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Title: The roles of focal firm in a Hungarian coopetitive network.

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Keywords

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Abstract

The paper deals with economic and spatial dimensions of a coopetitive (rivals' collaboration) network establishing in Tihany (Hungary). Since the network has spatial extension, the toolkits of spatial econometrics and network science are integrated to analyze impacts and externalities of this network. Furthermore, the Bianconi-Barabási model is applied to gauge the position and dynamic effects of a focal firm (the hub) in the network. This study based on qualitative and quantitative, primary graph dataset can be referred to as a cutting edge because the functions of focal firm have not so far investigated; the paper fills this gap employing Bianconi-Barabási model. The results show that the hub can only integrate and manage the network; the competitors could not organize network their activities, they loath each other because of their earlier experiences. Actually, this coopetitive network determines significantly the urban economic growth and development effectively between 2008 and 2014.

Preface and short overview

The paper possesses twofold aims. It scrutinizes on one hand marketing functions of focal firm in a coopetitive network based on a Hungarian case study. On the other hand it describes how a focal firm at network level determines significantly local economic growth and development as well. The authors will draw heavily on a paper Jóna (2017) and Jóna-Tóth (2017) providing general information on a new marketplace that has been established by a focal firm in Tihany, Hungary.

Nowadays, the most relevant driving force of the Hungarian regional economic growth and development occurs the competitors' collaboration. The rivals' cooperation has appeared as a new interregional economic phenomenon that is regarded as coopetition. It implies a special and dynamic interplay among rivals in which competitors collaborate and compete with each other simultaneously within a framework of horizontal or vertical inter-firm relationship at same geographical unit so as to maximize their profit rates (Bradenburger-Nalebuff 1996, Czernek–Czakon 2016, Bengtsson–Kock 1999, Mariani 2007, Bengtsson–Kock 2014, Gnyawali- Madhavan-He-Bengtsson 2016). In general, by eliminating cost of transportation, higher profit could be realized year by year.

Rival companies in the coopetitive network, of course, do not trust in other because of their early harmful experiences grounded on cutthroat competition, notwithstanding, every enterprise trusts in the focal firm that is able to integrate and organize totally the network (Czakon 2009,

Czakon–Rogalski 2014). Obviously, the rivals do not interact with each other (competitors' cooperation is never easy) therefore the focal firm mediates and bridges among them. Ultimately, the focal firm fills the structural hole in the coopetitive network, it has outstanding role in the economic network encompassing only rivals. The focal firm is referred to as different ways in different scientific branches, for example, dominant firm (Shukla-Bhattacharyya-Narayanan 2016, Ulph-Folie 2016), central firm (Sanou-Roy-Gnyawali 2016, Yang–Zhu–Santoro 2016), hub (Lao et.al. 2016), broker (Brailly-Favre-Chatellet-Lazega 2016) or major firm (Teece 2016) but each category means the same. The paper applies only the notion focal firm for the sake of intelligibility.

Above mentioned case study the members of coopetitive networks led by focal firm established a new marketplace in Tihany, the peninsular of Balaton lake (Jóna 2017).

The new marketplace is defined as a network, more specifically coopetitive network.

Within this informal coopetitive network the rivals cooperate in the mutual purchase and mutual transportation thus financial resources can be saved in order to invest in creating new jobs or/and increasing incomes. The inter-organizational interactions are managed, organized and planned by a focal firm.

In recent years the number of the coopetition-oriented business networks has been stride increased so intensively both at local and transboundary level as well; the coopetition has become practice in the business processes and does not remain only a theory. In Hungary four informal coopetitive networks have so far functionalized at least 450 agents involved meanwhile more than one-hundred same inter-firm alliances can be reveled in the Scandinavian, Polish, British, German and Italian regions too (Breznitz 2009, Choi-Garcia-Friedrich 2010, Czernek-Czakon 2016, Lawson-Guthrie-Cameron-Fischer 2008). The greatest successes in the coopetition have been achieved by the Scandinavians business circles mainly Danish and Swedish enterprises where well-known past and serious traditions of networking willingness can be revealed (Rusko 2011). Furthermore, a large number of coopetitive networks with focal firms operate mainly in the agricultural sector in the USA and Australia (Lyson-Stevenson-Welsh 2008). Indeed, coopetitive relationship may as well be formed both among small and medium-sized enterprises and between multinational companies too. For example, SONY Corporation and Siemens Electronics made strategic alliance to finance together cost of innovation of new productions (Gnyawali-Park 2011).

