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REFLEXIVE MODELING BUSINESS PARTNER SELECTION IN SUPPLY CHAIN

The article deals with the problem of selecting a partner in supply chain, taking into account the peculiarities of thinking of business entities that define their behavior during the interaction. The developed reflexive model reflects the characteristics of the process of mutual influence of business entities in the selection of partners during the formation of the supply chain. Alternative options to reflexive control of the interaction of business entities have been proposed. A methodical approach to solving the problem of selecting a partner in the supply chain has been developed, taking into account the reflexive impact of business entities on themselves and their partners with a view of convergence of the real and ideal images in the minds of each other. Selection of suppliers/intermediaries in the supply chain is made taking into account the mutual interest of business entities in collaboration, resulting in the equal significance of their mutual evaluations when selecting the best partner.

Keywords: reflexive control, supply chain, reflexive model, business partner selection, an image of a business entity

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1. Introduction

Enterprises logistics activity is associated with various tasks of selection that need to be solved in the process of managing material flows in supply chains from suppliers of raw materials to consumers of finished products. The best known among them are supplier, reseller and logistics intermediary selection problems characterized by non-compliance of the objectives and the need for coordination of interests of interacting business entities that requires the use not only of methods of rational selection but also consideration of thinking features of business partners that define their behavior during the interaction.

The impact of subjective assessments, psychological and emotional factors characterizing business entities determines the reflexive nature of the process of market interaction. The core of the reflexive approach to interaction management is in the conscious influence of one (control) subject on another (controlled) with a view to persuade the latter to come to a decision that is required or beneficial for the first one (Lefebvre, 2009, p. 89).

Reflexive processes occur in various forms of interaction among business entities in a market economy (business-to-business systems): both in conflict situations, rivalry and in cooperation, partnership. Reflexive control is applied when the need for conscious influence on business partners, on their vision of a situation, on their actions, on their decision-making process is high enough (Lepa, 2012, p. 7).

At the present stage the practical use of the reflexive approach in economic processes management is ahead of the theoretical research in this area that stipulates the need for improving the methodology of reflexive control and, first and foremost, its modeling in various situations of the market interaction of business entities.

2. Literature review

Reflexive modeling is widely used in studies of various problems at the intersection of psychology, economics and management, by the solution of which both classical (Boolean logic, graph theory, game theory) and modern (fuzzy mathematics, cognitive modeling) mathematical modeling methods are used.

The founder of application of a mathematical approach to reflexive control of behavior and interaction of subjects is Lefebvre (1967, 1973), who proposed different models of reflexive bipolar choice within a theory of moral choice. Lefebvre's ideas were developed in works by Miller and Sulcoski (1999a, 1999b), who

proposed application of a model based on multi-attribute utility function (MAUF) in automated decision support systems. The model represented a chain of binary choices, for each of which its own reflexive model can be built. Taran (2002) elaborated models of multi-criteria reflexive selection and researched conditions that create prerequisites for management of a subject's behavior under decision making. In collaboration with Shemayev (2005) she also proposed an approach to solution of problems of cognitive conflicts modeling, considering the influence of the external environment, psychological set and intentions of subjects.

Works by Novikov and Chkhartishvili (2003, 2014), Roth and Sotomayor (1992) were dedicated to the use of game theory for modeling of reflexive processes in management. Game-theoretic models allow to clearly describe reflexive processes by mathematical methods and get a formalized solution to many practical and applied tasks of the interaction between different subjects, which make decisions based on a hierarchy of representations. In his works, Lepa (2012), Lepa ed. (2010; 2012; 2013) considered conceptual and applied aspects of modeling of reflexive processes in various spheres of economic activity (from inter-organizational collaboration management and planning at enterprises to impact on the external environment of an economic system). Using graph theory Sergeeva and Bacurova (2010) developed a model of system structure with reflection, that enable to apply cognitive modeling and optimization methods for using advantages of reflexive control in providing the viability of socio-economic systems. London et al. (2006) suggested a reflexive capability conceptual model for the individual firm in relation to e-business is developed which relies upon merging economic and social practices through an industrial organization economic theoretical lens and social science theories of communication.

