Distribution Networks In The Russian Chemical Industry

Work-in Progress paper

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Abstract

Over the past two decades, the literature has increasingly moved to consider inter-firm networks as an efficient form of organizing business activities. Network approaches vary significantly being numerous and diverse but having all together formed foundation for the development of a new paradigm (Rumyantseva and Tretyak, 2003).

In the paper the process of distribution networks development in Russia is investigated on the basis of Markov's chain theory and the network paradigm. In line with IMP tradition, interaction between companies in industrial markets is seen from a relationship perspective, where relationship is defined as "mutually oriented interaction between two reciprocally committed parties" (Håkansson and Snehota 1995).

The paper is organized around the following topics. Firstly, we will give a brief overview of the literature on the subject. Secondly, we aim to give insight into some country-specific and segment-specific features of distribution in Russia. Then we will describe situation in chemical industry in Russia. Focusing on the question of the current structures of distribution chains, we aim to identify the main features of distribution models of each type. Thirdly, the process of selecting partners will be described using time-homogeneous Markov chains approach. There are two main options: **opportunistic** behavior (the choice of a partner is driven solely by the price offer); **networking** behavior (the choice of a partner is based on well-established supplier-distributor relationships). Finally, a matrix of agent behavior will be proposed based on the empirical findings on distribution networks in Russian chemical industry.

Keywords: distribution networks; relationships; transaction costs; Russia, Markov chains

1. Introduction

The paper takes network paradigm as a main basis of investigation looking at the development of distribution networks in Russia. Our research is based on the IMP Group approach: interaction between companies in industrial markets is seen from a relationship perspective (Håkansson & Snehota, 1995), relationship being defined as mutually oriented interaction between two reciprocally committed parties. The network approach in analyzing distribution is in line with the main trend of the recent decades manifesting itself in growing number of network-type distribution chains, a kind of "webs of capabilities embedded in an extended enterprise" (Narus and Anderson, 1996). Firms increasingly depend on the resources controlled by other actors and thereby are "able to combine resources in new ways, gain additional resources, and dispose of superfluous resources" (Wilson and

Daniel, 2007). Such distribution practice allows tailoring to individual end-user requirements (Gadde and Ford, 2008).

In this paper Markov chain model is suggested to examine distributors' behavior in a network. The model makes it possible to take into account the focal network agent (distributor) switching over between the company and its competitors. The delivery is optimized by this agent at each decision-making node. Therefore a probabilistic way of the network formation process can be used.

The empirical study draws on the case method (Eisenhardt & Graebner 2007; Flyvbjerg 2006). As a matter of fact, single case often provides better theoretical insights than multiple-case research based on creating good constructs (Dyer and Wilkins, 1991). The case study approach implies the detailed examination of a single example of a class of phenomena.

2. Literature review

2.1. Distribution networks: a relationship perspective

Over the past two decades, the literature has increasingly moved to consider inter-firm networks as an efficient form of organizing business activities (Rumyantseva and Tretyak, 2003). Business networks can be viewed as inter-firm exchange relationships or as interconnections between autonomous business units, either initiated by the supplier or the buyer, whereby both parties recognize their mutual dependence and interest in each others resources (Cunningham, 1980). The involved parties are free to enter into, maintain or dissolve these relationships and networks (Camp, 2004).

B2B distribution is considered to have been undergoing a process of significant evolution (Gadde, 2000; Gadde, Snehota, 2001; Frauendorf et al, 2007; Tretyak, Sheresheva, 2005; Vaskin, 2008). Distribution strategy is recognized as a key factor for enhancing customer satisfaction which is crucial for inter-firm network success. Distributor being not long ago considered mainly as a passive collector of orders is now an agent having the core position in the supply chain. First of all, distributor is an agent selecting appropriate partners in order to decrease business risk and improve efficiency. It is one of the most important managerial decisions in networking (Tallura and Backer, 1996; Jagdev and Browne, 1998; Mikhailov, 2002). Distributor's efforts to integrate manufacturers, suppliers of different services and customers in the supply network help to cope with the issues of optimal quantity, cost, and quality.

