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DEVELOPING AND IMPLEMENTING RELATIONSHIP MARKETING SYSTEM THROUGH THE ANALYSIS OF TRANSACTIONS NETWORK

The paper presents how the tools of networks analysis can be used to study network transactions to develop and implement a relationship marketing system at business-to-business (B2B) market. The approach relies on the existing information an industrial organization has on its customers, as demonstrated on the real-life example analyzed.

Keywords: *B2B market; buyer-seller relationship; relationship marketing; network dynamics.*
JEL classification: L140; M300; C5; C690.

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РОЗРОБКА ТА ВПРОВАДЖЕННЯ МАРКЕТИНГОВОЇ СИСТЕМИ ВІДНОСИН ШЛЯХОМ АНАЛІЗУ МЕРЕЖІ ВЗАЄМОДІЙ

У статті описано, як інструменти мережевого аналізу можуть бути використані при вивченні взаємодії всередині мережі задля впровадження та подальшого функціонування маркетингової системи відносин на ринку B2B. Даний підхід виходить з наявної в промислової компанії інформації стосовно її клієнтів, що продемонстровано на прикладі реально діючого підприємства.

Ключові слова: *ринок B2B; відносини між покупцем та продавцем; маркетинг відносин; мережева динаміка.*
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РАЗРАБОТКА И ВНЕДРЕНИЕ МАРКЕТИНГОВОЙ СИСТЕМЫ ОТНОШЕНИЙ ЧЕРЕЗ АНАЛИЗ СЕТИ ВЗАИМОДЕЙСТВИЙ

В статье описано, как инструменты сетевого анализа могут быть использованы в изучении взаимодействий внутри сети для внедрения и дальнейшей работы маркетинговой системы отношений на рынке B2B. Данный подход исходит из имеющейся у промышленной компании информации о её клиентах, что показано на примере реально действующего предприятия.

Ключевые слова: *рынок B2B; отношения между покупателем и продавцом; маркетинг отношений; сетевая динамика.*

Introduction. Business-to-business (B2B) markets are complex systems of numerous actors and numerous relations between them. We can view B2B market as a network, where companies are nodes and relationships between them are threads. Each node (a company), with its specific technical resources and people, is in many different ways connected with several other nodes (companies) through relationships (Hakansson et al., 2002). The network approach in relationship marketing uses the social network theory as a tool to monitor how relationships between participants develop and how relationship ties get strengthened in networks (Sheth et al., 2000). Research has shown that investments in relationship marketing lead to enhanced customer trust and commitment, which in turn leads to improved performance (Dwyer et al., 1987; Morgan et al., 1994; Wilson, 1995). The positive effect of strong customer relationships on seller financial performance at B2B markets has been widely accepted by both business managers and researchers (Hakansson et al., 1995; Sheth et al.,

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2000). To harness the power of networks within B2B environment, P. Kothandaraman et al. (2011) for example suggest mapping buying centres by using information the sales persons have on their buyers and relations among them. This approach however requires data collection and extensive collaboration of the sales people.

In the present paper, we suggest an approach on how a company can use existing information it has on its customers and sales to display the network of its relations with customers and use this information to improve its relationship marketing. We propose using information on past sales to link customers and products in order to gain better understanding of these relations with the help of tools offered by network analysis. A case study of a network of relationships that a particular company has with its customers is presented and changes in this network during a five-year-period are examined.

Theoretical background. Network approach views B2B marketing as interactions in a network. The essence of this approach is the awareness that one particular relationship cannot be viewed and managed separately from other relationships a company has. Each relationship is embedded in a network together with other relationships; its development and functions cannot be properly understood if these connections are not taken in consideration (Hagedoorn, 2006; Hakansson et. al., 2002; Wilkinson et. al., 2002). Network research in social sciences is usually understood as the study of participants, dyads and network structure (Hoang and Yi, 2015). B2B markets are networks of relationships in which companies are frequently involved in a set of different, close and lasting relationships with important suppliers and customers. Buyers and sellers are seen as attractive participants in long-term relationships with marketers and purchasers supporting and developing relationships rather than merely having one-off transaction (Baron et al., 2010).

