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Dominika BRÓZDA-WILAMEK*
https://orcid.org/0000-0002-0513-2286

A NETWORK ANALYSIS OF CROSS-BORDER MERGERS AND ACQUISITIONS IN POLAND, CZECHIA, AND HUNGARY

Abstract

Background: Cross-border mergers and acquisitions (CBM&As) have taken the form of a network, as there are complex business relationships between the participating entities. The concept of social network analysis (SNA) to study business connections is poorly described in the literature. There is also a lack of comprehensive structure studies on CBM&A purchases by Central and Eastern Europe (CEE) companies.
Research purpose: The purpose is to evaluate the geographical and sectoral structure of the Polish, Czech, and Hungarian CBM&A network in 2010–2020. This article also aims to present a new methodological approach to studying the structure of the M&A market related to the application of SNA metrics.
Methods: The study is carried out using social network analysis. Sectoral M&A data taken from the Eikon Refinitiv database are used, and several network indicators are applied, i.e., degree, prestige, and betweenness centrality, for the analysis.
Conclusions: In 2010–2020, Polish, Czech, and Hungarian companies were characterized by investment activity not only in the CEE countries, but also in Western Europe, Russia, and the United States. Enterprises from the financials, industrials, consumer cyclicals, and technology sectors have played an important role in CBM&A networks. Entities operating in the energy and healthcare sectors (in Hungary) and the real estate and utilities sectors (in Czechia) have also occupied a central place in the analyzed networks. Private equity and hedge funds play a key role in cross-sectoral transactions.

Keywords: cross-border mergers and acquisitions, Central Eastern Europe, social network analysis, centrality.

JEL classification: D85, G34, L14

* Ph.D., University of Lodz, Faculty of Economics and Sociology, Department of International Business and Trade; e-mail: dominika.brozda@uni.lodz.pl

1. Introduction

In the era of ongoing globalization and capital flow liberalization, the creation of network connections between entities has noticeably increased corporations' effectiveness on the global market.[1] One type of international expansion strategy is cross-border mergers and acquisitions (CBM&As). This dominant form of foreign direct investment (FDI) in the world economy has increasingly taken the form of a network, as there are complex business relationships between the participating entities.

This network has unique properties that can be analyzed with network analysis based on social network analysis (SNA). This research method includes statistics that allow the researcher to consider the data from a new perspective. On the one hand, SNA makes it possible to graphically visualize the relationships between the examined entities; on the other hand, SNA enables detailed identification of the relationship characteristics between these entities. It is an interdisciplinary research method widely used in sociology, mathematics, biology, computer science, and physics. Such an approach is not yet widespread in the economic literature, although the use of SNA to analyze mergers and acquisitions (M&A) network allows for the identification of so far imperceptible capital links of an indirect nature.

The economic literature focuses on determining the factors behind M&As. CBM&As are analyzed for various aspects such as motivation, value creation, and payment methods, as well as behavioral, organizational, and cultural aspects. Despite the importance that is attributed to M&A transactions in terms of growth and value creation, only a few studies (including Sánchez Díez et al.,[2] and Luty[3]) deal with the topology of CBM&As as networks of complex interactions between countries or sectors. The lack of research in this area is because publicly available statistical data published by UNCTAD do not provide detailed information on CBM&A transactions simultaneously at the country and sector level.

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1 **M. Rosińska-Bukowska**, *Global Business networks. Concept – structure – competitiveness*, Publisher of the University of Lodz, Lodz 2020, pp. 15–16.

2 **A. Sánchez Díez**, **P. Galaso Reca**, **J.M. García de la Cruz**, *Mergers and acquisitions carried out by Spanish firms in Latin America: a network analysis study*, CEPAL Review 2016/2016/120, pp. 51–69.

3 **P. Luty**, *Połączenia i przejęcia transgraniczne z udziałem polskich spółek w latach 2005–2014 – wybrane zagadnienia*, Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia: Ryzyko, zarządzanie, wartość 2015/3 (73), pp. 547–557.

It should be noted that the studies investigating different aspects of M&A concern developed countries, mostly the United States and West Europe, and only to a limited extent do they look at Central and Eastern European (CEE) countries. Kazmierska-Jozwiak notes that although CEE's share of the global M&A market is negligible, during the sixth wave of M&As, emerging European countries have shown increased activity on the M&A market. However, comprehensive structure studies on CBM&A purchases by CEE companies are lacking in the literature.[4]

The main objective of the paper is to evaluate the geographical and sectoral structure of the Polish CBM&A network against the Czech and Hungarian CBM&A networks in 2010–2020. For this purpose, statistical data were taken from the Refinitiv Eikon database. The study uses SNA to visualize three sectoral CBM&A networks separately for the Polish, Czech, and Hungarian economies. For their geographical and sectoral structure analysis, several network indicators are applied, i.e., degree, prestige, and betweenness centrality.

Taking into account the above, this article aims to present a new methodological approach to studying the structure of the M&A market related to the application of network analysis metrics. Thus, it will contribute to filling the existing gap, which is the space between purely theoretical research in the field of M&A and case studies for individual entities.