J.A.Weber was quite right to admit that resource sharing in distribution serves as foundation for building sustainable competitive advantage, due to the increase of resource body available to the company and increase of flexibility (Weber, 2001). The role of distributor in supply chain is now considered to be crucial for establishing relations with numerous agents specializing in specific distribution functions: transport companies, finance organizations, custom brokers etc. The interconnection of firms' activities generates, and is increased by, interconnected relationships that outline the network approach within the supply chain (Cantu et al, 2009).

Russia as an economy in transition provides a unique opportunity to investigate changing and adapting network structures, stakeholder interaction and relationship constellations (Smirnova et al., 2009). The nature of the relationships in Russia analyzed recently in a couple of papers (e.g. Davis et al, 1994; Johanson, 2007; Smirnova, Kousch, 2007; Tretyak, Sheresheva, 2005) proved to have some specifics due to overall specifics of the emerging Russian economy, including instability of the market, lack of information on potential partners, higher propensity to opportunistic behavior (Ford et al, 2006, Johanson 2007, Halinen, Salmi, 1996). Distribution in Russia is characterized by some trends including shift in distribution channels' structure, cutting number of distributors in many industries, internalization of distribution networks, and growing role of information infrastructure (Sheresheva, 2005; Vaskin, 2008). Still, there is a need in more research, since the empirical data is scarce, especially on networking in particular branches of Russian economy.

2.2. Markov's chain theory

Research on network formation is generally motivated by the observation that social structure is important in a wide range of interactions, including buying and selling of many goods and services. Very popular tools in modeling networks are those of the graph theory. Network is considered as either a non-directed or a directed graph; the type of graph is chosen depending on the context.

There are two main types of network formation models. The first type is derived from random graph theory considering economic or social relationship as a random variable. The other uses game theory tools and examines actors (people, or firms, or other actors involved) as exercising discretion in forming their relationships.

In this paper we will focus on the random graphs as formal models used to understand the network formation: a good example is pure Bernoulli process of link formation (see Erdös and Rényi, 1960). Let's consider a network where the (non-directed) link between any two nodes is formed with some probability p (where 1>p>0), and this process occurs independently across pairs of nodes. Such random method of forming links potentially allows emergence of any network, still some networks are much more likely to emerge. Moreover, as the number of nodes becomes larger, there is much to be deduced what the structure the network is likely to be, as a function of p. As Erdös and Rényi had shown, such a random graph exhibits a number of 'phase' transitions as the probability of forming links, p, is varied in relation to the number of nodes, n; that is, resulting networks exhibit different characteristics depending on the relative sizes of p and n.

Whether or not such a random graph model is recognized to be a good fit as a model of network formation, it is still of definite interest. It indicates that networks having different densities of links tend to have different structures. The model also provides comparisons for network formation processes. Some of the basic traits of random graph are as follows. When p is small in relation to n, so that p<1/n (that is, the average number of links per node is less than one), then with a probability approaching 1 as n grows the resulting graph consists of a number of disjointed and relatively small components, each of which has a tree-like structure. (A component of a network is a subgraph, so that each node in the subgraph can be reached from any other node in the subgraph via a path that lies entirely in the subgraph, and there are no links between any nodes in the subgraph and any nodes outside the subgraph.) Once p is large enough in relation to n, so that p>1/n, then a single 'giant component' emerges; that is, with a probability approaching 1 the graph consists of one large component, which contains a nontrivial fraction of the nodes, and all other components are vanishingly small in comparison.

Advanced random-based models of networks take into consideration the most basic network property that the presence of links tends to be correlated. On an intuitive level, models of network formation where links are formed independently tend to look too much like 'trees', while observed social and economic networks tend to exhibit substantial clustering, with many more cycles than would be generated at random (Watts, 1999).