Mapping the relationships between customers is of a special importance at B2B markets. P. Kothandaraman et al. (2011) suggest mapping relationships among decision-makers on the buyer side by using the information available to seller staff. Sellers are asked to identify the relations between members of a buying centre, the strength of these relations and positions of their members. Using these information a network is constructed, which allows better development and implementation of the relationship marketing system. The approach however relies on subjective information available to sales persons, and the collection of this information requires quite a lot of effort on the part of individuals and organization. Social CRM approach on the other hand harnesses the information on customers that is ready-made available to customers. I. Nitzan et al. (2011) argue that firms should take the social networks of their customers into account when trying to predict and manage customer churn.

We suggest combining the two approaches, i.e. use the existing information a company has on its customers and use them to develop and implement a CRM system at B2B market. We suggest using information on past transactions of customers in order to map consumers and group them into groups with similar characteristics. The methodology we propose allows us identify the strength of relationship between customers and products from the viewpoint of company and identify core customers and core products. As an additional benefit, the approach we are suggesting allows us mapping the products the company is selling in a similar fashion, which allows a company address the relationship marketing from two different angles – either customer-based, or product-based.

The network of relationships between a company and its customers: A case study. The case study uses a network of customers around the company Iskra, an electrical company with more than 60 years of experience in the development, production and sales of various electronic components. The components are sold to large users directly (mostly original equipment manufacturing producers) but distributors are used to reach a lot of minor customers. Thorough knowledge of customers is at the core of their relationship marketing. The more the company learns about its customers, the easier it gets to detect those buyers who can bring more profit.

1. Methodology. By applying the generalized block-modelling (Doreian et al., 2005) within Pajek program (de Nooy et al., 2005) the author examines which customers share similar characteristic regarding the purchase of products and examines the ties within a group and between groups of customers. Because of the dynamical nature of interactions in a network, researchers encounter conceptual as well as empirical challenges (Powell et al., 2005; Snijders et al., 2010; Varela et al., 2015). The need for longitudinal network research is expressed in the studies by F. Caniato et al. (2009), C. Harmeling and R. Palmatier (2015), J. Hite and W. Hesterly (2001), A. Larson et al. (1993), W. Powell et al. (2005). In addition, we can also find it in M. Granovetter's (1973) early call for research into consecutive development phases of a network. By saying this, we do not want to posit that no other study has ever addressed the issue of development in time. However, longitudinal research studies into the networks of connections are relatively rare and mostly directed towards, for example, counting of activities or different types of network contacts in time. We can find an extensive survey of research studies into structural and functional field of networks in the work of M. Newman (2003). Due to all of the above analysis was conducted in a five-year-period, which enables us observe the dynamics of transitions between customer units as well as the purchase value of an individual buyer etc. Individual links between customers based on their purchases were inspected by employing stochastic unit-oriented models for network development interpretation. These models are based on the Monte Carlo simulation of Markov processes in a continuous time period. Several models, describing the emergence of a symmetric tie between customers, were used in the analysis of the dynamics in a customer network: forcing model, unilateral initiative and reciprocal conformation, pairwise conjunctive model and pairwise compensatory (additive) model (Snijders et al., 2009: 28).

2. Data specifications. The empirical analysis includes customers with the annual turnover of at least 100.000 EUR, and products with annual turnover of at least 1000 EUR. In 2014 Iskra had 487 customers; 42 of them bought products worth more than 100,000 EUR on the annual basis. Sales revenue from these 42 customers represents 80% of the total sales revenue. There were 232 products altogether. Considering the restriction that the analysis included products with the annual turnover of at least 1,000 EUR, Iskra had 110 such products in 2014. As the study was focused on sales value dynamics of individual customers within a 5 year observation period, sales share files were created for individual customers with regard to being a major buyer. This study examines the links based on purchases made by individual customers. Therefore, we define the link between customers as follows: two customers are related if they have at least one product in common. In other words, linked customers buy at least one same product from Iskra.