Studies of the reflexive approach in the sphere of market interaction of business entities are developing particularly actively. The researches deal with models of reflexive control of consumer demand (Petrachkova, 2007; Pokotilova, 2015), formation of supply chain and dealer network (Vandaele and Gemmel, 2007; Ustinov, 2011; Isikova, 2013), influence on competitor behavior (Malchuk, 2010), seller-buyer interaction during business transaction (Metcalf et al., 1992; Brigg and Grisaffe, 2010; Freydina and Koroh, 2015). Hartmann et al. (2008) used the principles of reflexive control in modeling passive and active social interactions in marketing. Bettany and Woodruffe-Burton (2009) proposed a structured approach to the possibilities of critical reflexive practice in marketing and consumer research.

However, a logistical aspect of decision making in the field of trade relations, that became an independent integrant component of management in today's economy determining the effectiveness of management of interaction of business entities in the supply chain, does not take into consideration in these works.

3. Formulation of the problem and a description of the model

Modeling of supplier or intermediary selection made by an enterprise, with considering a behavior of interacting business entities as well as their ability to be aware of themselves and each other, is especially important in conditions of diversity of options of a supply chains organization that are formed by the market.

This paper is aimed at developing a reflexive model of the selection process in the conditions of the multiplicity of suppliers and intermediaries in the supply chain, taking into account the mutual influence of business entities.

It is important for ensuring business entities integration in the supply chain to build hybrid forms of organization of interaction. It allows not only to optimize material flows by the criteria of total logistics costs but also to achieve the optimum coherence in the actions of interacting enterprises with considering a global goal, that is common to all, and individual value for each therefrom, received from participating in a particular supply chain. It stipulates the use of reflexive control of the interaction of business entities in dealing with problem of selecting partner in supply chain on the stage of foundation and reaching agreements on parameters of purchase/sale of goods (services) and their delivery: prices, quantities, discounts, terms, quality, payment conditions, package etc.

Reflexive control consists of combining the management processes based on taking account the reflection of interacting business entities into one system of the purposeful and continuous influence that encourages them to act in accordance with their purchasing or marketing strategies. Regardless of whether an enterprise is a customer or supplier of goods (services), reflexive control of its interaction with business partners is aimed at the following:

- change of their ideas of a company;
- change of their ideas of their advantages;
- change of objective characteristics of an enterprise for the purpose of the maximum conformity its real characteristics to the image of the enterprise at business partners.

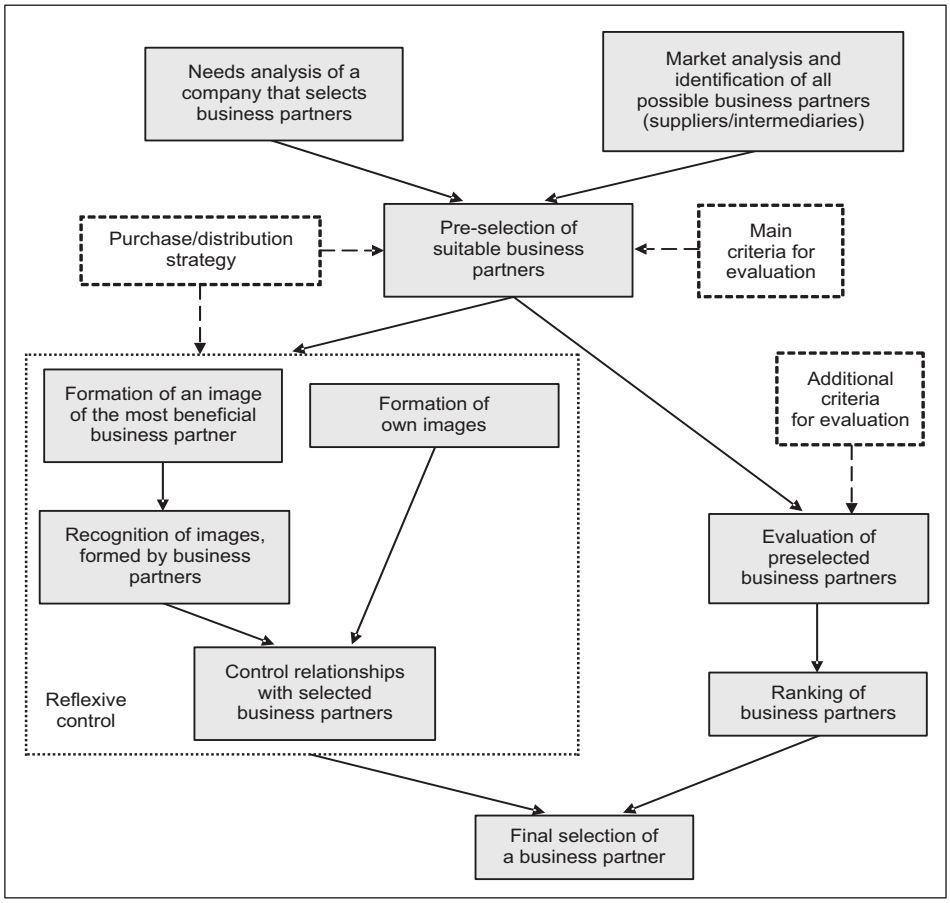
The use of reflexive control expands decision-making process of selecting partner in supply chain, organizing, in parallel with a rational selection of business partners by quantitative and qualitative criteria, informational influence thereon, taking into account a behavioural aspect (reflection) of interaction by means of formation and detection of their images as well as control of relations therewith (Figure 1).