2. Literature review of SNA applications to M&A research

The links between companies have been known for decades, but research has traditionally focused on analyzing individual bilateral transactions. No attention has been paid to the entirety of multi-subject complex systems of dependencies between entities. The network approach as a concept of analyzing economic reality and cooperation between entities was created in the late 1970s as a result of increased international competition and technological changes that were taking place on the enterprise market.[5] It exposes the full significance of corporate contacts with the business community, creating an extensive network of relationships.

Empirical analysis of the network approach is most often carried out using case studies, multidimensional statistical analysis, or network analysis.

[4] **B. Kaźmierska-Jóźwiak**, *Activity of Central Eastern Europe Countries on Mergers and Acquisitions Market*, Social Sciences 2014/83 (1), p. 72.

[5] **M. Rosińska-Bukowska**, *Global Business networks*…, pp. 15–16.

The third research method based on SNA refers to a set of analytical tools to map and measure links between social entities, such as people, enterprises, organizations, countries, or any social unit.[6] Although the concept of using links between individuals is not new, only the availability of large relational data sets and advanced computer programs make it possible to use SNA on a large scale.

In the 20th century, the network approach was used in analyses related to internationalization. The number of scientific studies using network analysis tools to study international financial and trade flows has gradually increased. Minoiu and Reyes[7] used network analysis tools to graphically and analytically present the features of the global banking network. Using data on cross-border banking financial connectedness for 184 countries between 1978 and 2010, it has been shown that the density[8] of the global banking network is procyclical, expanding, and contracting with the global cycle of capital flows. In turn, the centrality and importance of individual countries in the world trade network were analyzed by De Benedictis et al.[9]

In recent scientific work, this research method has focused mainly on analyzing international financial crises[10] and shareholding structures in transnational corporations.[11] Particularly noteworthy is the study conducted by Wang et al.[12] Using a complex network methodology, they analyzed the spatial patterns of shipping networks before and after the merger of COSCO and CSCL in 2016.

Yusuf Kurt and Mustafa Kurt drew attention to the still untapped potential of SNA in research in the field of international business. They emphasized that despite its growing theoretical utilization, the empirical analysis of networks has

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6 **S. Wasserman**, **K. Faust**, *Social Network Analysis – Methods and Applications*, Cambridge University Press, Cambridge 1994, pp. 3–4.

7 **C. Minoiu**, **J.A. Reyes**, *A network analysis of global banking: 1978–2010*, Journal of Financial Stability 2013/9 (2), pp. 168–184.

8 Density measures how close the network is to being complete, i.e., a complete network has all possible edges and a density equal to 100%.

9 **L. De Benedictis**, **S. Nenci**, **G. Santoni**, **L. Tajoli**, **C. Vicarelli**, *Network analysis of world trade using the BACI-CEPII dataset*, Global Economy Journal 2014/14 (3/4), pp. 287–343.

10 **M. Elliott**, **B. Golub**, **M. Jackson**, *Financial networks and contagion*, American Economic Review 2014/104/10, pp. 3115–3153.

11 **S. Vitali**, **S. Battiston**, *The community structure of the global corporate network*, PLoS ONE 2014/9/8, e104655, pp. 1–13.

12 **L. Wang**, **N. Zhang**, **F. Ye**, **Y.-Y. Lau**, **C. Ducruet**, *The complex network analysis of liner shipping networks: Lessons from the merger between COSCO and CSCL*, Growth and Change 2020/51/4, pp. 1877–1893.

been scarce in international business. In these studies, the market is treated as systems of networks, and it is assumed that international business activities occur within the context of network relationships. Nonetheless, the network view in these studies has been generic and metaphorical, as the structural and positional attributes of networks have not been integrated into empirical analyses.[13]

Other research on M&A transactions using SNA tools was carried out by, among others, Mirc,[14] Sánchez Díez et al.,[15] Guo et al.,[16] He Ze et al.,[17] and Brózda-Wilamek.[18] The first one is strictly theoretical. Mirc[19] discussed the potential contribution of SNA to M&A market research. She pointed out that SNA allows M&As to be considered a contextual and relational phenomenon in which links between companies, groups, and people influence the processes both before and after the takeover.

Mirc emphasizes that relatively few scientific studies on M&A transactions use network analysis tools. Three basic types of such research can be distinguished:[20]

- The first line of research studies the impact of a company's network on M&A decision-making and target selection.
- The second body of research focuses on the post-acquisition phase, and tries to understand the effects of M&A on companies' business networks. This approach is taken by several marketing researchers who used SNA to study the impact of M&A on the business network, in particular, customer relations.

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13 **Y. Kurt**, **M. Kurt**, *Social network analysis in international business research: An assessment of the current state of play and future research directions*, International Business Review 2020/29/2, p. 1.

14 **N. Mirc**, *Merging networks – contributions and challenges of social network analysis to study mergers and acquisitions*, in: **A. Risberg**, **D. King**, **O. Meglio** (eds.), *Routledge companion on mergers and acquisitions*, Routledge, London 2015, pp. 259–271.

15 **A. Sánchez Díez**, **P. Galaso Reca**, **J.M. García de la Cruz**, *Mergers and acquisitions*…, pp. 51–69.

