



Integrational Interaction Synergy Effects in Export Distributional Channels of Enterprise

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Authors' contributions

This work was carried out in collaboration between both authors. Author TS designed the study and wrote the first draft of the manuscript. Author NH managed the literature searches, analyses of the study performed the synergy analysis, managed the process of model development. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: In modern conditions on international market, there are trends of strengthening the relations between manufacturers and members of distribution network, which allows enterprises to adapt more flexibly to the changing demand in the foreign market, to optimize transaction costs in the sales channels and to become more competitive. The main aim of the research is to investigate kinds of synergetic effects that arise during deepening the integrational interaction in export distributional channels of enterprise.

Place and Duration of Study: Kuznets Kharkiv National University of Economics, Department of International Economics and International Management, between April 2015 and July 2015.

Methodology: Game theory has been used as the main method of research which allowed to prove the emergence of self-organization effect during deepening the interaction between the distribution channel participants in international markets.

Results: The system of indicators which represent the synergistic effect of deepening integration into export channels in conditions of variable and dynamic environment, and the fuzziness of information that directly affects the process of integration, was substantiated. Taking into account

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the determinate types of synergy effects that arise in integrated export channel, namely the operating, financial, optimization and self-organizational synergies, such indicators include: total transaction costs per sold unit reducing; sales increasing; profitability of export operations rising; rate of receivables turnover reducing; logistics costs reducing; current assets increasing as a result of pricing mechanism within the channel, that takes into account the value of receivables; entropy reduction.

The investigation of synergistic managerial effect showed the appearance of export system's self-organizational effect due to deepening the integrational interactions, and thus the reducing of entropy level with the appearance of these trends in structural transformations, that result in increasing its adaptability to the environment, more predictive management solutions, sustainability of functioning and development of competitive competence in international market.

Conclusion: The obtained research results allow to catch out the indicators of synergetic effects due to deepening the integrational interactions in export channels. The strong correlation between the stage of integration and the level of entropy in international sales system was proved.

Keywords: Export; distributional channels; integration; synergetic effect; entropy.

1. INTRODUCTION

Current market conditions of enterprises export activities are characterized by liberalization of foreign economic relations, intensification of price competition between producers simultaneously with service level requirements increasing, the tendencies to consolidation and extension of market share by hidden internal agreements, and a high degree of competition and uncertainty of market environment. These conditions reduce time range of product distribution planning in the international market. Such conditions define the importance of intensive coordination between export distributional channel participants as one of the possible direction of support and development the sustainability of enterprises and ensuring the planned size of the economic benefits during export activities.

The knowledge and understanding of the sales system integrality due to the combination of internal heterogeneous components and the generation of synergetic effects due to optimal coordination of system components will help all of system participants to adapt more effectively to the external environment and achieve the sustainable development, defined by common trend and bifurcation moments that occur during the certain stages of organizational and economic interaction.

Due to that points, the aims of this article are:

To systematize the synergistic effects and form the system of their indicators (characteristics) in integrated export channels;

To identify and explore the synergetic effect of self-organization, that arise with intensification of integrational interaction in export activity of enterprises.

2. METODOLOGY

This research is based on a literature survey [1,2,3,4,5,6,7,8] and is aimed at systematization and formalization the synergetic effects, that appear with more intensive interaction within sales system. General scientific methods are the methodological foundation of the study. They include analysis, synthesis, induction, formalization, systematic and synergetic approach that help describe the phenomenon development in a more understandable way. We also have applied the method of expert assessments, that allowed to estimate the system characteristics achieved due to integrational processes in export channels. Also game theory has been used as the main method of research which allowed to prove the emergence of self-organization effect during deepening the interaction between the distributional channel participants in international markets. The use of simplex method has provided the validity of conclusions about investigated theme.

3. RESULTS AND DISCUSSION

3.1 Types and Indicators Synergy Effects in Integrated Export Channel

In terms of progression the evaluation of the deepening cooperation in the integration of

export distribution channels effectiveness in modern conditions we consider necessary:

To explore the kinds of effects: the economic and social and internally system effects that occur during the deepening interaction;

To substantiate a system of indicators that reflect each of the appearing effects in terms of variable and dynamic environment, and the fuzziness of information that directly affects the process of integration.

Taking into account the nonlinearity of distribution system development in the international market, which is directed on deepening the relationship between its components; the presence of bifurcation points that arise during the transition from one to the next more close interaction stage; creating additional effect as a result of self-organization the complex nonlinear systems or subsystems into one with a common purpose, it is proposed to use the synergistic approach to analyze the performance of coherent interaction during export activities.