In the process of selecting partner in supply chain, interacting business entities are simultaneously both subjects and objects of reflexive control. It should be

emphasized that in this case it is not about organizations as such, but about individuals who make decisions in these organizations.

Figure 1.

SCHEME OF PARTNER SELECTION PROCESS IN THE SUPPLY CHAIN, TAKING INTO ACCOUNT THE REFLEXIVE CONTROL OF THE INTERACTION OF BUSINESS ENTITIES

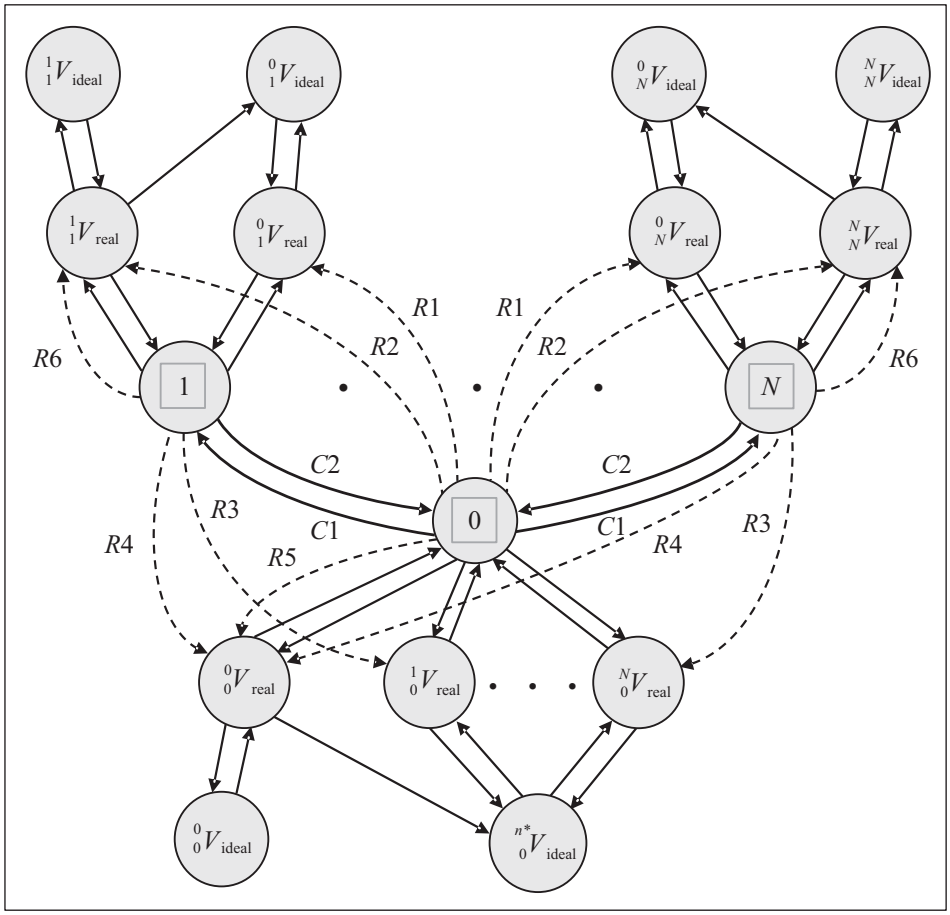


Source: Author.