To sum up, in 2008 the rivals' network managing with a focal firm establish a new marketplace in Tihany informally to sell goods. The new marketplace has been built and sustained by the

network of sellers working under monitoring, initializing and catalyzing of focal firm; the coopetitive network is connected by a marketing of focal firm.

The main goal of this paper is to scrutinize theoretically and empirically how a focal firm can establish, maintain and organize the new local market that based on the marketing strategy of coopetition. More precisely, what are properties of a focal firm through which it manages the coopetitive network and a new marketplace? What are marketing characteristics of focal firm integrating competitors' network? Simply put, why does focal firm help among competing enterprises by creating and coordinating new marketplace?

Whereas the marketing science focuses so intensively on analyzing features and evolution of new marketplace defining a network, it will be studied by network science to understand functionalizes and effects of new marketplace on the urban economic development. Well-known and relevant marketing topic is investigated from new and fashionable perspective calling network theory.

Methods

We managed to map an informal, bottom-up Hungarian coopetitive network up functionalizing at a new marketplace in Tihany with 71 competitors and a focal firm as well. Since at the new marketplace rivals from Tihany and Budapest also work, the network is regarded as network Budapest and Tihany (hereinafter NBPTH).

The primer graph dataset includes qualitative and quantitative data too. On one hand, the qualitative database is collected by questionnaire that is analyzed by advanced toolkits of network science, particularly using Bianconi-Barabási model (Bianconi-Barabási 2001). On the other hand, the qualitative dataset is mustered by sociological snowball method applying sociological, individual semi-structured interviews and is scrutinized by both the structured content analysis and input-output analysis. Every enterprise took part in survey hence 72 interviews are made and 72 questionnaires are filled to recognize deep structure of coopetitive network. This chapter depicts general properties of applied network model. The coopetitive network (N) of Tihany and Budapest includes vertices (V) and edges (E) too $N=(V,E)$. More specifically, in the network model the E shows premises of firms, rivals and V presents cooperative links can be revealed among them. The E embraces only small and medium-sized enterprises. The edges can be $i,j \in E$, that could be evolved adequately by adjacency matrix $\mathbf{A} := \mathbf{A}(N)$. Components of adjacency matrix:

$$V_{ij} = \begin{cases} 1 \; if \; ij \in E \\ 0 \; if \; ij \notin E \end{cases}$$

The adjacency matrix **A** *(N)*, where *N* includes from an *n*n* numbers of cells. The V_{ij} takes value 1, if edge exists between *i* and *j*, $V_{ij} \in E(N)$, V_{ij}=0 otherwise. In the network model every edge occurs undirected and unweighted so the flow of interaction is parallel among vertices $V_{ij} = V_{ji} \forall i,j \in V(N)$, the adjacency matrix emerges symmetric ($N_{ij} = N_{ji}$) (Bailey–Gatrell 1995, Carfi-Donato 2016, Osarenkhoe 2010).

The functions and characteristics of a focal firm can be understood by the Bianconi-Barabási model depicting how a node can muster links within a coopetitive network (Bianconi-Barabási 2001). More precisely, this model addresses the question whether a vertex possesses a special characteristics with which collect links. The node's ability to acquire edge is called as fitness. 'The fitness is an individual's gift to turn a random encounter into a lasting friendship; it is a company's knack to acquire consumers relative to its competition.' (Barabási 2017: 247). Of course, the Bianconi-Barabási model is usually regarded as fitness-model. In a nutshell, core attributes of focal firm can for example in a coopetitive network be described by belonging growth rate and fitness as well. Namely, the focal firm could increase its number of links at the rate that is defined by its individual's fitness.

The fitness of a node can be computed in a simple way:

$$\prod_i = \frac{\eta_i k_i}{\eta_j k_j} \tag{1}$$

where *i* is an old node and *j* is a new, connecting node in the network, η expresses fitness of j, *k* is the degree of node. The degree shows the number of connections of a certain vertex. Basically in the real networks a new node ties to a node with higher fitness with higher probability. In the coopetitive network the focal firm's η value is extra high meanwhile overwhelming majority of companies operate with relatively low η value. The paper attempts to gauge η methods of qualitative and quantitative employing a Hungarian case study.