16 **X.-Y. Guo**, **K. Yang**, **X.-M. Wu**, **J.-G. Liu**, *Statistical properties of Chinese merger and acquisition network*, Physica A: Statistical Mechanics and its Applications 2019/526, pp. 1–8.

17 **Z. He**, **Zh. Chong**, **Y. Yang**, **Yn. Zhou**, **Y. Liu**, *Evolutionary investment network and the emerging energy power in Central Asia: From the perspective of cross-border mergers and acquisitions*, Journal of Geographical Sciences 2020/30 (11), pp. 1849–1870.

18 **D. Brózda-Wilamek**, *The social network analysis of Chinese cross-border mergers and acquisitions*, w: **M. Rosińska-Bukowska**, **K. Zielińska-Lont** (eds.), *Asia's global expansion: business and financial aspects*, Wydawnictwo Uniwersytetu Łódzkiego, Lodz 2020, pp. 59–72.

19 **N. Mirc**, *Merging networks*…, pp. 259–271.

20 *Ibidem*.

- The third line of research uses SNA to address organizational integration dynamics and to disentangle the effects of M&A transactions on companies' internal ties during the integration process.

In turn, the studies conducted by Sánchez Díez et al.,[21] Guo et al.,[22] He Ze et al.,[23] and Brózda-Wilamek[24] are empirical. Sánchez Díez et al.[25] analyzed the changing role played by Spanish firms in foreign investment through M&A in Latin America. Using SNA, which enables a more complex analysis than traditional approaches, the position of agents as members of the network under consideration was studied. Using density and centrality indicators, they revealed the network's structure and how it changes over time, and thus showed the relative position of each country investing in Latin America. Assessing the M&A market structure using network analysis measures was also of interest to Guo et al.[26] Taking into account the data on the financial flows resulting from Chinese M&A transactions, they constructed temporal directed M&A networks. They use the degree, betweenness, and closeness centrality and the PageRank algorithm. The structure of the Chinese M&A market, using network indicators, was also analyzed by Brózda-Wilamek[27] and He Ze et al.,[28] although attention focused on CBM&A transactions.

In the literature on the subject, SNA as a research tool is used not only to analyze M&A transactions, but also other forms of cooperation between enterprises. For example, using network analysis, the latest research in this field published by Birkinbine and Gómez[29] illustrates the joint ventures that exist among the five largest media firms. They emphasized that this type of analysis can supplement existing measures of media concentration and may also be useful in making decisions in reviews of the proposed M&A.

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21 **A. Sánchez Díez**, **P. Galaso Reca**, **J.M. García de la Cruz**, *Mergers and acquisitions*…, pp. 51–69.

22 **X.-Y. Guo**, **K. Yang**, **X.-M. Wu**, **J.-G. Liu**, *Statistical properties of Chinese*…, pp. 1–8.

23 **Z. He**, **Zh. Chong**, **Y. Yang**, **Yn. Zhou**, **Y. Liu**, *Evolutionary investment network*…, pp. 1849–1870.

24 **D. Brózda-Wilamek**, *The social network analysis*…, pp. 59–72.

25 **A. Sánchez Díez**, **P. Galaso Reca**, **J.M. García de la Cruz**, *Mergers and acquisitions*…, p. 51.

26 **X.-Y. Guo**, **K. Yang**, **X.-M. Wu**, **J.-G. Liu**, *Statistical properties of Chinese*…, pp. 1–8.

27 **D. Brózda-Wilamek**, *The social network analysis*…, pp. 59–72.

28 **Z. He**, **Zh. Chong**, **Y. Yang**, **Yn. Zhou**, **Y. Liu**, *Evolutionary investment network*…, pp. 1849–1870.

29 **B.J. Birkinbine**, **R. Gómez**, *New Methods for Mapping Media Concentration: Network Analysis of Joint Ventures among Firms*, Media, Culture and Society 2020/42/7–8, pp. 1078–1094.

3. SNA as a research tool for the M&A market

In SNA, the network is defined by a set of nodes and the connections between them. Thus, the two main elements that form a network can be distinguished:[30]

- nodes (vertices) – entities included in the system,
- edges (relations) – relationships that reflect interactions between entities in the system.

In empirical research, networks are often presented in the form of graphs. Graphically, the node is presented as a circle and the edge as a straight line linking two nodes.

SNA offers analytical tools different from traditional statistical methods. It contains a wide range of centrality indicators that allow for a detailed analysis of the position of a given entity in the network. Four centrality dimensions can be distinguished: degree centrality, prestige centrality, betweenness centrality, and closeness centrality,[31] and interpreting these indicators should be adapted to the type of network considered. Due to the specifics of this study, only the value of the first three will be calculated.

For the M&A network, degree centrality makes it possible to specify the number of direct transaction relations of a given sector with other sectors in the network. This indicator was proposed by Freeman.[32] Lee and Sohn point out that in the case of directed networks for a given node, the following can also be calculated:[33]

1) Out-degree centrality – Its level is determined based on relations pointing away from the given node. In this paper, it allows us to identify the main sectors from which CEE countries are expanding their activities through CBM&A.
2) In-degree centrality – Its level is determined based on relations towards the inside of a given node. In this paper, it allows us to identify the main industry sectors in which enterprises from CEE countries invest abroad through CBM&As.