3. Network analysis employing generalized block-modelling. Customer network of the selected company is presented by means of generalized block-modelling (discussed thoroughly in P. Doreian et al. (2005)). We examined unit connections, investigated units with similar characteristics and detected outstanding network units. The network of customers linked by common products is shown in Figure 1. The relation is valued, the value of a relation tie is the total number of products purchased by both customers. The size of the created network equals the number of the selected customers, 42.

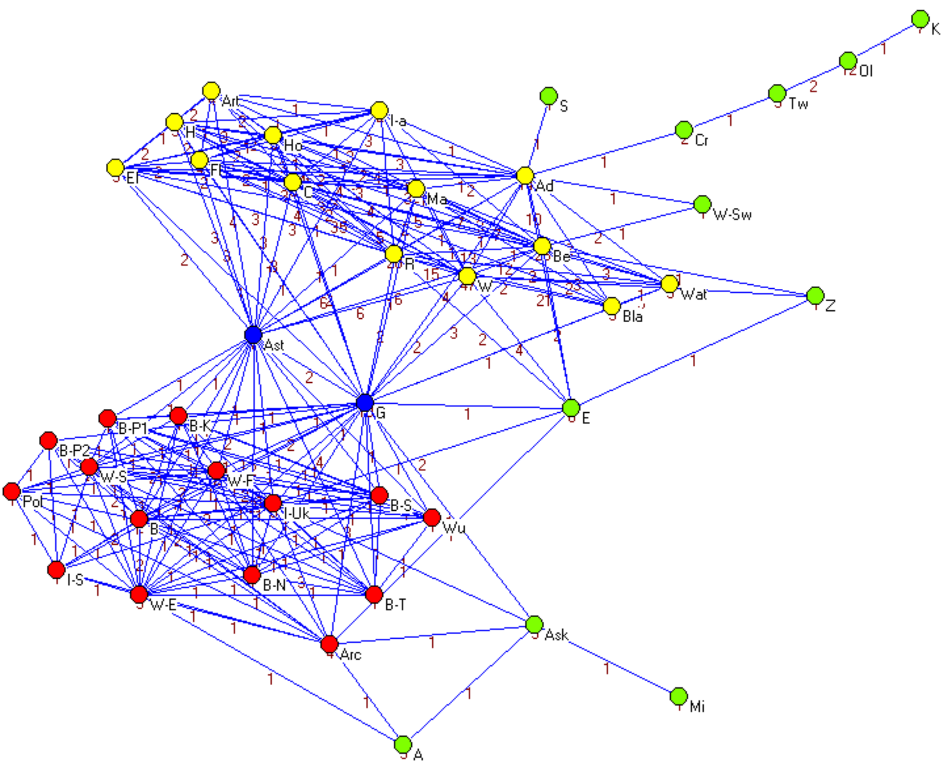

Figure 1. **Network of customers based on common transactions in the last period, 2014,** *author's own survey*