Frank and Strauss (1986) identified a class of random graphs that generalize Bernoulli random graphs, which they called 'Markov graphs' (also referred to as p* networks). Their idea was to allow the chance that a given link forms to be dependent on whether or not neighboring links are formed. Specific interdependencies require special structures, because, for instance, making one link dependent on a second, and the second on the third, can imply some interdependencies between the first and third. These sorts of dependencies are difficult to analyze in a tractable manner, but nevertheless some special versions of such models have been useful in statistical estimation of networks (Jackson, 2008)/

Formally, a Markov chain is a discrete random process with the Markov property (Markov, 1906; Markov, 1971). A discrete random process means a system which can be in various states, and which changes randomly in discrete steps. It can be helpful to think of the system as evolving through discrete steps in time, although strictly speaking the "step" may have nothing to do with time. The Markov property states that the probability distribution for the system at the next step (and in fact at all future steps) only depends on the current state of the system, and not additionally on the state of the system at previous steps. Since the system changes randomly, it is generally impossible to predict the exact state of the system in the future. However, the statistical properties of the system at a great many

steps in the future can often be described. In some applications these statistical properties are important.

The changes of state of the system are called transitions, and the probabilities associated with various state-changes are called transition probabilities.

Formal definition

A Markov chain concerns about a sequence of random variables (X1, X2, X3, ...) which corresponds to the state of a certain system, in such a way that the state at one time horizon depends only on the one in the previous time horizon. Independence of the present state, the future and past states is the basic propriety of Markov chain. Formally,

 $\Pr(X_{n+1} = x | X_1 = x_1, X_2 = x_2 \dots, X_n = x_n) = \Pr(X_{n+1} = x | X_n = x_n).$

The possible values of Xi form a countable set S called the state space of the chain.

Markov chains are often described by a directed graph, where the edges are labeled by the probabilities of going from one state to the other states.

Variations

- Continuous-time Markov processes have a continuous index. •
- Time-homogeneous Markov chains (or stationary Markov chains) are processes where

 $\Pr(X_{n+1} = x | X_n = y) = \Pr(X_n = x | X_{n-1} = y)$ for all *n*. The probability of the transition is independent of n.

A Markov chain of order m (or a Markov chain with memory m) where m is finite, is a process • satisfying

$$\Pr(X_n = x_n | X_{n-1} = x_{n-1}, X_{n-2} = x_{n-2}, \dots, X_1 = x_1)$$

=
$$\Pr(X_n = x_n | X_{n-1} = x_{n-1}, X_{n-2} = x_{n-2}, \dots, X_{n-m} = x_{n-m}) \text{ for } n > m$$

In other words, the future state depends on the past m states. It is possible to construct a chain (Yn) from (Xn) which has the 'classical' Markov property as follows:

Let Yn = (Xn, Xn-1, ..., Xn-m+1), the ordered m-tuple of X values. Then Yn is a Markov chain with state space Sm and has the classical Markov property.

An additive Markov chain of order m where m is finite, is where

$$\Pr(X_n = x_n | X_{n-1} = x_{n-1}, X_{n-2} = x_{n-2}, \dots, X_1 = x_1) = \sum_{r=1}^{m} f(x_n, x_{n-r}, r)$$

Markov chains

The probability of going from state *i* to state *j* in *n* time steps is

$$p_{ij}^{(n)} = \Pr(X_n = j \mid X_0 = i)$$

and the single-step transition is

$$p_{ij} = \Pr(X_1 = j \mid X_0 = i).$$

For a time-homogeneous Markov chain:

$$p_{ij}^{(n)} = \Pr(X_{n+k} = j \mid X_k = i)$$

and

$$p_{ij} = \Pr(X_{k+1} = j \mid X_k = i).$$

so, the *n*-step transition satisfies the Chapman–Kolmogorov equation, that for any *k* such that 0 < k < n,

$$p_{ij}^{(n)} = \sum_{r \in S} p_{ir}^{(k)} p_{rj}^{(n-k)}$$

where *S* is the state space of the Markov chain.

