 114 enterprises with a low level of internationalisation, highly networked and moderate in innovation, which can be called "local innovation and network front runners". In the third cluster, there are 88 enterprises with a low degree of internationalisation, moderate degree of networking and a moderate degree of innovativeness, which are "local innovation and network commoners". The fourth cluster contains 31 companies with the lowest degree of internationalisation, the lowest degree of networking and the lowest degree of innovativeness. Let us call them "local innovation and network laggards".

In summary, the analysis carried out with the use of the Kohonen network clustering allowed us to confirm the H2 hypothesis adopted in the study:

H2: There are different modes of interconnections between the degree of networking, innovativeness, and internationalisation of firms,

and the particular H2a and H2b hypotheses, as follows:

H2a: The most innovative and internationalised firms are highly networked

H2b: The least innovative and internationalised firms are poorly networked

Clusters of firms distinguished in the analyses allow us to see significant differences in levels achieved for each of the indices and the interconnections among them. It can be assumed that, in the case of the first cluster, a relatively high level of internationalisation goes hand in hand with innovativeness and is supported by a high degree of networking of those firms. In the case of the second cluster, the achieved moderate level of innovativeness is not related to the internationalisation of firms included here, which is low. Their innovativeness might be "pushed up" by networking as such firms have the highest scores in the research sample. In turn, the third cluster contained firms with the same degree of internationalisation as the firms included in the second cluster. It can be assumed that, in this situation, their relatively lower levels of innovativeness may be associated with a significantly lower degree of networking. The last cluster contained firms operating mainly on the local market with the lowest degree of innovativeness accompanied by the lowest level of networking. Interestingly, this is the only cluster in which the value of the networking index is lower than the values of internationalisation and innovativeness indices. It can be stated that the low networking level of those firms (with a comparable degree of internationalisation, as in the second and third cluster), is "pulling down" their innovativeness.

Conclusions, Contributions and Further Research

The presented results show quite clearly that the innovativeness of a firm is related to its involvement in the network in such a way that the higher the degree of networking in a firm, the higher the degree of its innovativeness. It can be also seen that a high degree of networking accompanies a higher degree of internationalisation of a firm. On the other hand, the lowest networking degree corresponds with the lowest innovativeness degree and the lack of international commitment of a firm. The research results corroborate the thesis included in the paper's title, i.e. the networking is a driver of innovativeness and internationalisation of firms.

The contribution of the research is the finding that networking is supporting innovativeness of firms, which may lead to a higher degree of the firm's internationalisation. The interconnections between the three phenomena have been usually researched separately, i.e. networking with innovation, networking with internationalisation and innovation with internationalisation. There has been no research so far that would combine all these interdependencies in a single study. There is also a methodological aspect of the study, which may be perceived as an original contribution, i.e. the construction of the composite indices of networking, innovativeness and internationalisation of firms. The construction of indices has been based on the relatively easily accessible data and their reliability and usability has been proved in the study.

When it comes to the future research, it is worth stressing that the empirical data available today make it possible to carry out further in-depth studies on the issues of the networking, innovativeness and internationalisation within and across clusters, sectors and industries, firms of varied sizes and origins of capital, etc. Moreover, a deeper insightful analysis of the network nature is also possible here. The next step of the study could be also an attempt to find possible relations between the NET, INN and INT degrees and financial performance measures of individual firms and within particular clusters.

REFERENCES

Ahmed, P.K., 2000. Sixth generation innovation: innovation systems into the future, *European Journal of Innovation Management*, No 3.

Alter, C. & Hage, J., 1993. *Organizations Working Together*. Newbury Park, Calif.: Sage.

Anand, B.N. & Khanna, T., 2000. Do Firms Learn to Create Value? *Academy of Management Journal*, vol. 33.

Anderson, J., Häkansson, H. & Johanson, J., 1994. Dyadic Business Relationships within a Business Network Context, *Journal of Marketing*, vol. 58.