We visualize the relations among customers on the product base to cluster the customers based on their similarity in purchasing and to establish which products could additionally be offered to a customer according to its positioning into a cluster. The ***degree centrality*** shows that customers G and Ast are the most central (they together form a cluster of their own, as will be seen further on). This result is unexpected, because the first customer core business is household appliances and the other is from consumer electronics. Both customers are of key importance for Iskra. The loss of either of them would mean a huge loss for the company, not only financially but also in the availability of information from the market that Iskra gains from both customers. By cooperating with them Iskra develops its own range of products and tracks progress in the field. Let us now consider ***the betweenness centrality***. The most central units, positioned on several shortest links between the pairs of all other units in the network, are detected by employing betweenness centrality according to the betweenness of a unit (de Nooy et al., 2005). The betweenness centrality can serve as an index for resource and information control and it best defines the leading unit within a group of units. The most central buyer is once again customer G, which puts this customer among Iskra's central (key) customers. This customer is the linking element for many different buyers. From the market-oriented point of view, customer G acts as an indicator at the market. The critical issue for management here is monitoring changes in the network structure that affect the position and thus the capability and capacity of company (Hakansson et al., 1995: 48). If Iskra loses its central customer and could not win him back, it would have to carefully weigh the immediate situation and examine the possibilities for replacing the lost customer. It is possible to select one of the existing buyers whose applications are most similar to those of the central buyer and start developing closer relationship on the assumption that the chosen customer recognizes the benefits from the relationship and is prepared to cooperate. On the other hand, the company can decide to employ a different strategy and find a potential candidate at the market to fill the gap. However, this requires plenty of time, energy and finances and has an unpredicted outcome.

In the existing network (Figure 1), ***the clusters of units*** with a similar link pattern with other units was determined. These clusters form a partition. Thus, generalized block-modelling comprises structures formed when all units from the same cluster shrunk into one unit. Generalized block-modelling was started with random starting partitions which were then optimized, 1,000 iterations and 4 clusters were chosen. According to the resulting arrangement of customers into clusters, the reordered matrix of customer network is shown in Figure 2. Partitions with 4 clusters were most appropriate for the customer network of 2014, which consisted of:

C1 = {C, W, Ho, Be, R, Ad, H, I-a, Fl, El, Ma, Art, Bla, Wat}.

C2 = {Ask, A, E, S, W-Sw, Tw, K, Ol, Z, Cr, Mi}.

C3 = {Ast, G}.

C4 = {Arc, B-T, I-Uk, W-S, W-E, B, B-N, B-S, B-P1, Wu, B-K, W-F, Pol, I-S, B-P2}.

Blocks:

$$\begin{bmatrix} C & N & C & N \\ N & R & N & N \\ C & N & C & C \\ N & N & C & C \end{bmatrix}. \tag{1}$$

where C – complete; N – Null; R – regular.

Examining the structure of links in individual blocks (rectangles) of the reordered matrix, it can be observed that cluster 3 contained only 2 previously discussed special customers that have very strong links with both clusters, 1 and 4 (nearly complete blocks between them). Buyers from cluster 1 form strong links between themselves as they purchased the same products. There were literally no links between

		1	5	8	9	11	17	24	28	32	34	36	37	40	42	21	22	23	26	27	30	31	35	38	39	41	6	13	2	3	4	7	10	12	14	15	16	18	19	20	25	29	33
C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ho	8	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R	11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ad	17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H	24	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-a	28	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fl	32	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
El	34	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ma	36	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Art	37	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bla	40	1	1	0	1	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wat	42	1	1	0	1	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ask	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
A	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
E	23	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
S	26	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W-Sw	27	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tw	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ol	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z	38	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	39	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mi	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ast	6	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
G	13	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Arc	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1
B-T	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
I-Uk	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W-S	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W-E	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B-N	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
B-S	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
B-P1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Wu	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
B-K	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0
W-F	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pol	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1
I-S	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1
B-P2	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1

Figure 2. **Permutated matrix of customer network,** *aurhor's*

clusters 1 and 4; however, there was some overlap between clusters 1 and 2 and strong links to cluster 3. Cluster 2 contained less internal links than clusters 1 and 3. Its connections with other 3 clusters were practically non-existent. Obviously, customers from cluster 2 purchased products that were not interesting for other clusters. This is the only cluster that doesn't have any links to special customers in cluster 3. There were strong links among buyers within cluster 4; they did not purchase products that were bought by other clusters except the small cluster 3.