The functions and properties of focal firm unfold in network evolution hence it is operationalized by degree dynamics referring to the number of connects of *i* (hereinafter: degree) shifts in time accordingly (1) equation thus

$$\frac{\partial k_i}{\partial t} = l \frac{\eta_i k_i}{\sum_i \eta_i k_i} \tag{2}$$

where *l* expresses the new relations of a new node. The Bianconi-Barabási model supposes the network has scale-free property with fitness-dependent exponent $\alpha(\eta_i)$, the network structure can be explained by power law degree distribution. Fundamentally, the scale-free network

structure can be defined as power-law degree distribution. In principle, the degree distribution illustrates how often nodes occur with varying edges in a network. Simply put, usually one or only some nodes have a large number of connections in the network, in so doing, the most of agents have only a few links thus hubs (high degree nodes is called hub) are formed that guarantee the robustness and integration of the network. The power-law degree distribution system is usually evolved by preferential attachment automatisms referring to the more connected players; the more likely it is to receive new and new ties. Consequence of the scale-free network topology is that the robustness of network becomes high. More precisely, in the coopetitive network a focal firm is known by everyone in the network, playing crucial role in the collect and allocation of information, organizing, coordinating and integrating entrepreneurs of the network. Lastly, the dominant firm (the hub) is defined as the Achilles Heel of network of SMEs (Barabási 2017) since it is the main actor in the network.

Simply put, in a network usually only one or some nodes possess overwhelming of links meanwhile the most of nodes have only a few (one or two) connections:

$$k(t, t_i, \eta_i) = l(\frac{t}{t_i})^{\alpha_{(\eta_i)}} \tag{3}$$

where *k* means average degree and *t* is time. Inserting (3) into (2) we obtain that dynamic exponent satisfies

$$\alpha(\eta) = \frac{\eta}{A} \tag{4}$$

where *A* the demonstrates partition function, with

$$A = \int p(\eta) \frac{\eta}{1 - \alpha(\eta)} d\eta. \tag{5}$$

To sum up, quantitative methods of Bianconi-Barabási model and qualitative toolkits of structured content analysis and input-output analysis are synthesized to understand the real marketing functions of central firm in the coopetitive network.

Empirical results

Tihany has always been a typical ecclesiastical and historical middle-sized town in Hungary locating on a peninsula of the north-Balaton lake approximately 140 km far from Budapest (capital of Hungary). The local societal of Tihany can be called special too, consisted of few members of elite and numerous citizens who had been living under the Hungarian average

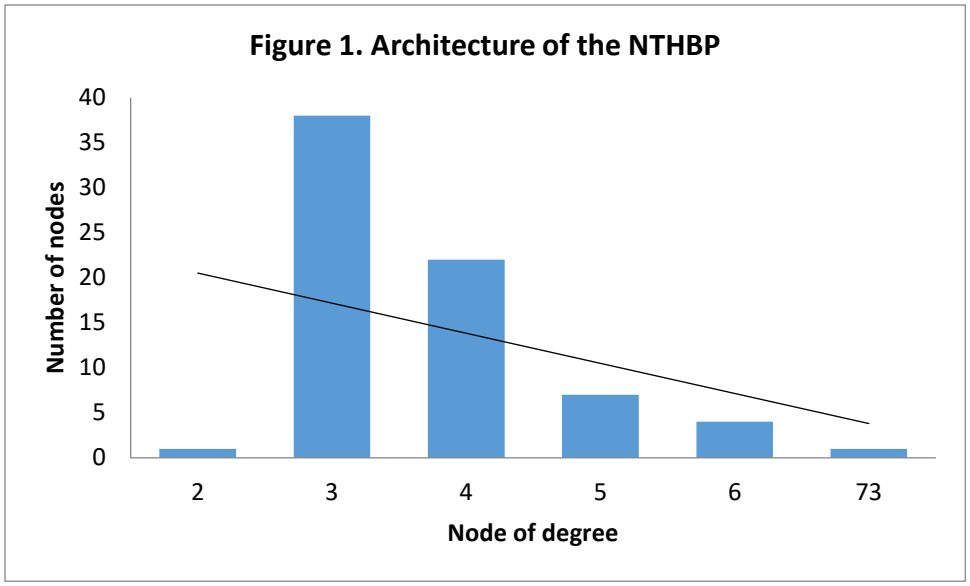
living standards (Horváth 2015). Nevertheless, this sad socio-economic circumstance has been reshaped basically by a very successful entrepreneur of Budapest who was born in Tihany. He decided on buying a piece of ground in Tihany and establishing a new local marketplace where the poor local inhabitants could sell their old and handmade products, odds and ends, vegetables and fruits from home gardens, etc. Put another way, because of the new local marketplace overwhelming of unemployed local residents started working at new marketplace and became entrepreneur and taxpayer citizens, moreover, they have been able to employ further unemployed people of Tihany. By establishing a new marketplace with a focal firm, the poverty and regional inequalities were managed to eliminate at local geographical scale.