For visual depicting of the reflexive model, reflecting the interaction of business entities in the process of selecting partner in supply chain, it makes sense to

Figure 2.

REFLEXIVE_MODEL OF A PARTNER SELECTION
IN THE SUPPLY CHAIN



Source: Author.

use a model of a final weighted graph with two kinds of vertices: a finite set of vertices that correspond to real participants of this process (denoted as: 0 – an enterprise that makes a selection, and 1,…,*N* – supplier/intermediary enterprises, where *N* – number of suppliers/intermediaries among which a selection is made), and a finite set of vertices that correspond to their images of different ranks (denoted as: symbol *V* with two indices, namely, the lower index characterizes a business entity, which creates an image, and the upper index – a business entity, an image of

which is created) (Figure 2). R in Figure 2 stands for informative reflexive impact. Furthermore, the graph arcs represent both the exchange of information among the real business entities, and the formation/perception of different images by them.

The presented reflexive model of a partner selection in the supply chain can be described in the form of a tuple:

$$\left\langle V, W_V, E, W_E, Z, A \right\rangle,$$

where: V – set of vertices of the graph, $V = V_C \cup V_O^1 \cup V_O^2$; V_C – set of graph vertices corresponding to interacting business entities, $|V_C| = N + 1$; V_O^1 – set of graph vertices that correspond to images of business entities in their mind (images of first order); V_O^{II} – set of graph vertices corresponding to images of business entities in their partners' mind (images of second order); W_V – set of weights of graph vertices; E– set of graph arcs; W_E – set of weights of graph arcs; Z – numerical function that allows assessing the proximity of business entities and their images in the space of weights; A – set of alternatives for reflexive control.

Nonreflexive information interaction between business entities occurs through the following channels:

$C1$ – potential suppliers get the information from the enterprise that makes a selection about the needs and requirements for goods (services) and their supply or potential intermediaries get the information about goods, capability of their supply and requirements for formed distribution channels;

$C2$ – information about goods (services), suppliers themselves and their capability to organize supply is transferred from potential suppliers to the enterprise that makes a selection or information about the need for goods, intermediaries themselves and their capability to organize distribution channels - from intermediaries.

A system of images that business entities form in their mind in dealing with a partner selecting problem in the supply chain includes:

${}^0_0V_{\text{real}}$, ${}^1_1V_{\text{real}}$,…, ${}^N_NV_{\text{real}}$ and ${}^0_0V_{\text{ideal}}$, ${}^1_1V_{\text{ideal}}$,…, ${}^N_NV_{\text{ideal}}$ – own real and ideal images of business entities, reflecting their objectives and capability at the current time considering their limitations;

${}^1_0V_{\text{real}}$,…, ${}^N_0V_{\text{real}}$ and ${}^{n^*}_0V_{\text{ideal}}$ – real and ideal images of suppliers/intermediaries, reflecting in the mind of the enterprise, that makes a selection, their objectives and capability to organize supply or distribution channels at the current time;

${}^0_1V_{\text{real}}$,…, ${}^0_NV_{\text{real}}$ and ${}^0_1V_{\text{ideal}}$,…, ${}^0_NV_{\text{ideal}}$ – real and ideal images of the enterprise, that makes a selection, reflecting in the mind of suppliers/intermediaries, its requirements and capability, that occur by interacting with it at the current time.

A variety of quantitative and qualitative indicators of the condition of business entities determines a description of graph vertices through vector characteristics $X_n = \{x_{n1},...,x_{nM\,n}\}$, where $n = 0,N$; M_n – number of indicators of quality of the *n*-th business entity. Furthermore, for vertices that correspond to business entities and their real images, vector features reflect real values of indicators or their expert assessment. Also, for vertices that correspond to ideal images, vector features reflect reference values of indicators or expert assessment of their optimum values under predetermined conditions of business activity of enterprises. To resolve problems of the incompatibility of units of measurement of different indicators and a vector view of characteristics, weights of graph vertices are determined as generalized quality criteria via normalization methods (values lie in an interval (0;1]) and multi-criteria evaluation: direct methods, incomparability thresholds methods, compensation etc. (Lapaiev and Yurlov, 2008).