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30 **A.L. Barabasi**, *Network Science*, BarabasiLab, Boston 2012, p. 26.

31 **S. Yang**, **F.B. Keller**, **L. Zheng**, *Social network analysis: methods and examples*, CA: Sage Publications, Los Angeles 2017, pp. 61–88.

32 **L.C. Freeman**, *Centrality in social networks conceptual clarification*, Social Networks 1978/1 (3), pp. 215–239.

33 **H. Lee**, **I. Sohn**, *Fundamentals of Big Data Network Analysis for Research and Industry*, John Wiley & Sons, Ltd, United Kingdom 2016, p. 77.

Another indicator to determine the relative importance of a sector in the M&A is prestige centrality, also known as eigenvector centrality. It refers to the vertices that are associated with the most related nodes that form the network. The node's eigenvector measures an entity's closeness to other 'central' entities; therefore, the central location of a given business sector depends on the centrality of the main industries in the network. This indicator is used to identify the most prestigious vertices, including flagship entities, and it determines the quality of connections between nodes. The high value of the eigenvector centrality indicates that the nodes are leaders in the network because they have many relations with other entities that hold a significant position in the system.[34]

Finally, betweenness is a measure of centrality in a network based on the shortest paths. It shows how often the analyzed entity is on the shortest path of the relationship between the vertices, and indicates which nodes are the most significant in the context of communication between nodes.[35] In M&A networks, betweenness centrality determines the extent to which a business sector is a link between two other sectors.

In an attempt to use SNA measures to study the structure of Polish, Czech, and Hungarian CBM&As, a network that consists of nodes (business sectors) and edges (reflecting M&A) was used. The Refinitiv Eikon database was applied together with the Refinitiv Business Classification (TRBC).[36] Ultimately, the database used to conduct the study consisted of the following:

1) the node list – which constitutes a list of nodes that represent the business sectors of the acquiring and targeting companies, along with the economic sectors assigned to each node;
2) the edge list – which contains a list of connections, which reflect sectoral CBM&As. Each relation has been assigned attributes:
   - the form of the CBM&A transaction,
   - the host country of the Polish, Czech, and Hungarian CBM&A,
   - the economic sector that is represented by the acquiring and targeting companies.

The study was carried out on a sample of Polish, Czech, and Hungarian companies (both private and public) that are subject to foreign entities' CBM&As. In the Refinitiv Eikon database (see Table 1), a total of 691 completed

[34] *Ibidem*, p. 111.

[35] *Ibidem*, p. 84.

[36] The TRBC classification scheme has a hierarchical structure of five levels, within which, the following are distinguished: 13 Economic sector, 33 Business sector, 62 Industry group, 154 Industry, and 898 Activities.

transactions were identified in 2010–2020. Based on the data in Table 1, it can be seen that in 2010–2020, the total number of edges representing the number of CBM&A transactions for the individual countries covered by the analysis is 291 for Poland (POL), 315 for Czechia (CZE) and 85 for Hungary (HUN). According to the definition adopted by UNCTAD, the country of the acquirer or purchaser is the 'home country,' and the country of the target or acquired company is the 'host country.'[37]

4. Results of the CBM&A network study using SNA measures

CBM&As have a stimulating effect on economies, positively influencing their economic development.[38] Acquirer entities increase their level of internationalization and thus strengthen the position of their economies in the global network of connections. CBM&As are an important external corporate growth strategy that enables companies to expand into new markets, gain access to strategic assets, and transfer them to headquarters and at the same time to the home country.[39]

Foreign market entry through CBM&As has become the predominant mode of market entry by large emerging market multinational enterprises over the past 20 years. Table 1 shows that on average in 2010–2020, Czech and Polish companies were the most active in CBM&A transactions. Furthermore, for the Czech companies, CBM&As constitute a significant share (24%) of all transactions carried out on the M&A market. Against this background, it is clearly visible that the Hungarian entities record the lowest number of CBM&A transactions. On average, in 2010–2020, cross-sectoral transactions accounted for about half of all CBM&A in the CEE countries, which may indicate the lack of a dominant form of foreign acquisition. This contradicts the study conducted by Luty.[40]

[37] **UNCTAD**, *World Investment Report*, 2000, p. 99.

[38] **B. Eichengreen**, **H. Tong**, *Is China's FDI coming at the expense of other countries?*, Journal of the Japanese and International Economies 2007/21 (2), pp. 153–172.

[39] **A. Klimek**, *Cross-Border Mergers and Acquisitions by Chinese State-Controlled Enterprises*, Research Papers of the Wroclaw University of Economics 2016/447, p. 154.

[40] **P. Luty**, *Połączenia i przejęcia transgraniczne*…, pp. 547–557.