It has to be emphasized that the local market was formed in 2008, however, the solvent demand missed therefore focal firm, owner the local marketplace, succeeded in inviting its VIP friends from Budapest so that they could purchase local residents' productions and as a result the local market has expanded. Relational capital of the focal firm has been converted into economic capital and spillover effects could prevail on rest of Tihany. Afterwards, some successful enterprises of Budapest had been interested in selling products at new marketplace of Tihany so nowadays approximately 20% of the NTHBP derive from Budapest.

Hence mutual transportation and buying, typical forms of the coopetition, prevail in this coopetitive network, these automatisms have to be demonstrated thoroughly at this point.

Initially, members of the coopetitive network understood that the price of transportation (expenditure) can be reduced by mutual transportation. So, when products start running out, an entrepreneur (the focal firm of the network) books orders and musters the list of needed goods. Just as many trucks are used for transporting goods that is enough for delivering the ordered volume of products hence savings can be realized collectively. For example, in the NTHBP usually 57 trucks deliver goods for 72 firms thus the cost of transportation and amortization of 57 trucks have to be paid by 72 enterprises. By sharing and reducing transportation cost, firms can save financial resources to establish new workplaces or to increase income of their employees. Furthermore, the rivals purchase goods together at same, entrepreneurs receive trade discount as well.

Arguably, the focal firm has core function in the coopetition in Hungary that can be identified adequately by scrutinizing architecture of the NTHBP. As Figure 1 shows, the NTHBP has scale-free property referring to that only one agent (namely the focal firm) in the network has a large number of cooperative relationship meanwhile numerous nodes have only a few cooperative links.



Source: Our calculation.

Simply put, the focal firm is known and trusted fully by everyone engaged in coopetition based business but the entrepreneurs do not trust in each other. The focal firm mediates among firms in the network and can build bridge among competitors; the hub is the most connected node in the coopetitive network. It can be lighted by a part of an interview.

'I hate C. J. (name of an entrepreneur was mentioned) because she deceived me a lot earlier. We hate each other. But I know A. P. (name of focal firm of the NTHBP was mentioned) who also knows C. J. I know that mutual transportation always brings me huge profit but I cannot negotiate with her so A. P. manages transportation between us. A. P. is a really good man, I trust him. He asks me and C. J. what we need next weekend and these are transported for us. But I never negotiate with C. J. but the mutual transportation works because A. P. helps and mediates between us! ' (61st interview)

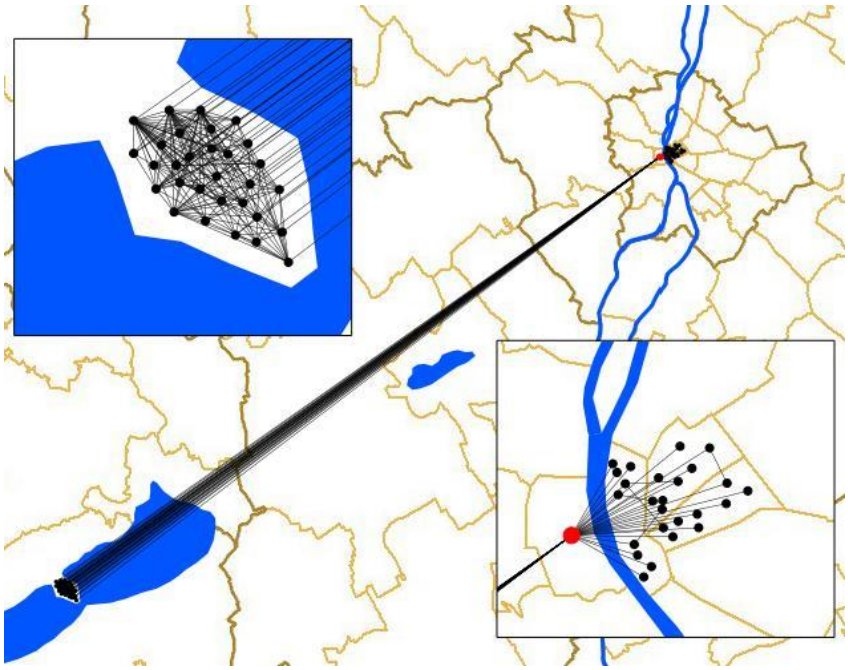
The qualitative results are proved by quantitative fitness value, A=0,883.