Division of images of business partners into real and ideal allows comparing a real business entity with the one, which a partner in interaction would like it to see from the point of view of achieving his goals and considering his limitations.

Emphasizing of own real and ideal images is a deepening of self-reflection and trends towards development and perfecting of own enterprise, taking into account requirements, set by business partners, and shortcomings, identified during interaction with them.

The arcs $(0, {}^{0}_{0}V_{\text{real}})$, $(1, {}^{1}_{1}V_{\text{real}})$,…,$(N, {}^{N}_{N}V_{\text{real}})$ correspond to the process of formation of intrinsic motivation of business entities to self-reflect. The arcs can be weighted by a share of resources (time and financial resources), that each of the business entities ready to spend on comprehension of own goals and opportunities in each particular situation of interaction.

The arcs in reverse direction $({}^{0}_{0}V_{\text{real}},0)$, $({}^{1}_{1}V_{\text{real}},1)$,…,$({}^{N}_{N}V_{\text{real}}, N)$ reflect the process of influence of own formed image on actions of the business entity. Weights of these arcs correspond to quality assessment of self-reflection, that shows how close the real business entity and his formed image in feature space of the business entity. A numeric function, that allows evaluating the closeness of the business entities and their real images, is defined as the difference between their weights:

$$Z_n = v_{Cn} - v_{On};\ n = \overline{1,N+1}, \tag{1}$$

where: v_{Cn} – arc weight, corresponding to *n*-business entity; v_{On} – arc weight, corresponding to the real image of *n*-business entity.

The arcs $(0, {}^{1}_{0}V_{\text{real}})$,…,$(0, {}^{N}_{0}V_{\text{real}})$ and $(1, {}^{0}_{1}V_{\text{real}})$,…,$(N, {}^{0}_{N}V_{\text{real}})$ correspond to the process of formation of intrinsic motivation of business entities to reflect with other participants of interaction. The arcs also can be weighted by a share of re-

sources (time and financial resources), that each of the business entities ready to spend on studying and understanding goals and capability of business partners.

The arcs in reverse direction $({}^{1}_{0}V_{\text{real}},0),\ldots,({}^{N}_{0}V_{\text{real}},0)$ and $({}^{0}_{1}V_{\text{real}},1),\ldots,({}^{0}_{N}V_{\text{real}},N)$ reflect the process of influence of the formed image of the business partner on actions of the business entity. Weights of these arcs should demonstrate how this or that supplier/intermediary or consumer suits him as a business partner. For these weights evaluation various criteria of the quality of business partners is used, which is also applied in rational selection.

A real image of a partner and an image of a business entity itself, which forms requirements to the partner, influence formation in the mind of each business entity an ideal image of a partner. The supplier/intermediary each independently forms an ideal image of an enterprise that makes a selection – the arcs $(({}^{0}_{1}V_{\text{real}},{}^{0}_{1}V_{\text{ideal}}),({}^{1}_{1}V_{\text{real}},{}^{0}_{1}V_{\text{ideal}})),\ldots,(({}^{0}_{N}V_{\text{real}},{}^{0}_{N}V_{\text{ideal}}),({}^{N}_{N}V_{\text{real}},{}^{0}_{N}V_{\text{ideal}}))$. The enterprise itself forms one ideal image of a supplier/intermediary using a variety of real images of all business partners among which makes selection – the arcs $({}^{0}_{0}V_{\text{real}},{}^{n^*}_{0}V_{\text{ideal}}),({}^{1}_{0}V_{\text{real}},{}^{n^*}_{0}V_{\text{ideal}}),\ldots,({}^{N}_{0}V_{\text{real}},{}^{n^*}_{0}V_{\text{ideal}})$.

Reflexive control consists in the influence on images that have been formed in the mind of business entities. Furthermore, exposure is made only on real images. Reflexive control of business entities is distinguished by impact on images of interaction partners and on own image. In the first case, considering the active nature of market interaction among business entities, the effect is symmetric and is aimed at formation of a positive self-image in the mind of a partner ($R1$, $R3$), interesting him in cooperation, and a realistic assessment of his capability ($R2$, $R4$), adjusting his goals and stimulating him to find solutions profitable for controlling subject. In the second case, controlling influence of the business entity is aimed at self-improvement and self-development of the enterprise for the purpose of improving its image in the eyes of partners, respectively for an enterprise that makes a selection ($R5$) and suppliers/intermediaries ($R6$).