Taking closer look at the nature of the members of individual clusters may shed some light into why we observe such a configuration. In cluster 1 we find customers C, W, Be, R and Ad have the widest range of diverse products. Immediately a question arises as to how it is that customers Ho, H and Wat do not purchase a broader spectrum of Iskra's products. We were right to presume that their end buyers install various products marketed by Iskra, yet, they buy them from Iskra's competitors. As an illustration: customer H is an agent doing regular business with 12 end manufacturers and 2 local distributors. Truly, each end-buyer specializes in a certain segment within the scope of applications where Iskra's capacitors are installed. However, Iskra does not supply them with all the components. What is the cause for this? One of the reasons might be the cost, delivery time may be too long, or there are other similar factors. Also, it is possible that the customer does not know Iskra's product range well enough. We realize that particularly both distributors should offer a wider range of Iskra's products. What is Iskra's task in this particular case? It should examine its customers, inform them about its whole product range, and concretely offer a range of products suitable for the solution of their problems. A common denominator in the second cluster is that these are buyers with few links within the group as well as among the clusters. The second cluster consists of those customers that are interesting to Iskra as they need more products than they actually buy from Iskra. Thus, Iskra should pay more attention to these customers. Cluster 3 consists of customers G and Ast, who have been Iskra's strategic partners for several decades. Long-term relationships based on trust as well as constant quality of products and service offered by Iskra enable this continued cooperation. Similar to the second group, additional offers should be considered for all buyers from the fourth group who only purchased one product.

In conclusion, this analysis helps us decide which products could be offered additionally to individual customers according to their position into a cluster. Illustrated network research can help management find out which customer relationships are worth developing and preserving.

4. Analysis of network dynamics of the company during the five-year-period. Dynamic network demonstration enables a better insight into network characteristics at the beginning of network research as well as in the presentation of research results. SIENA program (Simulation Investigation for Empirical Network Research) is a useful approach to the analysis of dynamic networks; it uses modelling by means of Markov models and is a member of the family of stochastic models for the co-evolution of network and units' properties (Boer et al., 2006). We studied the evolution of links between Iskra and its customers by means of actor-oriented stochastic models for the explanation of network development. The research was conducted on the data ranging from 2010 to 2014 in yearly intervals, with the units being selected those buyers whose annual turnover with Iskra exceeded 100,000 EUR in 2014. Let us recall that a link is established between two customers when they buy the same product.

During 5 observation times the number of customers matching the criteria was growing from 31 in the first period, through 34, 39 and 40 to 42 in the last observation. ***Network density*** reached its highest point in the last year of observation and amounted to 0.27, indicating a rather dense network. In 2014, ***the average unit grade*** reached its highest point and amounted to 11.37. The result was expected since Iskra focused on the relationships with its customers, developed and improved them with an attitude of mutual cooperation, closer contacts and building trust. Economic results of a relationship in Iskra were measured by the profitability of each customer. The number of companies with a mutual tie in two subsequent periods increased from one period to another. On the other hand, there was a decline in the number of companies with no mutual links in two subsequent periods. This confirmed that Iskra not only maintains the relationships with its customers but also develops them.

The first dependent variable in the customer network is ***sales share*** of an individual buyer per each year according to a major buyer. Throughout all 5 years, buyer C holds the leading position in sales share and thus has the share of 100, followed by Arc with 43% sales share in relation to buyer C in period t = 1 and an 81% sales share in period t = 2, and so forth. The main reason for these average values of sales changes is the change of sales income with reference to customer C. If this was the only reason, this would mean that sales share changes would either only rise, or only drop within each individual period. The largest sales share reduction occurred from 2012 to 2013 with 22 customers, reaching 134 (or on average 6% per buyer). This is due to the fact that sales share with customer C rose by 18 percent in 2013 in comparison to 2012. On the other hand, 10 buyers kept their sales share unchanged. As many as 10 customers have higher sales shares. If absolute value is considered, they purchased 2 to 3 times more than a year before. We must emphasize that in the observed time there was no worthy price change notices by Iskra or its competitors. There were no perceived problems with a competitor (e.g., none went out of business; no dependability issues etc.). The increase in sales share with so many buyers, despite a decline in sales share with the reference buyer, implied that Iskra is increasingly being perceived as high quality supplier. This indicates the quality of products and the quality of service, ranging from product portfolio to regular supplies, immediate problem-solving, advising as well as creating closer mutual relationships, all of which are becoming increasingly more important in today's business environment. In the last period the rise in sales shares of several buyers occurred due to lower sales shares with customer C and, as a matter of course, due to Iskra's proper treatment of customers. On average, sales share of individual customers between the two periods rose by 2.9%, which means that sales shares kept rising over the years.