The focal firm guarantees integration and robustness of the coopetitive network. Formally, the focal firm organizes mutual transports so that price reduction and profit maximization can be reached by all entrepreneurs in the NTHBP.

The NTHBP is defined territorially because it embraces 72 enterprises (57 from Tihany and 15 from Budapest) but only some firms of Budapest have coopetitive nexus with enterprises of Tihany. More specifically, the NTHBP may be divided into two sub-graphs territorially. The first sub-graph can be found in Budapest, another one is revealed in Tihany and the two sub-

networks are integrated by the focal firm (red point in Figure 2) therefore the NTHBP become a connected network.

Figure 2. Spatial extension of the NTHBP



Source: Our calculation.

To date, the NTHBP possesses domestic and international reputation showing a large number of the elites, VIPs and celebrities have already visited to purchase and meet friends at local market. The solvent demand and urban milieu can be improved intensively and the NTHBP promotes to the value creation, values capture and value appropriation at interregional level.

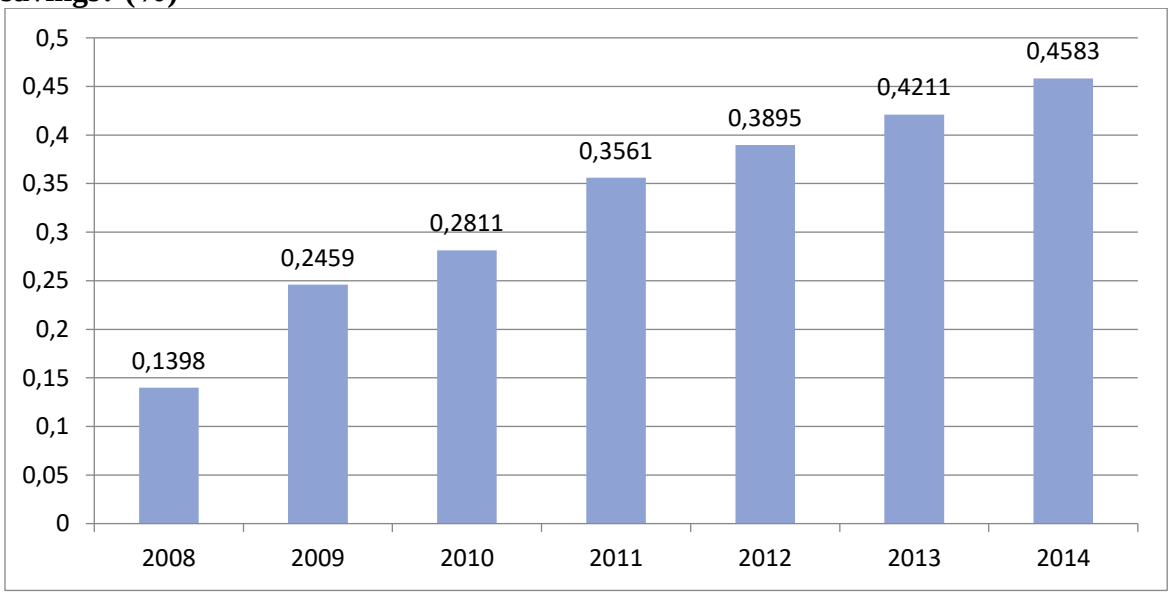
Now paper focuses on quantifying longitudinally how the coopetitive networks define trajectory of regional economic growth. To date, there is no standard spatial econometrics method how the effects of the coopetitive networks can be operationalized on regional economic development. In this vein, the paper now attempts to quantify network effects. In developed network model, the effect of the coopetitive networks on the regional economic development is defined by (1) pay raising and (2) new jobs of creation. Actually, the applied network model answers the question how and to what extent the coopetition strategy defines the change of income and employment rate on a certain network territory.

Basically, the gauging is divided into two components such as quantitative and qualitative ones. On one hand the quantitative research focuses on employment and income data of the networks,

on the other hand the qualitative dataset depicts how the regional milieu and atmosphere have been shifted in studies phase.