In respect that in the proposed model of the process of selecting a partner in the supply chain all participants of interaction are subjects of control, influencing on their business partners, the following alternatives of reflexive control can be possible:

1) for an enterprise that makes a selection:

alternative A_1 – a change of supplier's/intermediary's representations about itself ${}^{0}_{1}V_{\text{real}},\ldots,{}^{0}_{N}V_{\text{real}}$ through information influence ($R1$);

alternative A_2 – a change of business partners' representations about their goals and capability ${}^{1}_{1}V_{\text{real}},\ldots,{}^{N}_{N}V_{\text{real}}$ through providing them with additional information on requirements to suppliers/intermediaries and possible benefits, striking up contracts ($R2$);

alternative A_3 – a change of the real self ${}^{0}_{0}V_{\text{real}}$ through improving financial condition, introducing innovation, increasing capacity (needs) or implementing other organizational and economic measures ($R5$) in order to bring itself closer to own ideal image in partners' mind ${}^{0}_{1}V_{\text{ideal}},\ldots,{}^{0}_{N}V_{\text{ideal}}$;

2) for a supplier/intermediary:

alternative $A_1^{'}$ – a change of representations of an enterprise that makes a selection about itself ${}^{1}_{0}V_{\text{real}},\ldots,{}^{N}_{0}V_{\text{real}}$ though information influence ($R3$);

alternative $A_2^{'}$ – a change of representations of an enterprise that makes a selection about its goals and capability ${}^{0}_{0}V_{\text{real}}$ through providing it with additional information on goods (services), suppliers/intermediaries and benefits of striking up contracts with them ($R4$);

alternative $A_3^{'}$ – a change of the real self ${}^{1}_{1}V_{\text{real}},\ldots,{}^{N}_{N}V_{\text{real}}$ through improving financial condition, expanding the range of goods (services), improving their quality, offers certain exemptions or implementing other attractive obligations ($R6$) in order to bring itself closer to own ideal image in the mind of the enterprise that makes a selection ${}^{n^*}_{0}V_{\text{ideal}}$.

The first two alternatives of reflexive control for both parties of market interaction are subjective, because the impact is made only on images in partners' mind, which makes them quite effective in the short term. The third alternatives are more difficult to implement or require additional financial costs, because they reckon for a change of real features of enterprises to eliminate existing shortcomings in their activities or for increasing the attractiveness in order to interest potential business partners in cooperation.

Successful interaction of business entities in the course of solving the problem of selecting a partner in supply chain reflects an aspiration of each of them to get own benefit:

- from the point of view of an enterprise that makes a selection – choosing the best among business partners by specified criteria, creation of comfortable operating conditions depending on a place in a supply chain;
- from the suppliers' point of view – maximizing their income, an increase in their own production facilities, search for new customers, receipt of orders_in the long term, etc.;
- from the intermediaries' point of view – minimizing their costs, search for reliable suppliers with good reputation, flexibility of their response to requests and changes occurring, obtaining favorable payment terms, etc.

4. Methodical approach to selection of business partner, taking into account the reflexive control

It is obvious that in order to achieve these goals it requires a combination of real and ideal images of partners in the mind of each other by their use of aforecited control alternatives. To determine the optimal controlling effect of business entities (informational or the implementation of projects on own development) on partners for the purpose of bringing closer their real image to their ideal image in their mind, it is necessary to set resource costs functions (financial, material, informational resources) $F_0^n(Z_0^n)$, $F_n^0(Z_n^0)$; $n=\overline{1,N}$ that can be used to influence their partners in a particular situation of interaction.