In these latter days the considerable attention of Reshetylo V. [1,2] Chaika G. [3], Hoshovska O. [4], Khodakivskiy E. [5], Gershenson C. and Heylighen F. [9], Dessein W., Garicano L., Gertner R. [10] has been paid to investigation such aspects as the definition, analysis and evaluation of the synergy effects arising from the deepening of cooperation in economic relations as well as during mergers or acquisitions. However, the question of investigation the synergetic interaction efficiency in distributional channels during export activity, and the development a system of indicators for its evaluation is underrepresented.

Thus, according to synergistic approach, the diagnosis of integration interaction efficiency as strategic direction of distributional channels development in foreign markets should be directed onto determining the difference between effect that arose at the primary level of cooperation and the effect that was achieved due to its intensiveness. Moreover, cooperation will be mutually beneficial when a synergistic effect will occur for each part of the system (Fig. 1).

The first step of estimating synergistic effects in export-oriented integrated channels is to determine the indicators that characterize achieving economic, social and internal integrated system objectives.

From the economic efficiency evaluation perspective it is advisable to identify those items at which management function is aimed in distributional channels: trade, pricing within the channel, logistic infrastructure, production accounting that ensure the availability and accessibility of goods [11, p.31].

V. Reshetylo in her monograph [2, p.141] defines several types of synergy, and therefore describes possible manifestations of synergistic effects occurring during interaction: operational, financial, optimization, self-organizing. Analyzing the essence of each manifestation of synergy due to V. Reshetylo, it is possible to carry out the synthesis of synergetic effects and objects of management function in distributional channels and identify indicators which alterations show the manifestation of integrative interaction effectiveness in export channels. They are presented in Table 1.

Operating, financial and optimization synergy will have probabilistic nature and can be measured in monetary terms. Therefore, for its evaluation in case of deepening interaction in the integrated distributional channels, we propose the following algorithm:

- 1) Forecasting volumes of export through a channel under constant cooperation conditions;
- 2) Determining the potential synergies due to deepening integrative cooperation in three scenarios: pessimistic, optimistic, realistic;
- 3) Calculating the possible synergetic economic effects for each of the scenarios.

3.2 Characteristics of Management Functions Relative to the Levels of Integrated Interaction during Export

The cooperation of participants in integrated distributional channels is characterized by the ability of making decisions about the qualitative characteristics of interaction, and therefore – about the level of integration that influences the strategy and determines the synergistic self-organizational effect of distributional systems.

In this case, under the self-organization is proposed to identify as the irreversible process that due to a cooperative interaction between subsystems results in forming more effective system structures [12, p.42]. In terms of self-organization theory, each stage of the relationship is defined by certain management

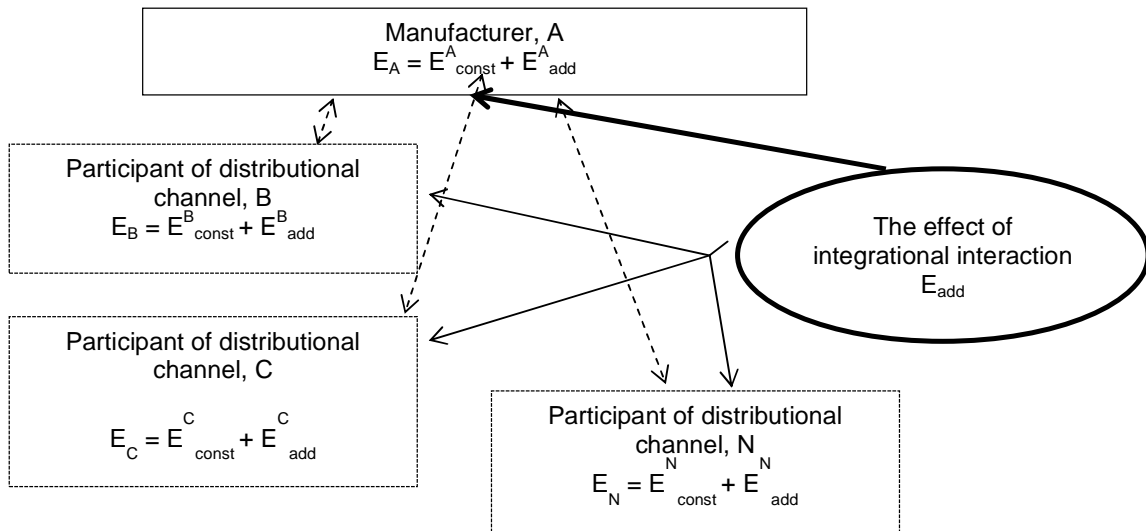
parameters, and the main factor of balance in the system is well-directed management that is based on strong agreed communication with other participants.