The marginal distribution $Pr(X_n = x)$ is the distribution over states at time *n*. The initial distribution is $Pr(X_0 = x)$. The evolution of the process through one time step is described by

$$\Pr(X_n = j) = \sum_{r \in S} p_{rj} \Pr(X_{n-1} = r) = \sum_{r \in S} p_{rj}^{(n)} \Pr(X_0 = r).$$

Note: The superscript (*n*) is an index and not an exponent. (Sokolov, Chistykova, 2005).

3. Distribution chains in Russia: evidence from chemical industry

There are three main stages of distribution channel formation in Russia which correlate with the drastic changes in economic and social environment. Distribution chains in the USSR were hieratical structures strictly managed by government under conditions of non-market economy. Over the post-Soviet decades, the Russian market has undergone numerous changes, with distribution chains being at first badly destroyed. During the first post-Soviet decade demand exceeded supply in almost all segments of Russian market. In the highly uncertain and unstable political and economic environment, long-term relations were almost impossible. A lot of "fly-by-night companies" established in 1990s purchased and distributed goods without any commitment. The 1998 default leaded to decreased number of international trade contacts and impressive slump of import. Still, during the next decade the basic economic infrastructure had been formed and then distribution chains restored step by step at a new voluntary basis. Due to ICT intensively spread in Moscow and then in other regions of Russia, building of inter-firm networks became less costly, and a number of sustainable distribution networks started to grow. It is precisely this last decade developments that will be the main focus of our research based on the data on chemical distribution channels of western part of Russian Federation.

The chosen market segment is polymerized vinyl chloride (PVC) market. Traditionally this market includes three main groups of row materials for PVC production:

1) PVC resins – the basic component;

2) PVC plasticizer – which is added to the resins in order to get necessary viscosity of plastic mass (such as DOP, DINP);

3) Additives – which are added to the plastic mass to improve the production process and for giving necessary proprieties to manufactured goods. This group includes thermo stabilizers, lubricants, flame retardants, coloring agents, etc.

PVC market in Russia had an impressive dynamics during the decade having grown 2.4 times in years 2000-2007. In 2008-2009 the dynamics became slower due to crisis but some companies including Ruskhimset still managed further growth. In 2009 there was a remarkable reduction of PVC consumption in Russia. In the first half of the year the consumption of PVC was 40 % in comparison with 2008. In summer 2009 the highest prices were fixed due to unprecedented deficit; PVC prices increase in January- June 2009 was about 48,5 %. So, the market has obtained seasonality in the last years. It is also important to mention a 27 % increase of PVC price in Europe and that of 14,8 % in Asia.

Average price for domestic PVC resin remained at the level of 1.05 euro while the price for import PVC resin did not exceed 0.7–1 euro per kg on the terms Ex Works storehouse in Europe. The Russian domestic market volume is estimated by 974.4 thousand tons in 2008. About a half of this amount (578.6 thousand tones) counts for domestic production, the rest was imported. Russian

government takes measures protecting local producers in spite of the fact that domestic production capacities are unable to satisfy demand for PVC row materials. The custom duty for PVC resin is 15 %, and in October 2009 the additional euro compound was brought in (0,12 euro per Kg). Volatility of prices and inability of production capacities to supply the demand by domestic row product are the main difficulties facing Russian market of PVC products.

There are numerous actors at the market, including large producers, small trade companies and a lot of consumers. The range of PVC products is rapidly increasing. As a result, it is very difficult to reach any consensus within the PVC market community. Under these circumstances networking may be crucial for obtaining stability and predictability of the market.

4. «Ruskhimset» company

The Join Stock Company Russian Chemical Net («Ruskhimset») chosen for the case study started its operations in 2000. The company provides following services: delivery, information support, storage, etc. Its annual turnover is now more than 50 million USD. There is about 30 employees in Moscow office and about 100 in regional representative offices. The main goal is to provide wide range of chemicals for small and medium producers which are the target market of the company.