Thus, the problem of reflexive control of interaction between business entities can be formulated as the task of minimization of difference of weights of graph vertices of the reflexive model, which correspond to their ideal and real images. Furthermore, this problem is subdivided into two separate optimization tasks:

for the enterprise that makes a selection:

$$F_0^n = v_{\text{ideal }0}^{n^*} - v_{\text{real }0}^n \to \min;\ n=\overline{1,N};$$
$$c_n^0 \le c_n^{\text{all}};\ n=\overline{1,N}, \tag{2}$$

where: $v_{ideal\,0}^{n^*}$, $v_{real\,0}^n$ – weight of the vertices corresponding to ideal and real images of the *n*-th supplier/intermediary in the mind of the enterprise that makes a selection; c_n^{all} – set amount of resources in the value terms that *n*-th supplier/intermediary can allocate to the reflexive control at the current time; c_n^0 – costs of the resources of *n*-th supplier/intermediary to implement alternatives to reflexive management of interaction with the enterprise that makes a selection;

for suppliers/intermediaries:

$$F_n^0 = v_{\text{ideal }n}^0 - v_{\text{real }n}^0 \to \min;\ n=\overline{1,N};$$
$$c_0 \le c_0^{\text{all}}, \tag{3}$$

where: $v_{ideal\,n}^0$, $v_{real\,n}^0$ – weight of the vertices corresponding to ideal and real images of the enterprise that makes a selection in the mind of the *n*-th supplier/intermediary; c_0^{all} – set amount of resources in value terms, which the company making the selection can select for reflexive control at the current time; c_0 – resources of the enterprise, making the selection, to implement alternatives for reflexive control of interaction with all suppliers/intermediaries. With a uniform allocation of resources for each business partner – c_0^n, $c_0 = c_0^n N$.

It should be assumed that limitation of resources allocated on implementation of alternatives of reflexive control does not allow to entirely combine real and ideal images of business entities and, consequently, the obtained values of the functions F_0^n and F_n^0; $n = \overline{1,N}$ are in the interval (0;1). Furthermore, values of the function F_0^n in contradistinction to values of the function F_n^0 do not match for different *n*.

The above-mentioned tasks are the tasks of best mutual selection, the solution of which implies the coincidence of preferences of both interacting parties (Roth and Sotomayor, 1992). In our case, this means that for the best supplier/intermediary selection, the smallest values of the functions $F_0^{n^*}$ and $F_{n^*}^0$ for the same business entity $n^*, n \in \{N\}$ must also coincide. In case of absence of such matching, the rule of the best supplier/intermediary determining is proposed, using the minimax criterion and the criterion of minimum of discrepancy evaluations that reflects mutual interest of business entities in cooperation, taking into account as evaluations of the enterprise that makes a selection, as evaluations of suppliers/intermediaries:

1) for each supplier/intermediary, the largest value of the functions corresponding thereto is selected $\max(F_0^n; F_n^0)$; $n = \overline{1,N}$;
2) among the set of the maximum values of functions obtained, the smallest value $\min_n(\max(F_0^n; F_n^0))$ is selected, which will correspond to the best supplier/intermediary;
3) if there are several equal minimum values, for suppliers/intermediaries which they correspond to, differences of functions values are calculated $\left|F_0^n - F_n^0\right|$;
4) the smallest absolute value of difference of functions values F_0^n and F_n^0 corresponds to the best supplier/intermediary;
5) in case of the same value of difference for several suppliers/intermediaries, taking into account the objective of partner selection reflexive control in the supply chain, preference is given to a business entity with a smaller value of function F_0^n.

Consider the final fragment of problem solving of partner selection in the supply chain – selecting the best supplier, taking into account the received mutual evaluations of participants in the selection process using the proposed methodical approach.

A company chooses a product supplier among five (*N*=5) producers. Determining generalized quality criteria, which evaluate condition of enterprises over the set of indicators of their activities and capabilities, is not considered in this example due to the many existing approaches to the evaluation of suppliers (Agarwal et al., 2011; Ho et al., 2010; Tahriri et al., 2008). The weights of the graph vertices of the reflective model reflecting the real and ideal images of business entities in

the mind of each participant of the process selecting are determined by normalizing the generalized quality criteria of these enterprises and are given as initial data (Table 1, Table 2).

Table 1.

VALUES OF WEIGHTS OF IDEAL AND REAL IMAGES OF SUPPLIERS IN THE MIND OF AN ENTERPRISE THAT MAKES A SELECTION

Images of business entities	**The supplier 1**	**The supplier 2**	**The supplier 3**	**The supplier 4**	**The supplier 5**
An enterprise that makes a selection	1 / 0,7	1 / 0,4	1 / 0,8	1 / 0,6	1 / 0,3
Value of the function F_0^n	0,3	0,6	0,2	0,4	0,7

Note: evaluation of an ideal image / evaluation of a real image of a business entity.