Therefore, for determining internal or managerial and organizational effect, which should be revealed in the form of entropy reducing (as the level of integrated distributional system self-organizing in the international market under uncertainty and diversity of partnerships), it is proposed to describe the management functions of the product manufacturer that are carried out on every stage of integrated interaction evolution in distributional channels. The results are shown in Table 2.

3.3 Determination of Self-organizing Synergistic Effect Due to Deepening Integrational Interaction in Export Channels

The deepening of integrational interaction during export implies more close correlation of the

distributional channel participants' purposes, coordination processes during sales, which would increase the synergy effects manifestation and appears in self-organizational synergy, ie reduce the level of entropy within the passage each stages of integration. The proving of this statement is possible by using game-theoretical model. Problem statement of estimation the integrational cooperation impact in product distribution channels for ensuring stable function on the international market comes down to normal form of antagonistic games, due to the necessity of searching the optimal behavior strategy of sales system participants. Number of experts in the group was determined by taking into account recommendations of scientists who worked on the methodology of conducting expert evaluations. They recommend to create a group of not more than 10 persons for ensuring reliability of the procedure [13, p. 107]. The group of nine experts included management of companies, that are engaged in foreign economic activity, and business owners that are intermediaries in the distribution channels.



where E – a total effect of economic activity;
 E_{const} - an effect of traditional (separated) activity;
 E_{add} – an additional effect of integrational interaction.

Fig. 1. Model of the deepening cooperation effect division in the integrated distributional channels (composed according to [2,3,4])

Table 1. Indicators of manifestation the synergistic integrative interaction effects during export activity of enterprises

Type of synergy manifestation		Characteristic	Indicators of synergy manifestation
1	2	3	4
Economic effects	Operating synergy	Shows material (economically measurable) results of activity	The total transaction costs per sold unit reducing; Sales increasing; Profitability of export operations rising
	Financial synergy	Presents opportunities of cash flows moving and sources of economic growth	The rate of receivables turnover reducing
	Optimization synergy	Is the result of optimizing the main processes carried out in sales channels	Logistics costs reducing; Current assets increasing as a result of pricing mechanism within the channel, that takes into account the value of receivables
Managerial and organizational effects	Self-organizational synergy	Arises as a result of complementarity the previous three manifestations of synergy in the integrated sales system and is associated with the formation of a system's ability to react flexibly and adapt to the rapidly changing environment; is manifested in complex nonlinear sales systems (channels), which structure and organization is based on the mechanism of self-organizing	Entropy reducing

Table 2. Characteristics of export activity management functions in the context of integrational interaction in distributional channels

Management functions	The absence of integrational interaction			Levels of integrational interaction	
	Random interaction	Specifications for delivery	Contractual partnership	Partnership, based on common investments	Vertical integration
Planning	Arrangements for the next delivery volume		Determining the forecasted values of commodity flows in the long term	Harmonization of the interaction strategic goals	Equality in the establishment and usage means towards common goals of development, harmonization the methodologies of internal integration planning
Organization	Implementation of the necessary procedures to fulfil a delivery		Setting up the communication links.	Development the matrix of functions division in distributional chain	Creating a mechanism of regulation the cooperative activities; forming the general system of exchanging the strategic and tactical important information
Motivation	Is absent		Development and implementation of discounts due to volume purchases	Consolidation of assets and creation the system of participation in the invested capital	Forming a general price policy and mechanism of transfer pricing in distribution channels
Control	Calculation of economic efficiency export operation		Analysis of the integration synergy potential	Evaluation the possibility of internal conflicts, and development the measures to prevent them	Defining the general criteria and volume of synergetic interaction performance

The first step is to carry out the expert survey evaluating the impact of integrational relations in the channel during export on distributional system self-organization (Fig. 2). To ensure the reliability of the expert survey results it is necessary to define competence indicators of

each expert group member. Among the existing methods of estimation the competence we propose to determine subjective and objective indicators which form composite index of competence.