Let us consider the results of the ***stochastic approximation algorithm***[2] (Table 1). The observation included network changes in all periods, the number of ties, sales share changes in individual periods and the number of transitive triads. The research also examined the temporal development of customer networks. Furthermore, it

[2] The explanation of the process of an iterative stochastic simulation, and the model type that has six possible values can be found in (Snijders et al., 2009).

Table 1. **Statistics for the measured variables,** *author's*

Variable	model 1 ("forcing")			model 2 ("agreement")		
	average	**standard dev.**	**t-ratios**	**average**	**standard dev.**	**t-ratios**
amount of network change in period 1	-0,562	14,402	-0,039	-0,902	15,942	-0,057
amount of network change in period 2	0,182	18,885	0,010	-3,066	26,496	-0,116
amount of network change in period 3	-0,952	14,275	-0,067	-0,580	15,224	-0,038
amount of network change in period 4	0,522	15,065	0,010	-0,484	15,387	-0,031
amount of network change xD/P	-0,289	11,558	-0,025	-3,858	65,431	-0,059
number of edges	-1,422	18,663	-0,076	-2,084	40,252	-0,052
number of transitive triads	-2,348	114,203	-0,021	-12,484	239,743	-0,052
number of (direct and indirect) ties	-1,280	46,765	-0,027	-6,282	83,585	-0,075
amount of sales chare change in period 1	2,246	23,616	0,095	0,804	23,098	0,035
amount of sales chare change in period 2	-0,538	39,154	-0,014	0,022	40,458	0,001
amount of sales chare change in period 3	1,560	20,382	0,077	0,565	19,842	0,028
amount of sales chare change in period 4	1,515	30,163	0,050	-0,046	27,640	-0,002
sales chare	2,125	127,809	0,017	-5,557	102,873	-0,054
Variable	**model 4 ("conjunctive")**			**model 6 ("compensatory")**		
	Average	**standard dev.**	**t-ratios**	**average**	**standard dev.**	**t-ratios**
amount of network change in period 1	-0,226	14,006	-0,016	-15,808	14,401	-1,098
amount of network change in period 2	517,694	25,642	20,189	471,098	133,082	3,540
amount of network change in period 3	0,065	14,003	0,005	-11,880	14,521	-0,818
amount of network change in period 4	0,940	14,504	0,065	-13,392	14,932	-0,897
amount of network change xD/P	-0,258	20,381	-0,013	166,585	157,538	1,057
number of edges	87,520	245,745	0,356	101,673	93,294	1,090
number of transitive triads	355,710	4063,633	0,088	-181,605	1542,648	-0,118
number of (direct and indirect) ties	104,040	507,457	0,205	218,362	187,138	1,167
amount of sales chare change in period 1	-1,600	20,727	-0,077	0,357	21,934	0,016
amount of sales chare change in period 2	0,790	39,324	0,020	4,751	37,876	0,125
amount of sales chare change in period 3	-1,250	18,829	-0,066	0,176	19,954	0,009
amount of sales chare change in period 4	2,440	27,668	0,088	1,339	29,007	0,046
sales chare	16,600	84,227	0,197	-2,289	88,409	-0,026

shows value dynamics of sale to an individual buyer according to the largest buyer in a particular observation period and its time-related changes. On average 2,995 iterations were performed per each model. On average, parameter evaluation derived from 2,220 iterations. The diagnosis of convergence and derived matrices was based on 1,000 iterations. According to target values, SIENA program calculates average values, standard deviations and the t-value.