Source: Author.

Table 2.

VALUES OF WEIGHTS OF IDEAL AND REAL IMAGES OF AN ENTERPRISE THAT MAKES A SELECTION IN THE MIND OF SUPPLIERS

Images of business entities	**An enterprise that makes a selection**	**Value of the function F_n^0**
The supplier 1	0,9 / 0,4	0,5
The supplier 2	0,8 / 0,4	0,4
The supplier 3	1 / 0,6	0,4
The supplier 4	1 / 0,8	0,2
The supplier 5	0,9 / 0,6	0,3

Note: evaluation of an ideal image / evaluation of a real image of a business entity.

Source: Author.

First, determined the largest values of one of the functions F_0^n and F_n^0 for each supplier (Table 3).

Table 3.

SELECTING THE LARGEST VALUES AMONG THE VALUES OF FUNCTIONS F_0^n, F_n^0

Images of business entities	**Value of the function** F_0^n	**Value of the function** F_n^0	**Value** $\max(F_0^n; F_n^0)$
The supplier 1	0,3	0,5	0,5
The supplier 2	0,6	0,4	0,6
The supplier 3	0,2	0,4	**0,4**
The supplier 4	0,4	0,2	**0,4**
The supplier 5	0,7	0,3	0,7

Source: Author.

By minimax criterion, suppliers 3 and 4, who have the same given indicators equaling to 0.4 are selected.

Considering that these suppliers are also equivalent by the criterion of minimum of discrepancy evaluations (|0,2|), preference is given to the supplier 3, who received a higher score at the enterprise that makes a selection.

5. Conclusions

The proposed reflexive model shows features of thinking of business entities that define their behavior during interaction when selecting a partner for the formation of supply chains. Using for the formalized description of this model the apparatus of graph theory made it possible to display the character of reflexive control of the partner selection process, taking into account the entire set of information and reflexive impacts of business entities on each other.

Alternatives of the reflexive control of interaction between business entities aimed at changing their perception of themselves and each other (goals, opportunities and ways of improvement) are singled out.

A distinctive feature of the methodical approach to solving the problem of selecting partner on the basis of this model is the optimization of reflexive effect of business entities on themselves and their partners for the purpose of bringing closer real and ideal images in the mind of each other as well as the selection of suppliers/intermediaries, taking into account the mutual interest of business enti-

ties in cooperation, resulting in the equal significance of their mutual evaluations when selecting the best supplier/intermediary. This approach can be applied on the stage of foundation and reaching agreements between suppliers and customers, suppliers and intermediaries on parameters of procurement and supply. Furthermore, it can be the basis for creating various forms of organizing above interactions and integration that ensures the coherence of actions of potential participants of supply chains, taking into account their common goals and individual values.

Joint application to solve the problem of selecting partner analytical and reflexive models significantly expands representations about interaction of business entities, increases adequacy of modeling of complex and multi-variant processes of the formation of supply chains.

An important task in further research is the development of a reflexive model of the process of selecting a business partner in the supply chain using simulation modeling.

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REFLEKSIVNO MODELIRANJE ODABIRA POSLOVNOG PARTNERA U OPSKRBNOM LANCU

Sažetak

U članku se razmatra problem odabira partnera u opskrbni lanac, uzimajući u obzir obrasce razmišljanja poslovnih subjekata koji određuju njihovo ponašanje tijekom interakcije. Razvijeni refleksivni model odražava značajke procesa međusobnog utjecaja poslovnih subjekata pri odabiru partnera u tijeku stvaranja opskrbnog lanca. Predlažu se alternative za refleksno upravljanje interakcijom između poslovnih subjekata. Razvijen je metodičan pristup rješavanju problema odabira partnera u opskrbnom lancu, uzimajući u obzir refleksivni učinak poslovnih subjekata na sebe i svoje partnere kako bi u međusobnim promišljanjima obuhvatio stvarne i idealne slike. Odabir dobavljača/posrednika u opskrbnom lancu uzima u obzir zajednički interes poslovnih subjekata u suradnji, što se izražava u jednakoj važnosti njihove međusobne procjene prilikom odabira najboljeg partnera.

Ključne riječi: refleksivno upravljanje, lanac opskrbe, refleksivni model, odabir poslovnog partnera, slika poslovnog subjekta