Andreson, J.C. & Narus, J.A., 1984. A Model of the Distributor's Perspective of Distributor-Manufacturer Working Relations, *Journal of Marketing,* vol. 48.

Andreson, J.C. & Narus, J.A., 1990. A Model of Distributor Firm and Manufacturing Firm Working Partnership. *Journal of Marketing*, vol. 54.

Barnes, J.G., 1997. Closeness, strength, and satisfaction: examining the nature of relationships between providers of financial services and their retail customers, *Psychology & Marketing*, 14(5).

Barry, J.M., Dion, P. & Johnson, W., 2008. A Cross-Cultural Examination of Relationship Strength in B2B Services, *Journal of Services Marketing*, 22(3).

Bradach, J.L. & Eccles, R., 1989. Price, Authority and Trust. From Ideal Types to Plural Forms, *Annual Review of Sociology*, vol. 15.

Buchanan, L., 1992. Vertical Trade Relationships: The Role of Dependence and Symmetry in Attaining Organizational Goals, *Journal of Marketing Research*, vol. 29.

Chesbrough, H., 2003. *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Cambridge Mass.: Harvard Business Press.

Child, J. Faulkner, D. & Tallman, S., 2005, *Cooperative Strategy. Managing Alliances, Networks, and Joint Ventures*, New York: Oxford University Press.

Cieślik, J., 2010. *Internacjonalizacja polskich przedsiębiorstw. aktualne tendencje – implikacje dla polityki gospodarczej*. Warszawa: Akademia Leona Koźmińskiego,.

Contractor, F.J. & Lorange, P. eds., 1988. *Cooperative Strategies in International Business*. Lexington, Mass.: Lexington Books.

Das, T.K. & Teng, B., 2002. Alliance Constellations: A Social Exchange Perspective. *Academy f Management Review*, vol. 27.

Donaldson, B. & O'Toole, T., 2000, Classifying Relationships Structures: Relationship Strength in Industrial Markets, *Journal of Business & Industrial Marketing*, 15(7).

Dörrenbächer, Ch., 2000. *Measuring corporate internationalisation: a review of measurement concepts and their use. Discussion paper*. Berlin: Wissenschaftszentrum Berlin für Sozialforschung.

Dyer, J.H. & Singh, H., 1998. The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage through Network Relationships. *Strategic Management Journal*, vol. 23.

Ebers, M. & Grandori, A., 2001. The Forms, Costs and Development Dynamics of Inter-Organizational Networking. In: E. Ebers, ed. 2001. *The Formation of Inter-organizational networks*. Oxford: Oxford University Press

European Innovation Scoreboard 2009, 2010. European Commission, Pro Inno Europe.

Finkelstein, S., 1997. Interindustry Merger Patterns and Resource Dependence: A Replication and Extension of Pfeffer (1972) *Strategic Management Journal*, vol. 18.

Fonfara, K. ed., 2012. *The development of business networks in the company internationalisation process*, Poznań: Poznań University of Economics Press.

Ford, D., 1984. Buyer-Seller Relationships in International Industrial Markets, *Industrial Marketing Management*, 13(2).

Ford, D., Gadde, L.E., Häkansson, H. & Snehota I., 2006. *The Business Marketing Course. Managing in Complex Networks,* Second edition. Chichester: John Wiley & Sons Ltd.

Forsgren, M. & Johanson, J., 1994. Managing internationalisation in business networks. In: M. Forsgren, J. Johanson eds. 1994. *Managing Networks in International Business*, Gordon and Breach Science Publishers.

Gołębiowski, T., Dudzik, T.M., Lewandowska, M. & Witek-Hajduk, M., 2008. *Modele biznesu polskich przedsiębiorstw*, Warszawa: Oficyna Wydawnicza. Szkoła Główna Handlowa.