TABLE 1: *Average values*[41] *of basic statistics for the Polish, Czech, and Hungarian CBM&A networks in 2010–2020*

		POL	CZE	HUN
Number of nodes		26	26	25
Number of edges (both cross-sectoral and intra-sectoral links)		291	315	85
Share of the number of CBM&As in all M&A transactions		10%	24%	16%
Number of cross-sectoral links		143	159	47
Share of cross-sectoral edges in total connections (%)		49	50	55
Number of countries where CBM&As were conducted		44	41	28
Share of particular forms of M&A in the structure of outward expansion	Acquisition of interest (%)	21	17	28
	Acquisition of assets (%)	56	64	46
	Mergers (%)	23	19	26

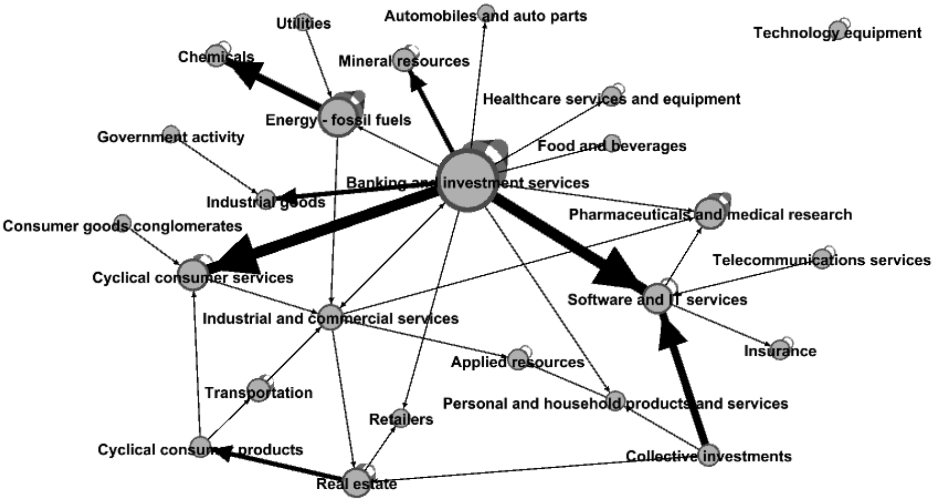
S o u r c e: own calculations.

The visualization of the CBM&A network is in the form of a directed graph, where the edges go from the acquirer's business sector to the target business sector. Figs. 1, 2, and 3 present the Hungarian, Czech, and Polish CBM&A networks in 2010–2020. The size of the node depends on the level of its degree centrality; relatively high values indicate key nodes in the network. The thickness of the edges reflects the intensity of the relationship (number of transactions) between the business sectors. An edge that connects a vertex to itself is known as a self-loop and indicates intra-sectoral CBM&A transactions.

When analyzing the Hungarian CBM&A network in detail, as shown in Fig. 1, it can be seen that intra-sectoral transactions occurred mainly within the financials, energy, and healthcare sectors. In turn, the largest number of cross-sectoral transactions took place in the connections between the following pairs of sectors: financials and technology, financials and consumer cyclicals, real estate and technology, and energy and basic materials.

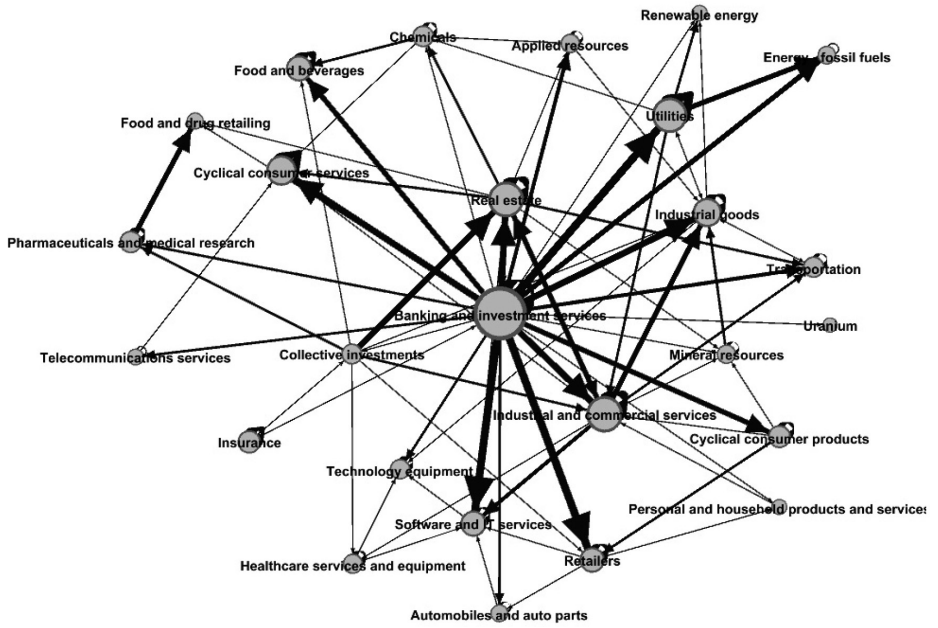
[41] In this article, the average level of network indicators refers to the arithmetic mean of these indicators' values.

FIGURE 1: *Visualization of the Hungarian CBM&A network in 2010–2020*



S o u r c e: own study in Gephi.