As seen from Table 1, ***model 1 ("forcing")*** and ***model 2 ("agreement")*** do not include any statistically significant effects. This means that "forcing" and "agreement" introduction of new ties does not seem like plausible models. It looks like subsidiaries have a lot of freedom in deciding about their suppliers (they cannot be forced) and that companies tend to stick to the same distribution channel. The result was somewhat different in ***models 4 ("conjunctive")*** and ***6 ("compensatory")***. In both of these models there was a significant effect on the change in period two. Since both these models may be related to new products introduction, it may be plausible to assume that when introducing new products it may be a good opportunity to link customers between themselves.

In general, we may conclude that the network of relationship between customers is very stable and not governed by any of the foreseen rules for change. This gives us the stable environment for the development of customer relationship marketing. Some significant effects in the models point to opportunities to develop the network. The results of network dynamics research, such as the growing number of customers with mutual ties in two subsequent periods, a decline in the number of companies with no mutual links in two subsequent periods, and the growing sales share of customers have confirmed that Iskra maintained the relationships with its buyers and strengthened them as well. Based on this, it follows that the analysed network is becoming increasingly denser, and average unit rate rose over time.

Conclusions and future directions. The presented study showed us how the existing information on customers and transactions could be harnessed to map the network of customers and products and help us develop and implement a relationship marketing system. Generalised block-modelling allows for the observation of customer network characteristics as a whole and enables the observation of the nature of its individual units. This helps identify the buyers that share similar characteristics in products purchase; it assists in detecting the nature of mutual links within a unit as well as among clusters of customers. Furthermore, it facilitates in deciding which products could additionally be offered to individual buyers according to their positioning into groups and which buyers create the core of the network and are therefore most important in view of a company's long-term management, which are all key elements of a successful relationship marketing system.

Customer network based on transactions has been changing over time. New products can be purchased by a customer, customers' position in the network changes over time and they can be linked in new ways. Combination of links that the company develops and the position of the company in the overall activity pattern have structural (efficient) and dynamic (developmental) effects (Hakansson et al., 1995). The analysis of network dynamics in a five-year-period presented time-related network changes. It illustrated what occurred with the links of individual customers and the number of products they bought. It enabled detection of outstanding participants and new customers. In addition, it explained the change of sales shares of individual buyers according to a buyer with the highest turnover etc. From the presented case study, we can conclude that social network analysis is a useful tool to improve relationship marketing. Knowledge on the network of customer relationships and its dynamics in a particular company is of utmost importance for the success of a network. It is of great assistance to management of a company when developing customer strategies and creating general strategies of a company.

This study concentrated solely on one part of the relationship, taking advantage of the information readily available to the company. It would be relevant to examine other types of relationship as well, such as the view of individual customers on their relationship with Iskra. Such research would foster broader treatment of the network where both companies are located, as there are many aspects of marketing relationships that are based on bilateral characteristics of both partners (cooperation, flexibility, knowledge transfers, social ties, communication etc.). This research is focused on the relationship between customers based on the patterns of purchases from the company. Further elaboration of this study could lead to the examination of an expanded network of a company with all its participants, that is, suppliers, financial institutions, media, local authorities, and others. The study could be broadened to the level of individuals within all cooperating companies, for example, it might examine a network of interpersonal contacts, their influence on the development and success of relationships etc. Another possible development of the study is to build on recent advancements in the analysis of two-mode networks and analyse both the block-modelling and the dynamics of the original bipartite network. The interpretation of this is much more demanding, however it offers great analytical possibilities. In our view, a research study including several informants from the same company would add to a more comprehensive picture of development and improvement of relationships in the relationships network. However, one should be aware of the complexity and the financial aspect of such a research undertaking.

References:

Baron, S., Conway, T., Warnaby, G. (2010). Relationship Marketing: A Consumer Experience Approach. London: Sage Publications Ltd.