Goodwin, C. & Gremler, D.D., 1996. Friendship over the counter: how social aspects of service encounters influence customers loyalty. In: T.A. Swartz, D.E. Bowen and S.W. Brown, eds. 1996. *Advances in Services Marketing and Management*, vol. 5, London: JAJ Press.

Gorynia, M., 2012. Ewolucja pozycji gospodarki polskiej w gospodarce światowej, *Ekonomista*, Nr 4.

Gulitai, R., Nohria, N. & Zaheer, A., 2000. Strategic Networks. *Strategic Management Journal*, vol. 43.

Häkansson, H. & Johanson, J., 2001. *Business network learning.* Oxford: Pergamon.

Häkansson, H. & Snehota, I., 1993. No business is an island: The network concept of business strategy. In: D. Ford, ed. 1993. *Understanding business markets: interactions, relationships and networks*, Academic Press Harcourt Brace & Comp. Publ.

Häkansson, H. & Snehota, I., 1995. *Business Networks*. London: Routledge.

Häkansson, H. & Waluszewski, A., 2003. *Managing Technological Development*, London: Routledge.

Häkansson, H. ed., 1982. *International Marketing and Purchasing of Industrial Goods – an Interaction Approach*, New York: John Wiley.

Häkansson, H., Ford, D., Gadde, L.E., Snehota, I. & Waluszewski, A., 2009. *Business in Networks*, John Wiley & Sons Ltd.

Hallén, L., Johanson, J., & Mohamed, N.S., 1987. Relationship Strength and Stability in International and Domestic Industrial Marketing, *Industrial Marketing and Purchasing*, 2(3).

Hamel, G., Doz, Y.L. & Prahalad, C.K., 1989. Collaborate with your Competitors – and Win. *Harvard Business Review*, vol.67, January-February.

Hennart, J.F., 1991. The Transaction Costs Theory of Joint Ventures: an Empirical Study of Japanese Subsidiaries in the United States, *Management Science*, vol. 37.

Ietto-Gillies, G., 1998. Different conceptual frameworks for the assessment of the degree of internationalisation: an empirical analysis of various indices for the top 100 transnational corporations, *Transnational Corporations*, 7(1).

Inkpen, A.C. & Currall, S.C., 2004. The Coevolution of Trust, Control, and Learning in Joint Ventures, *Organization Science*, vol.15.

Innovation Union Scoreboard 2011, 2012. The European Commission, Pro Inno Europe.

Innowacyjność 2010, 2010. Warszawa: Polska Agencja Rozwoju Przedsiębiorczości

Jarillo, J.C., 1993. *Strategic Networks. Creating the Borderless Organization.* Oxford: Butherworth, Heinemann.

Johanson, J. & Mattsson, L.G., 1988. *Internationalisation in industrial systems – a network approach.* In: N. Hood, J.E. Vahlne, eds. *Strategies in Global Completion*, New York: Croom Helm,

Johanson, J. & Vahlne, J.E., 1977. The internationalisation process of the firm: a model of knowledge development and increasing foreign commitments, *Journal of International Business Studies*, 8 (1).

Johanson, J. & Vahlne, J.E., 2009. The Uppsala internationalisation process model revisited:

From liability of foreignness to liability of outsidership, *Journal of International Business Studies*, 40 (9).

Johanson, J. & Wiedersheim-Paul, F., 1975. The internationalisation of the firm: four Swedish cases, *Journal of Management Studies*, October, 12 (3).

Kale, P. & Singh, H., 2007. Building Firm Capabilities through Learning: The Role of the Alliance Capability and Firm-Level Alliance Success, *Strategic Management Journal*, vol. 28.

Kohonen, T., 1990. The Self-Organizing Map. In: *Proceedings of the IEEE*, 78.

Larson, A., 1992. Network Dyads in Entrepreneurial Setting: a Study of Governance of Exchange Relationships, *Administrative Science Quarterly*, vol. 37.