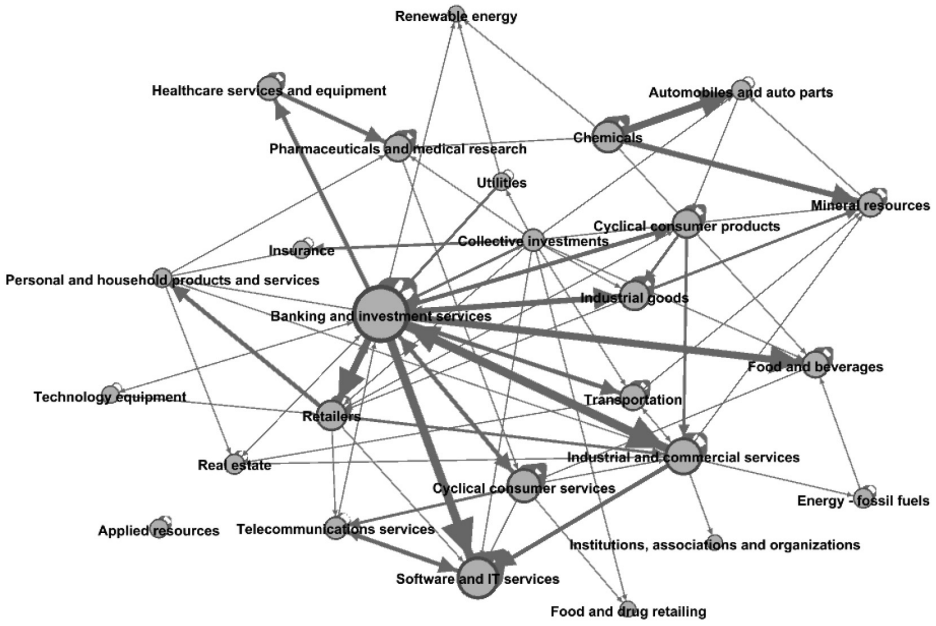
FIGURE 2: *Visualization of the Czech CBM&A network in 2010–2020*



S o u r c e: own study in Gephi.

As Figs. 2 and 3 show, in 2010–2020, the Czech and Polish CBM&A networks were much more extensive than the Hungarian network (see Table 1). In both the Polish and Czech networks, the largest number of cross-sectoral M&A deals was recorded in the consumer cyclicals, financials, and industrials sectors. The utilities sector also stands out within the Czech network, while within the Polish network, it is the technology, basic materials, and healthcare sectors. In turn, in both networks, the largest number of cross-sectoral transactions occurs within connections between the following pairs of sectors: financials and consumer cyclicals, financials and technology, financials and utilities, financials, and industrials. Additionally, in the Polish CBM&A network, a large number of cross-sectoral connections were recorded between the financials and consumer non-cyclicals sector (which represents the food and beverages sector).

FIGURE 3: *Visualization of the Polish CBM&A network in 2010–2020*

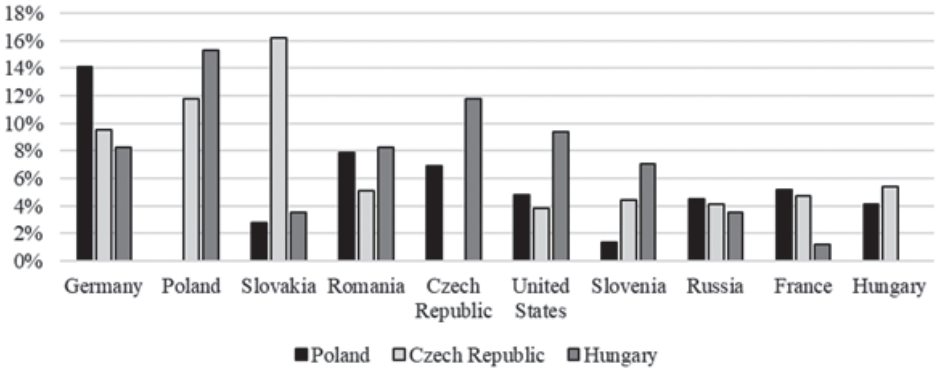


S o u r c e: own study in Gephi.

However, it is worth noting that in the cross-sectoral transactions, the financial sector dominates in all CBM&A networks studied, which is mainly represented by private equity and hedge funds. This observation is consistent

with the results of the study by Melnarowicz,[42] which additionally emphasizes that deals with private equity funds are an alternative method of financing transactions on the M&A market. Furthermore, private equity funds are increasingly being used by CEE countries to enter foreign markets.

FIGURE 4: *The main host countries of the Polish, Czech, and Hungarian CBM&A, 2010–2020 (% shares)*



S o u r c e: own calculations.

The main direction of Polish, Czech, and Hungarian CBM&As between 2010 and 2020 is presented in Fig. 4. More than 10% of M&A transactions were carried out in neighboring countries (i.e., in Germany, Slovakia, Poland, and Czechia). Companies who were headquartered in the analyzed countries also invested in Romania, Russia, and the United States.

The indicator analysis of the sectoral network structure leads to the following conclusions. On average in the 2010–2020 period, in all analyzed CEE countries, the highest level of the three measures of degree centrality (Table 2) was recorded by the financials, industrials, and consumer cyclicals sectors. From a global perspective, they are at the center of the network since they maintained most of the relationships with all entities in the system. On the one hand, the companies in these sectors expanded their activities through CBM&As, and on the other hand, these CEE countries located their foreign activities mainly in those sectors. In the analyzed CBM&A networks, a peripheral role was played by:

[42] **K. Melnarowicz**, *Finansowanie transakcji fuzji i przejęć z udziałem funduszy private equity w Polsce*, Roczniki Ekonomii i Zarządzania 2016/44 (1), pp. 157–173.