Considering huge territory of Russian Federation, there is a need for establishing regional infrastructure. JSC «Ruskhimset» has sales representative offices and specialized warehouses in a number of regions including Moscow, Saint-Petersburg, Tambov, Volgograd, Kazan, Yekaterinburg, Yaroslavl, Ivanovo, Rostov-on-Don, Perm, Minsk (Belarus).

In order to understand the structure of value creation chain of «Ruskhimset» we aim to analyze the actors of network: 1) Suppliers (Domestic, External suppliers); 2) Transport companies (Internal, International); 3) Financial agents (Banks, Insurance agents); 4) Distribution network of representations.

The starting point of analysis is to construct graphs of distribution channels. As a matter of fact, actors of channels have their own goals, producers being keen on promoting the product and expanding geographically, transport companies being interested in stable volume of cargo, consumers seeking for the best quality for less money, etc. Still, every actor is interested in gaining sustainable competitiveness and profit. Building the network and interact on the long-range basis is a way to raise their ability to create value and thus benefit from their position in the network.

Distribution chain of PVC chemicals we describe in terms of five essential networking principles include establishing a clear purpose and creating communication links (Stamps, Lipnack, 1994). «Ruskhimset» has established relationships with suppliers from all over the world. Actually, there are three types of supply chains managed by it:

- 1) Russian purchasing of goods from domestic producers.
- 2) European purchasing of goods from the European suppliers: Germany, Hungary, Italy, Switzerland, Belgium, Holland and including USA.
- Asian purchasing of goods of Asian origin: China, Taiwan, South Korea, and India. The Chart 1 below shows annual increase of import goods share:



Our point of view is that such an increase is widely stimulated by higher profitability of import goods. It is probably due to the shortage in financial and human resources necessary for internationalizing relationships which is typical of Russian market.



The Chart 2 below shows average profitability of sales:

Relationships built by «Ruskhimset» will be described hereinafter using ARA model. We aim to analyze these relationships by means of describing resources available, interaction parties involved, and interaction process and activities.

4.1. Distribution on the domestic market

Initially in 2000 year «Ruskhimset» started its business with domestic producers. So first of all we are going to describe a supply chain between domestic market actors. The majority of domestic suppliers have got common characteristic: most of them are built during the Soviet history, their production' quality is rather poor due to low tech and the outdated equipment. Obsolete facilities lead to the regular suspension of production and increased risk. The competitiveness is preserved mostly by setting lower prices. Since Russian government protects local producers by means of import duties regulation, it helps such companies to survive but prevent them from developing skills and inventing innovations. They also have no real stimulus to improve promotion of their products. Production of goods is the main concern, not logistics nor marketing. Products are sold on the Ex Works terms.

The graph of distribution channel is as follows:



Producer is interested in more "transactional" than "relational" ties seeking for distributors able to purchase in bulk and guarantee payment in time. Distributor organizes transportation using its own transport facilities or service of carrier for delivery goods to the warehouse in Moscow region.

The chain may be even shorter if factory ships the goods directly to the final consumer.

Let's illustrate this type of relationships by giving an example of Roshalskiy factory of plasticizers which is one of the main partners of «Ruskhimset». This factory was established in 1960s with the aim to produce plasticizer - dioctyl phthalate (DOF). Now the factory is privately owned.

«Ruskhimset» started to work with this factory as distributor in 2000. Since the partners had complementary skills and competences, cooperation was acknowledged as mutually beneficial.

Interaction between companies is now quite intensive, being based mainly on monthly agreements on schedule of delivery and price. While negotiating the factory captures dominant position. It seeks to dictate prices, volumes, and terms of delivery. Still, well established social contacts between staff of both companies always help to come to the mutually beneficial agreement. So, the channel is stable under turbulent environment and hard economic conditions mostly due to extensive social interaction.