Liljander, V. & Strandvik, T., 1995. The nature of relationships in services. In: T.A. Swartz, D.E. Bowen and S.W. Brown, eds. 1995. *Advances in Services Marketing and Management*. Vol. 4, Connecticut: JAJ Press.

Luostarinen, R. & Hellman, H., 1994. The Internationalization Process and Strategies of Finnish Family Firms, *CIBR Research Paper Series Y-1*, Helsinki: Helsinki School of Economics.

Mathews, J. A., 2002. *Dragon multinational. A new model for global growth*, New York: Oxford University Press.

McKechnie, G., 1994. A typology of Organizational Network Designs. Paper presented at the *European Science Foundation EMOT Conference: Assessing Interorganizational Networks*. 3-4 February 1994, Jouy-en-Josas.

O'Sullivan, D. & Dooley, L., 2009. *Applying Innovation*, Sage Publication, Inc.

Osborn, R.N. & Baugh, C.C., 1990. Forms of Interorganizational Governance for Multinational Alliances, *Academy of Management Journal*, vol. 33.

Oslo Manual, 2005. 3rd edition, Luxembourg: OECD Statistical Office of the European Communities.

Pfeffer, J. & Nowak, Ph., 1976. Joint Ventures and Interorganizational Interdependence, *Administrative Science Journal*, vol. 21.

Pisano, G.P., 1989. Using Equity Participation to Support Exchange: Evidence from the Biotechnology Industry, *Journal of Law, Economics, and Organization*, vol.5.

Powell, W.W., 1990. Neither Market nor Hierarchy: Network Forms of Organization, *Research in Organizational Behavior*, vol. 12.

Pyka, A. & Kuppers, G., 2002. *Innovation Networks: Theory and Practice*. Cheltenham: Edward Elgar.

Rothwell, R., 1992. Successful Industrial Innovation: Critical Success Factors for the 1990s', *R&D Management*, vol. 22.

Sharma, D. & Blomstremo, A., 2003. The internationalisation process of born globals: a network view, *International Business Review*, vol. 12.

Strzyżewska, M., 2011. *Współpraca między przedsiębiorstwami – odniesienie do polskiej polityki*. Warszawa: Oficyna Wydawnicza. Szkoła Główna Handlowa,.

Sullivan, D., 1994. Measuring the Degree of Internationalisation of a Firm, *Journal of International Business Studies*, 25(2).

Szymura-Tyc, M., 2011. The role of marketing in contemporary innovation processes – the perspective of transition economies. In: R. Springer & P. Chadraba eds. *Proceedings of the 19th Annual Conference on Marketing and Business Strategies for Central & Eastern Europe*, Vienna, 1-3 December 2011, Vienna: Institute for Export Management. Vienna University of Economics and Business.

Thomson, G.J., Frances, J., Levacic, R. & Mitchell, J., eds. 1991. *Markets, Hierarchies and Networks: The Coordination of Social Life*. London: Sage.

Tidd, J., Bessant, J. & Pavitt, K., 2005, *Managing Innovation. Integrating Technological,*

Market and Organizational Change. John Wiley & Sons Ltd.

Witek-Hajduk, M., 2008. *Strategie internacjonalizacji polskich przedsiębiorstw w warunkach akcesji Polski do Unii Europejskiej*, Warszawa: Oficyna Wydawnicza. Szkoła Główna Handlowa.

World Investment Report 2011, 2012. UNCTAD.

Wray, B., Palmer, A. & Bejou, D., 1994. Using neutral network analysis to evaluate buyer-seller relationships, *European Journal of Marketing*, 28 (10).

Young-Yabara, C. & Wiersema, M., 1999. Strategic Flexibility in Information Technology Alliances: The Influence of Transaction Costs Economics and Social Exchange Theory, *Organization Science*, vol. 10.

Zuchella, A. & Scabini, P., 2007. *International entrepreneurship, theoretical foundations and practices*, London: Polgrave Macmillan.