Boer, P., Huisman, M., Snijders, T.A.B., Steglich, C.E.G., Wichers, L.H.Y., Zeggelnik, E.P.H. (2006). An open software system for the advanced statistical analysis of social network // www.gmw.rug.nl.

Caniato, F, Cagliano, R., Kalchschmidt, M., Golini, R., Spina, G. (2009). Evolutionary patterns in e-business strategy. International Journal of Operations & Production Management, 29(9): 921–945.

de Nooy, W., Mrvar, A., Batagelj, V. (2005). Exploratory social network analysis with Pajek. New York: Cambridge University Press.

Doreian, P., Batagelj, V., Ferligoj, A. (2005). Generalized Block-modelling. Cambridge: Cambridge University Press.

Dwyer, R.F., Schurr, P., Oh S. (1987). Developing Buyer-Seller Relationships. Journal of Marketing, 51(4): 11–27.

Granovetter, M. (1973). The strength of weak ties. American Journal of Sociology, 78(6): 1360–1380.

Hagedoorn, J. (2006). Understanding the cross-level embeddedness of interfirm partnership formation. Academy of Management Review, 31(3): 670–680.

Hakansson, H., Ford, D. (2002). How Should Companies Interact in Business Networks? Journal of Business Research, 55(2): 133–139.

Hakansson, H., Snehota, I. (1995). Developing Relationship in Business Networks. London and New York: Routledge.

Harmeling, C., Palmatier, R.W. (2015). Relationship Dynamics: Understanding Continuous and Discontinuous Relationship Change. In: Handbook of Research on Distribution Channels. Charles A. Ingene and Rajiv P. Dant, eds. Northamption, MA: Edward Elgar Pubishing.

Hite, J.M., Hesterly, W.S. (2001). The evolution of firm networks: from emergence to early growth of the firm. Strategic Management Journal, 22(3): 275–286.

Hoang, H., Yi A. (2015). Network-Based Research in Entrepreneurship: A Decade in Review. Foundations and Trends in Entrepreneurship, 11(1): 1–54.

Kothandaraman, P., Agnihotri, R., Anderson, R.E. (2011). The salesperson's role in CRM success: Exploring the value of salespersons' mapping of buying centre structure. The Marketing Review, 11(3): 249–261.

Larson, A., Starr, J.A. (1993). A network model of organizational formation. Entrepreneurship Theory and Practice, 17(2): 5–15.

Morgan, R.M., Hunt, S.D. (1994). The Commitment-Trust Theory of Relationship Marketing. Journal of Marketing, 58(3): 20–38.

Newman, M.E.J. (2003). The structure and function of complex networks. SIAM Review, 45: 167–256.

Nitzan, I., Libai B. (2011). Social Effects on Customer Retention. Journal of Marketing, 75(6): 24–38.

Powell, W.W., White, D.R., Koput, K.W., Owen-Smith, J. (2005). Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. American Journal of Sociology, 110(4): 1132–1205.

Sheth, J.N., Parvatiyar, A. (2000). Handbook of relationship marketing. Thousand Oaks, Sage.

Snijders, T.A.B., Steglich, C.E.G., Schweinberger, M., Huisman, M. (2009). Manual for SIENA version 3.2 // www.stats.ox.ac.uk.

Snijders, T.A.B., van de Bunt, G.G., Steglich, C.E.G. (2010). Introduction to stochastic actor-based models for network dynamics. Social Networks, 32: 44–60.

Varela, L.M., Rotundo, G., Ausloos, M., Carrete, J. (2015). Complex networks analysis in socioeconomic models. In: Complexity and Geographical Economics. P. Commendatore et al. (eds.). Springer International Publishing Switzerland.

Wilkinson, I., Young, L. (2002). On Cooperating: Firms, Relations and Networks. Journal of Business Research, 55(2): 123–132.

Wilson, D.T. (1995). An Integrated Model of Buyer-Seller Relationships. Journal of the Academy of Marketing Science, 23(4): 335–345.

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