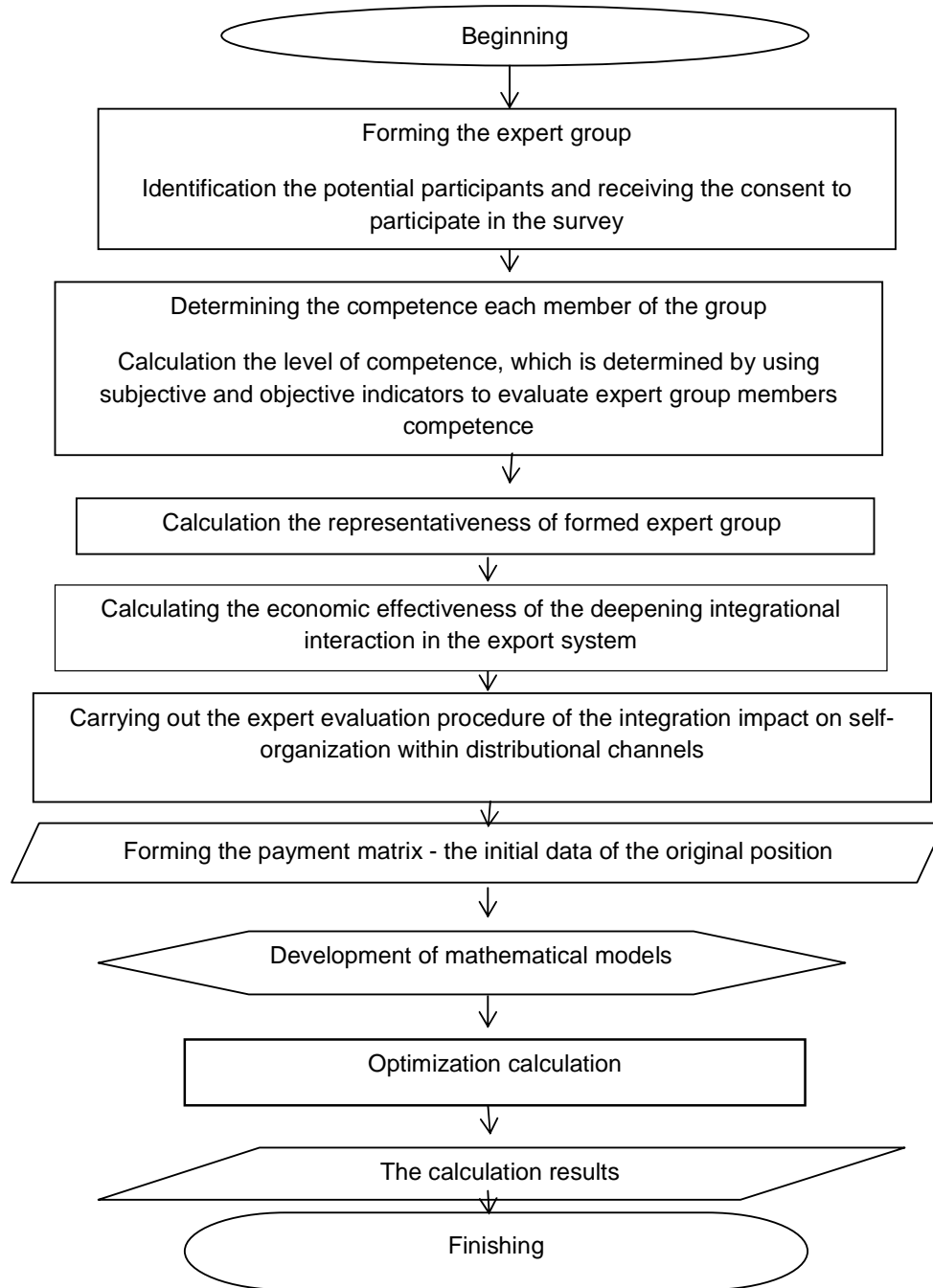


Fig. 2. Algorithm of determination the synergistic effects of the deepening integrational cooperation during export enterprises activity

Indicator of expert competence is interpreted as the probability of giving them accurate assessment. Taking into account that the level of competence can reach a value of 1 (full competence) to 0 (absolute incompetence) in the selected expert group should be involved only experts which calculated values of competence exceed the average level (> 0.5).