- the real estate, energy, and utilities sectors – in POL,
- the healthcare, consumer non-cyclicals, and energy sectors – in CZE,
- the basic materials, consumer non-cyclicals, and utilities sector – in HUN.

TABLE 2*: The average level of the three measures of degree centrality, 2010–2020*

Economic sector	Degree			Indegree			Outdegree		
	POL	CZE	HUN	POL	CZE	HUN	POL	CZE	HUN
Basic materials	66	42	15	31	24	**11**	35	18	4
Consumer cyclicals	113	96	20	59	57	14	54	39	6
Consumer non-cyclicals	36	38	4	23	26	3	13	12	1
Energy	13	15	**20**	8	14	9	5	1	**11**
Financials	**94**	**123**	**42**	36	27	**12**	**58**	**96**	**30**
Government activity	0	0	1	0	0	0	0	0	1
Healthcare	47	34	16	26	17	10	21	17	6
Industrials	**102**	**110**	18	**53**	**63**	10	**49**	**47**	8
Institutions, associations and organizations	1	0	0	1	0	0	0	0	0
Real estate	27	70	16	8	30	5	19	40	11
Technology	77	49	17	**44**	**32**	**11**	33	17	6
Utilities	6	53	1	2	25	0	4	28	1

S o u r c e: own calculations.

Based on a detailed analysis of the in-degree centrality, it can be stated that, in addition to the sectors listed above, all examined countries locate their foreign activities in the technology and basic materials sectors (POL and HUN), healthcare (HUN), and real estate (CZE). Regarding the out-degree centrality level, entities that operate in the real estate sector (CZE and HUN), energy and healthcare (HUN), basic materials (POL), and utilities (CZE) expand abroad.

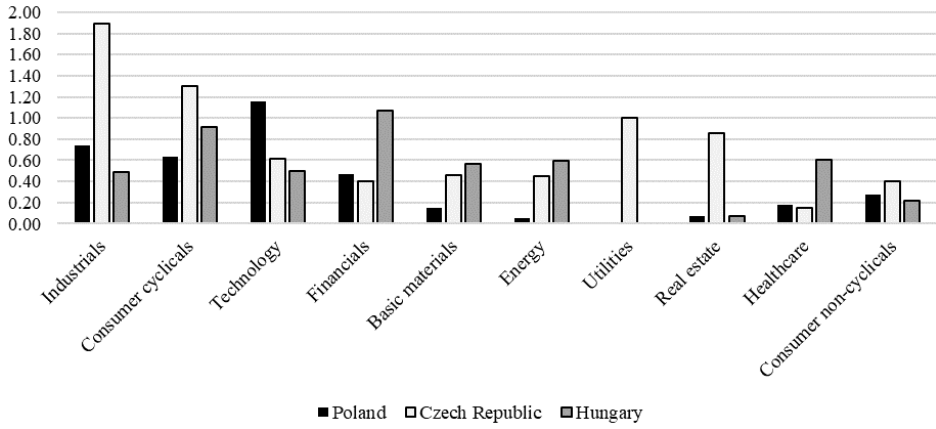
Additionally, in 2010–2020, the high average value of the eigenvector centrality (Fig. 5) for consumer cyclical confirms that entities operating in this business sector occupied a flagship place in all the examined CBM&As networks. Entities in these sectors made many connections with other entities

that hold important positions in the network. The following sectors are also characterized by relatively high levels of prestige centrality:

- the industrials and technology sectors – POL,
- the industrials, utilities, and real estate sectors – CZE,
- the financials, healthcare, and energy sectors – HUN.

Therefore, it can be assumed that those sectors are among the key directions of foreign investment for the analyzed countries.

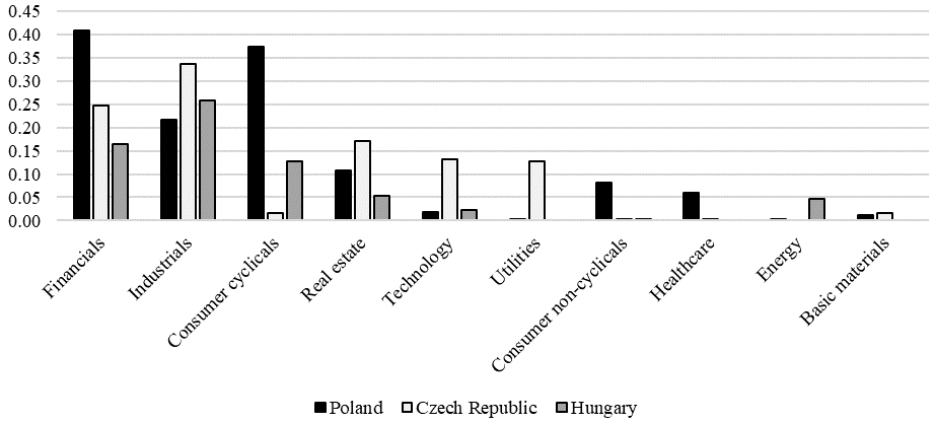
FIGURE 5: *The average level of eigenvector centrality in 2010–2020*



S o u r c e: own calculations.