The sharp question is how the gross costs of pay rise (*PR*) and the gross costs of creation new workplace (*NW*) can be financed by saving (*S*) that comes from coopetitive activities. On one hand, the coopetitive activities of firms can be expressed by saving (*S*), and on the other hand *PR+NW=GCRD* where GCRD is the gross cost of regional development. On condition that $S \geq GCRD$, then saving can finance absolutely the gross cost of regional development. Of course, if $S < GCRD$, then *S* is not enough to cover *GCD*. Moreover, $GCRD = \frac{S}{NW+PR}$ where *GCRD* [0,1] shows what proportion the gross costs of pay rise and creation new workplace can be covered by saving. The global value of *GCRD* within a time period: $\sum_{i=1}^{n} GCRD$. The Figure 3 reports the longitudinal changing of GCRD, obviously, the NBPTH was achieving great accomplishment between 2008 and 2014.

Figure 3. What proportion of pay rise and creation new jobs can be covered by coopetitive savings? (%)



Source: Our calculation.

The Figure 3 demonstrates that in 2014 the 45.83% of the regional economic development were covered by coopetitive accomplishment in the NTHBP. It is clear that coopetition in the practice has provides economic possibilities so that firms could expand market or create new marketplace, raise income and improve employee rate.

The quantitative data collection provides insight into the employment rate of this coopetitive network. According to the data, 136 new workplaces were being created by savings of NTHBP

in above-mentioned period. In brief, the coopetitive actions of rivals significantly contribute to the new job creation.

Interestingly, the influence of financial economic crisis of 2008-2009 was not strong on accomplishment of the coopetitive network. The coopetitive capacities of NTHBP was picking up sharply under the period of economic crisis. The effects of coopetitive network were consistent on the regional economic development irrespective of the global financial crisis 2008.

With same time, the qualitative results show that the regional milieu and atmosphere were reshaped in Tihany. The local attitude has been shifted and urban habit was prevailing representing that local residents have started following modern life style meanwhile retaining their traditions and past simultaneously. In a nutshell, qualitative research findings demonstrate that the new local marketplace has been able to modify the conservative image in Tihany by forming a special mixed form of the modern and historical conventions with local folklore. The coopetitive network has a qualitative spillover-effect namely these contribute to the strengthening of the local socioeconomic integration and institutional environment.

Summary

The paper describes the popularity of fairs as communication form for marketing and defines competitors' collaboration (so-called coopetition) as a network establishing new marketplace in Tihany, Hungary, at which extreme mistrust can be revealed among rivals thus the new marketplace where enterprises of the coopetitive network work together is led by a focal firm.

The Hungarian rivals of network have already increasingly launched to understand and exploit both collaborative and competitive advantages thereby allowing contributing to the regional economic development directly. It means that relatively developed business culture has appeared and emerged among the Hungarian small enterprises. In the practice, entrepreneurs of coopetitive network share business risks, transportation costs and market information so as to maximize their profit rate that finally covers partly or fully the cost of nodal regional economic growth. The empirical findings depict the urbanization economies of scale revealed on territory of the NTHBP.

Marketing of the focal firm has outstanding role in the NBPTH. Firstly, the focal firm purchased a piece of ground where the local marketplace has been operating and afterwards its relation capital has been converted into economic capital by inviting VIP, elite friends so that they could buy local traditional goods from the local residents living among poverty conditions. The

unemployed and marginalized social strata, therefore, have become taxpayer entrepreneurs who could be able to employ more local unemployed citizens.

Finally, marketing activities of the focal firm manifests in two fields. On one hand it bought piece of ground for the new local marketplace and invited VIP its friends from the capital thus local market managed to launch. On the other the focal firm musters business information and is distributed among rivals in order that they could purchase at discount price and transport same productions mutually.

Literature

Bailey, T. C. & Gatrell, A. C. (1995). *Interactive spatial data analysis*. London: Burt Hill, Longman Scientific and Technical.

Barabási, A. L. (2017): *Network science*. Cambridge: Cambridge University.

Bengtsson, M. & Kock, S. (1999). Cooperation and competition in relationships between competitors in business network. *Journal of Business and Industrial Marketing,* (14) 3: 178-194.

Bengtsson, Maria & Kock, Sören (2014). Coopetition—Quo vadis? Past accomplishments and future challenges. *Industrial Marketing Management,* (43) 2: 180-188.