The next stage of the evaluation according to the proposed algorithm is to develop mathematical game models: five levels of integration cooperation in the export and characteristics of their management functions will be the strategies of manufacturer behavior - the first player A in accordance with policies A1, A2, A3, A4, A5. The second player B will be participant in the export system, depending on the scale of its functioning: international distribution company, export-oriented national intermediary or broker that operates on the external market. Accordingly, the defined strategies are B1, B2, B3.

The importance of the integration impact on self-organization indicator was determined by the experts in ranges from 0 (no impact) to 1 (has maximum impact).

Due to chosen behavior strategies by the manufacturer, the importance of cooperation with participants, estimated by experts, is reduced to the payment matrix (Table 3):

For the first player - the manufacturer - mathematical model of combination strategies of initial system position is:

$$W_1 = x_1^* + x_2^* + x_3^* \rightarrow \min$$

$$\begin{cases} 0,432x_1^* + 0,464x_2^* + 0,554x_3^* + 0,346x_4^* + 0,701x_5^* \geq 1, \\ 0,223x_1^* + 0,320x_2^* + 0,609x_3^* + 0,458x_4^* + 0,374x_5^* \geq 1, \\ 0,358x_1^* + 0,632x_2^* + 0,258x_3^* + 0,673x_4^* + 0,723x_5^* \geq 1, \\ x_i \geq 0, i=1,2,3,4,5. \end{cases}$$

whereby $x_i^* = \frac{x_i}{v}$, $i=1,2,3,4,5$.

Solution of this linear task by simplex method shows that $X = [0;0;0,845;0,738;0,395]$.

These values show system's uncertainty and absence of coordinated interaction strategy.

For the second player - the participant of sales channel – the payment matrix, built as a result of strategies combinations expert evaluation – looks like:

Table 3. Summary payment matrix of strategies combination

Behavioral strategies of the manufacturer	Participants in sales channels		
	B1	B2	B3
A1	0,432	0,223	0,358
A2	0,464	0,320	0,632
A3	0,554	0,609	0,258
A4	0,346	0,458	0,673
A5	0,701	0,374	0,723

Mathematically, this means that payers haven't the unique strategy of behavior. In economic terms it can be argued that sales system is not self-organizing in such a state.

Since $\alpha \neq \beta$, the game has no solution in pure strategies and for the game the estimation of v was received:

$$\alpha < v < \beta, \tag{1}$$

To find the solution of the game with mixed strategies we shall enter probabilities vector $X = [x_1, x_2, x_3, x_4, x_5]$, with which Player A takes their own strategies A1, A2, A3, A4, A5. We know that game theory is associated with linear programming optimization tasks, as the normal form of the game with two players zero-sum can be represented as a linear optimization task and solved by the simplex method.

$$W_1 = y_1^* + y_2^* + y_3^* \rightarrow \min$$

$$\begin{cases} 0,432y_1^* + 0,223y_2^* + 0,358y_3^* \geq 1, \\ 0,464y_1^* + 0,320y_2^* + 0,632y_3^* \geq 1, \\ 0,554y_1^* + 0,609y_2^* + 0,258y_3^* \geq 1, \\ 0,346y_1^* + 0,758y_2^* + 0,673y_3^* \geq 1, \\ 0,701y_1^* + 0,374y_2^* + 0,723y_3^* \geq 1, \\ y_i \geq 0, i=1,2,3,4,5. \end{cases}$$

whereby $y_i^* = \frac{y_i}{V}, i=1,2,3.$

The solution of this task by simplex method is $Y = [1,888; 0; 0,515]$. Such scattering of probability for choosing a particular strategy of interaction with the other player's position also indicates considerable system uncertainty.

The next step is to identify factors or evolutionary typical features, according to which the integrational impact on self-organizing of export system will be evaluated. Based on the properties self-organizing systems, such as self-preservation, dynamic development, the ability to regenerate, that are investigated in scientific works [12,6,7,14] we propose to take into account some degree of next system characteristics achievement due to integrational processes in export channels:

Adaptability of the system relative to macrochanges- as a property to react flexibly to the macroenvironmental impact;

Competitiveness of the export channel (including pricing policies in the channels of distribution, logistics coordination and the optimality of sales parameters);

Internal stability of the export system, that result in reducing the probability of appearing the risk of intersystem bifurcation points that lead to negative consequences;

The balance of development - complementarily of permanent development process, which is characterized by efforts to support positive trends, and using the unpredictable and stochastic opportunities to accelerate the development.