The relationships between partners faced recently a serious challenge: Roshalskiy factory of plasticizers ceased the production for several months due to Energy Company refuse to provide energy (as a matter of fact, the factory had a huge debt at the time). In order to fill in the gap «Ruskhimset» had to diversify suppliers, and the additional supply from European companies was considered a best decision.

4.2. European partners

Cooperation with foreign suppliers is a good opportunity to extend product line and thus to attract more consumers. It is important to mention that international relations have positive impact on the image. In 2006 «Ruskhimset» had started to develop international business. Organizational structure was supplemented by the International relation department.

The distribution channel is rather complex as it is shown at the graph below; products going through the chain are usually unique, branded, of high quality and thus expensive.



Large European chemical producers provide financial support, e.g. postponement of payment, to the reliable partners but it takes certain time and efforts to prove the reliability.

European suppliers consider the BRIC markets to be very perspective and thus are intended to expand looking for further projects. As a result, transactions tend to increase constantly being quite regular and stable. The well-known European companies are open to the cooperation, and most of them have got representative offices in Moscow which are good help to facilitate development of relationships.

Communications in this chain are to a certain extent formalized and poorly developed. On the one hand, formalizing communications seem quite sound in terms of some business processes, such as placement of orders, arrangement of shipment receipt of shipping documents, payment etc. On the other hand, underdeveloped communications prevent taking into account special demands and requests of consumer. Exchange of information occurs mainly between representative working in Russian office and customer care manager in the point of shipment. Therefore the distribution efficiency strongly depends on personal relationships and individual qualities of certain persons. As to strategic issues of business relationships, they are usually defined on the CEO level.

European products are not yet well known for Russian companies. The overall demand for these products is quite modest. It appears to be one of the important obstacles in development of interactions. But in fact the main obstacle for effective development of relations with European companies is high price of the goods. The lower price could be provided by Asian suppliers.

4.3. Asian partners

In search for cheaper supply «Ruskhimset» started to establish contacts with Asian suppliers, since Asian countries have recently gained quite good competitive positions as producers of chemical row materials. Now production capacities of Asian region account for 20 mln. tones of PVC (about 50 % of worldwide capacities). Price-quality relationship for PVC from Asia is quite appropriate, and there are numerous suppliers. Still they have some common disadvantages, and the main problem is long period of delivery (45 to 60 days). The main way to start relationships with Asian companies is to take part in the exhibition. The interaction process between Russian and Asian firms is very intensive now but not very effective due to the language and culture differences.

The main problem in collaborating with Asia is long lead time. Working on the prepayment conditions «Ruskhimset» has to tie finance for 2-3 months. Another disadvantage is alteration of prices occurring almost every week. The final consumer price correlates strongly with fluctuations of rubble to dollar exchange rate. Price of the offer depends on stock exchange price and demand on the local (e.g. Chinese) market. Due to mentioned reasons transactions with Asian producers are quite risky. Aiming to decrease the uncertainty and to create mutual trust «Ruskhimset» facilitates development of distribution network with some partners from Asia. The chain of distribution in that third case usually is as follows:



5. Time-homogeneous Markov chains in distribution

Let's now try to apply the mathematical tool of Markov's chain theory to the process of distribution network creation, presuming that time-homogeneous Markov chain has got numerous similarities with the process due to the following:

1) Probabilities of future states of the process depend only on the present state. This can be used for description of opportunistic behavior of actors. It is applicable for description of network's agent behavior in case of inletting the permanent state which will be set indisputably (i.e. with probability one).

2) Existence of steps. Markov theory is applicable for description of process in discrete time. In our case it can be represented by sequence of transactions between economic agents.

We aim to describe the process of choosing a partner from the set of homogenous agents providing similar goods or services for distributor (product, credit, transport, storehouse, etc.).