Moreover, for all the analyzed countries, both the industrials and financials sectors were characterized by a relatively high average level of betweenness centrality (Fig. 6). In 2010–2020, these sectors were the main intermediaries in cross-sectoral M&A. This means that these nodes may be points of consistency loss in all examined CBM&A networks. In the Polish and Hungarian economies, the consumer cyclicals sector also plays an important role in international expansion, and in the Czech economy, it is the real estate sector.

FIGURE 6: *The average level of betweenness centrality in 2010–2020*



S o u r c e: own calculations.

5. Conclusions

To summarize, Czech and Polish economic entities aspire to be the largest direct foreign investors in the group of countries covered by the analysis. Foreign market entry through CBM&As is, for them, an attempt to create a complex organizational structure and thus gain a permanent position on the global market.

A common feature of these countries is that in 2010–2020 Polish, Czech, and Hungarian companies are characterized by investments not only in CEE countries, but also in Western Europe (i.e., Germany, France), Russia, and the United States. The financials, industrials, and consumer cyclicals sectors played a crucial role in the CBM&As networks, although entities operating in the energy and healthcare sectors (in HUN), real estate and utilities (in CZE), and technology (in POL) were also important. Another significant feature of these CBM&A networks is the lack of a dominant form of foreign expansion, i.e., about half of all transactions are both cross-sectoral and intra-sectoral transactions. Private equity and hedge funds play a key role in cross-sectoral transactions.

It is important to highlight two limitations of the study. First of all, the results are presented for aggregated data at the economic sector level. Comparative ranking tables at the individual business sector level for all examined countries would be too extensive, and thus unreadable. Second, the number of cross-border M&A purchases by CEE companies is still negligible for particular

years. Therefore, it was necessary to average the results of the analysis over a wider period.

Despite these limitations, the use of SNA in combination with data illustrating CBM&As allowed us to formulate general recommendations for increasing the intensity of FDI initiated by CEE countries in the 21st century. This study shows which sectors are the most active in CBM&A transactions and which ones play a peripheral role in the analyzed CBM&A networks. The article reviewed the main areas for consideration by policy-makers, which industries should be encouraged to expand into foreign markets, and offers support instruments for such investments.

This article presents a new perspective on the evaluation of the CBM&As market structure, taking advantage of the relational nature of the M&A data. This article is an introduction to an in-depth analysis of CBM&As processes in the context of a network approach. The issues discussed in this study require further analyses, the subject of which may be research on the ownership structure of the merging entities. It would also be worth identifying the structure of the CBM&A network in which entities from CEE countries act as target companies.

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Dominika BRÓZDA-WILAMEK

ANALIZA SIECIOWA TRANSGRANICZNYCH FUZJI I PRZEJĘĆ NA PRZYKŁADZIE POLSKI, CZECH I WĘGIER

Abstrakt

Przedmiot badań: Transgraniczne fuzje i przejęcia (CBM&A) przybierają formę sieci, gdyż między podmiotami w nich uczestniczącymi występują złożone relacje biznesowe. Koncepcja analizy sieci społecznościowych (SNA) do badania powiązań biznesowych jest słabo opisana w literaturze przedmiotu. W literaturze brakuje również kompleksowych studiów strukturalnych dotyczących CBM&A dokonywanych przez podmioty z Europy Środkowo-Wschodniej.
Cel badawczy: Celem jest ocena struktury sektorowej oraz geograficznej transgranicznych akwizycji polskich, czeskich i węgierskich przedsiębiorstw w latach 2010–2020. Artykuł ten ma również za zadanie zaprezentować nowe podejście metodologiczne do badania struktury rynku fuzji i przejęć (M&A), związane z aplikacją mierników SNA.
Metoda badawcza: Badanie zostało realizowane z wykorzystaniem SNA. W analizie wykorzystano dane sektorowe dotyczące M&A, zaczerpnięte z bazy danych Refinitiv Eikon. Do ich analizy zastosowano wskaźniki sieciowe, tj. centralność stopnia wierzchołka, centralność prestiżu i centralność pośrednictwa.
Wyniki: W latach 2010–2020 polskie, czeskie i węgierskie spółki odznaczały się aktywnością inwestycyjną nie tylko w krajach Europy Środkowo-Wschodniej, ale również w krajach Europy Zachodniej, Rosji oraz Stanach Zjednoczonych. Przedsiębiorstwa z sektora finansowego, przemysłowego, cyklicznych wydatków konsumenckich oraz technologicznego odgrywały istotną rolę w badanych sieciach CBM&A. Centralne miejsce zajmowały także podmioty prowadzące działalność w sektorze energetycznym i ochrony zdrowia (w przypadku Węgier) oraz w sektorze nieruchomości i użyteczności publicznej (w przypadku Czech). W ramach transakcji międzysektorowych szczególną rolę odgrywały fundusze private equity i fundusze hedgingowe.

Słowa kluczowe: transgraniczne fuzje i przejęcia, Europa Środkowo-Wschodnia, analiza sieci społecznych, centralność.