Bianconi, G. & Barabási, L. (2001). Bose-Einstein condensation in complex networks. *Physical Review Letters,* 86: 5632-5635.

Bradenburger, A. M. & Nalebuff, B. J. (1996). *Co-opetition*. New York: Doubleday Currency.

Brailly, J. & Favre, G. & Chatellet, J. & Lazega, E. (2016). Embeddeddness as a multilevel problem. *Social Networks,* (44): 319-333.

Breznitz, D. (2009). Globalization, coopetition strategy and the role of the state in the creation of new high-technology industries. In.: Dagnino, D. B. & Rocco, E. (eds.): *Coopetition strategy*. London – New York: Routledge Press. 103-128.

Carfi, D. & Donato, A. (2016). A critical analytic survey of an Asymmetric R&D Alliance in Pharmaceutical industry: bi-parametric study case. *Journal of Mathematical Economics and Finance,* 1: 21-57.

Choi, P. & Garcia, R. & Friedrich, C. (2010). The drivers for collective horizontal coopetition. *International Journal of Strategic Business Alliances,* 1: 271-290.

Czakon, W. & Rogalski, M. (2014). Coopetition typology revisited – a behavioral approach. *International Journal of Business Environment,* (6) 1: 28-46.

Czakon, W. (2009). Power asymmetries, Flexibility and the Propensity to Coopete: An Empirical Investigation of SMEs' Relationships with Franchisors. *International Journal of Entrepreneurship and Small Business*, 8(1): 44–60.

Czernek K. & Czakon W. (2016). Trust-Building Process in Tourist Coopetition: The Case of a Polish Region. *Tourism Management*, 52: 380-394.

Gnyawali, D. R. & Madhavan, R. & He, J. & Bengtsson, M. (2016). The competition-cooperation paradox in inter-firm relationships: a conceptual framework. *Industrial Marketing Management*, 53: 7-18.

Gnyawali, D. R. & Park, B. J. (2011). Coopetition between giants: collaboration with competitors for technological innovation. *Research Policy*, 40: 650-663.

Horváth, Gy. (2015). *Spaces and places in Central and Eastern Europe: Historical trends and perspectives*. London: Routledge.

Jóna, György & Tóth, Tamás (2017). Spatial effects and externalities of the rivals' network in Hungary. *Journal of Spatial and Organizational Dynamics*, (in press).

Jóna, György (2017). Roles of the coopetitive networks in the local business life. *Journal of Economics and Management*, 1: 26-41.

Lao, X. & Zhang, X. & Shen, T. & Skitmore, M. (2016). Comparing China's city transportation and economic network. *Cities*, 53: 43-50.

Lawson, R. & Guthrie, J. & Cameron, A. & Fischer, W. C. (2008). Creating value through cooperation. *British Food Journal*, 1: 11-25.

Lyson, T. A. & Stevenson, G. W. & Welsh, R. (2008). *Food and a mid-level farm*. Cambridge: MIT Press.

Mariani, M. M. (2007). Coopetition as an emergent strategy. *International Studies of Management and Organization*, 2: 97-126.

Osarenkhoe, A. (2010). A coopetition strategy. *Business Strategy Series*, 6: 343-362.

Pathak, S. D. & Wu, Z. & Johnston, D. (2014). Towards a structural view of co-opetition in supply networks. *Industrial Marketing Management*, 5: 254-267.

Rusko, R. (2011). Exploring the concept of coopetition. *Industrial Marketing Management*, 40: 311-320.

Sanou, F. H. & Le Roy, F. & Gnyawali, D. R. (2015). How does centrality in coopetition networks matter? *British Journal of Management*, 1: 1-18.

Shukla, R. & Bhattacharyya, S. & Narayanan, K. (2016). Firm size vis-á-vis industry size and innovation in a dominant firm-fringes oligopoly model. *Foreign Trade Review*,1: 13-25.

Teece, D. J. (2016). Dynamic capabilities and entrepreneurial management in large organizations: Toward a theory of the (entrepreneurial) firm. *European Economic Review*, 86: 202-216.

Ulph, A. M. & Folie, G. M. (2016). Dominant firm models and resource depletion. In.: Currie, D. & Peel, D. & Peters, W. (eds.): *Microeconomic analysis*. New York: Routledge, 77-107.

Yang, K. & Zhu, J. & Santoro, M. D. (2016). Inter-Firm Managerial Social Ties and Strategic Alliances Formation: A Multiplexity Perspective.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2628979