Let the set of system's statuses $(i_1, i_2, ..., i_N)$ be the set of homogenous agents. Each step is one transaction with one of the agents. There are two options: opportunistic behavior (the choice driven solely by the price offer) and networking behavior (based on well-established supplier-distributor relationships).

At each decision-making node distributor make a choice aiming to optimize the delivery. In order to simplify process of decision making it chooses not among all participants of the market, but among those who are in its network. In the network there may be several suppliers of one product, several 3PL providers, etc. Distributor can link any partner from the network with some probability.



In the case of opportunistic behavior we assign probabilities according to prices. For example: if $a_1, a_2, ..., a_N$ - prices that offer appropriate actors $i_1, i_2, ..., i_N$ and ξ is random variables that adopts the values $i_1, i_2, ..., i_N$, then probability of choice actor i_k (distribution of ξ) can be set as

$$P(\xi = i_k) = \frac{(a_k)^{-1}}{\sum_{j=1}^{N} (a_j)^{-1}}$$

The probabilities of transition are for example

$$\Pr(\xi_{n+1} = j/\xi_n = i) = p_{ij} = I(a_j \le a_i) \cdot \left(\frac{(a_j)^{-1}}{\sum_{(k:a_k \le a_i)} (a_k)^{-1}}\right),$$

where $I(a_j \le a_i)$ is an indicator function. Then the one-step transition matrix is given by

$$\mathbf{P} = \begin{pmatrix} P_{11} & P_{12} & P_{1m} \\ P_{21} & P_{22} & P_{2m} \\ \dots & \dots & \dots \\ P_{m1} & P_{m2} & P_{mm} \end{pmatrix}$$

For example, there are three transport companies (i_1, i_2, i_3) which provide third party logistic (3PL) services. In actual practice the choice of a 3PL provider depends on a variety of factors which differ from shipment to shipment. In order to eliminate these factors we have made a request for delivery of 20 tones of the product from the storehouse of supplier (A) to the store house of distributor (B).

We consider a sequence of tree transportation services rates from our 3PL suppliers (m=3) given by: {3500,3650,3700}

The matrix of transition probabilities (P_{ii}) will be the following

 $\begin{bmatrix} 1 & 0 & 0 \\ 0,51773 & 0,48227 & 0 \\ 0,350825 & 0,326796 & 0,32238 \end{bmatrix}$

The matrix shows probability of moving from one partner to another. We see that probability is higher for the transport company with the lower price. But there is always probability that we will not choose an agent with the best price offer.

The lower row of the matrix shows that all companies may have equal chances. This situation is possible due to two reasons. At first, in our case the price difference is insignificant. Secondly, there is price does not play the key role in all relations.

The same approach could be applied to a choice process of other partners in the network.

In the case of networking behavior we can equal to the highest value, for example 1, the probability of choice of established partner. Then probabilities to choose another partner are equal to 0.

 $p_{ik} = 1$; $p_{ij} = 0, j \neq k$, if i_k is our established partner.

For example, the second transport company is a partner in supply chain. Then the most probable choice will be that company. That is matrix of transition probabilities is the following one

 $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \end{pmatrix}$

This matrix shows probability, that probability of choosing of our permanent partner is equals to 100 %. In that case it does not matter for company how cheaper other transportation services rates are.

Appliance of Markov Chain theory is mostly convenient for step-by-step processes. Moreover some of the processes can be managed or controlled. In this case we have an optimization problem with some objective function. In our case we could try to control the supply chain formation by choosing partners that would provide an optimal value of this function.

Explicit benefits, which could be expressed in money value, are rather obvious. At the same time, it is rather difficult to estimate implicit benefits of transaction. Still, once we have calculated probabilities according to prices, we are able to compare them with *empirical probabilities*. The difference between transition and empirical probabilities could help us to evaluate implicit benefits which we get from the relations with partner in terms of probability theory.

The problem is trivial when the objective function is oriented only on product or service price. Then the minimal price would provide the optimal value of wealthy objective function. Situation becomes nontrivial when the hazard component appears. Then we could try to apply some results from optimal control theory. It allows us to compare an opportunistic behavior that has no implicit profit (or implicit hazard) and networking behavior that may provide a compensation for lost profit.

We can formalize our value creation chain with the following criterion function: $C_{dist} = Tr_{dist}^{E} + Ma_{dist}^{E} + Fn_{dist}^{E} + S_{dist}^{E} + Ma_{dist}^{I}$, where:

 C_{dist} - cost in distribution network $Tr_{dist}^{E^-}$ transport, explicit costs

 $\begin{array}{l} \operatorname{Tr}_{dist}^{E} - \operatorname{transport, explicit costs} \\ \operatorname{Ma}_{dist}^{E} - \operatorname{marketing, explicit costs} \\ \operatorname{Fn}_{dist}^{E} - \operatorname{finance, explicit costs} \\ \operatorname{S}_{dist}^{E} - \operatorname{storage, explicit costs} \\ \operatorname{Ma}_{dist}^{I} - \operatorname{marketing, implicit costs} (BTL) \end{array}$

The first attempt will be applying Controlled Markov chain model that allows us to find an optimal strategy in terms of appliance opportunistic or networking strategy. Each transition is provided here by a profit (positive or negative) and we can choose some transition probabilities on each time step from special set.

The existing algorithms of optimization of Controlled Markov chains are quite complex even in small problem dimensions. In our case the simple "brute force" comparison is more compatible.

Markov Chain theory describes the model quite well, so the direction of the further researches is in searching more adequate and simple ways of comparison 2 models of behavior within the Markov Chain theory.

6. Conclusions

Emerging distribution networks of chemicals in Russia being already identifiable are yet characterized by instability relationships. These dynamic networks are headed by focal firm ("chain captain") regulating distribution in commercial terms.

There are many small and medium producers of PVC in Russia filling mainly special orders concerning rather small quantities. As a result, individual client approach has to be applied and thus development of network relationships is reinforced.

Social contacts being the main base of business relations, close to the network type described by M.Granovetter (Granovetter, 1983; Granovetter 1985), build the main specifics of "entirely domestic" chains. As to distribution networks including foreign partners, the main concern is the reputation of partners and their goods. Still, in case of «Ruskhimset» there is also an obvious search for partners providing fair prices.

Distribution network including European partners usually becomes a part of already existing European distribution chain while cooperation with Asian partners, though regarded as prospective, is not yet well developed.

Companies on the market of chemicals are turning their hierarchical supply chains into strategic networks of partnerships but still fragmented. Networks are based on pooling complementary skills and resources by a huge number of actors whose activities are coordinated and synchronized by distributors. In our case a focal company «Ruskhimset» initiated cooperation and establishing network relationships and managed to coordinate the flow of information and goods quite successfully. Distribution chain stability and flexibility gained through networking helped the company to survive the crisis. Long term cooperation served as a base for trust within the network and thus made it possible to get some agent's payments postponed. It is important to underline that some competitors had to leave the market while the «Ruskhimset» company's profit increased rapidly in 2009. So, the main conclusion is: Network approach to distribution of chemical products is helpful in terms of sustainability and competitive advantage. Networking does matter – moreover, it is of great importance in unstable environment. In Breyer's words, "The channel group is obviously more than mere collection of individual channels – it is in the nature of a network" (Breyer, 1964).

In this paper network formation process is described in a probabilistic way. Markov chain model distributor optimizes the delivery at each decision-making node. One of the benefits to the network management is then as follows: once we have calculated probabilities according to prices we can compare them with *empirical probabilities*. The difference between transition and empirical probabilities could help us to evaluate implicit benefits which we get from the relations with partner in terms of probability theory.

Markov Chain theory describes the model of network formation quite well, so the direction of the further research will be searching more adequate and simple ways of comparing two models of behavior with the Markov Chain theory tool.

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