We propose to the estimation only the last three stages of integration (according to Table 2), namely contractual partnerships (S1), a partnership based on common investment (S2) and vertical integration (S3) as those which occur intersystem and synergistic connections. Thus, the experts were offered to estimate the impact of integration on export system self-organization on three strategies, that are stages of integration, with respect to the three participants in the export

system and taking into account the emerging systemic self-organizational characteristics.

Three matrixes were formed based on the results obtained by expert evaluations. The columns (A1, A2, A3, A4) of these matrixes show the characteristics of self-organizing systems; and rows are the participants in the distribution system on the international market.

Table 4. Estimating matrixes of integration cooperation strategies in export channels

Matrix 1 (S1 strategy)				
	A₁	A₂	A₃	A₄
B ₁	0,458	0,386	0,574	0,521
B ₂	0,426	0,349	0,568	0,512
B ₃	0,482	0,367	0,543	0,545
Matrix 2 (S2 strategy)				
B ₁	0,345	0,547	0,654	0,478
B ₂	0,376	0,562	0,623	0,462
B ₃	0,395	0,531	0,679	0,435
Matrix 3 (S3 strategy)				
B ₁	0,364	0,456	0,512	0,423
B ₂	0,342	0,434	0,509	0,438
B ₃	0,371	0,425	0,521	0,416

To explain the received results of synergetic effects analysis in self-organized export system it is necessary to determine the entropy rate of initial systems and of three analyzed strategies - stages of integrational interaction. The level of entropy as a quantified measure of uncertainty and disorganized systems has been investigated in the scientific works of L. Usov [15], I. Pranhysvly [16], O. Chumak [17], Gershenson C. and Heylighen F. [9], Vittikh, V., Skobelev [8]. Thus, the higher level of entropy is, the more export system is disorganized.

First, it is necessary to calculate entropy level for initial state of the system:

- 1) when $X = [0;0;0,845;0,738;0,395]$, level of entropy will be determined as

$$E_L = - (0,845\ln(0,845) + 0,738\ln(0,738) + 0,395\ln(0,395)) = 0,615.$$

Second, the entropy level is determined on each of the integrational interaction strategy:

- 2) The solution of the payment matrix:
 - strategy S1 is $X = [0;0;1,05;0,79]$, than

$$E_{L1} = - (1,05\ln(1,05) + 0,79\ln(0,79)) = 0,17;$$

- strategy S2 is $X = [0;0;1,61;0]$, than

$$E_{L2} = - (1,61\ln(1,61)) = - 0,77;$$

– strategy S3 is $X = [0;0;1,96;0]$, than

$$E_{L3} = - (1,96 \ln(1,96)) = - 1,31.$$

4. CONCLUSION

Thus, in the conducted investigation the system of indicators which represent the synergistic effect of deepening integration into export channels in conditions of variable and dynamic environment, and the fuzziness of information that directly affects the process of integration, was substantiated. Taking into account the determinate types of synergy effects that arise in integrated export channel, namely the operating, financial, optimization and self-organizational synergies, such indicators include: total transaction costs per sold unit reducing; sales increasing; profitability of export operations rising; rate of receivables turnover reducing; logistics costs reducing; current assets increasing as a result of pricing mechanism within the channel, that takes into account the value of receivables; entropy reduction.

The investigation of synergistic managerial effect showed the appearance of export enterprise system's self-organizational effect due to deepening the integrational participants' interactions, and thus the reducing of entropy level with the appearance of these trends in structural transformations, that result in increasing its adaptability to the environment, more predictive management solutions, sustainability of functioning and development of competitive competence in international market.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Reshetilo V. Synergy of regional economic systems formation and development. Kharkiv. 2009;218.
2. Reshetilo V. Economic synergetics institutional changes. Kharkiv. 2006;288.
3. Chaika G. Synergies in management. Kiev. 2011;71.
4. Hoshovska A. Synergy strategic management. Lviv. 2011;283.
5. Khodakivskiy E. Synergistic paradigm of economy. Zhytomyr. 2007;154.
6. Kolesnikov A. Synergetics: Self-organization processes and management. Taganrog. 2004;360.
7. Horodetsky V. Self-organization and multiparticipant systems. Models of multiparticipant self-organization. Izvestiya "Theory and control system". 2012;2: 92-120.
8. Vittikh V, Skobelev P. Multi-agent systems for modelling of self-organization and cooperation processes. In: XIII International Conference on the Application of Artificial Intelligence in Engineering, Galway, Ireland. 2002;91–96.
9. Gershenson C, Heylighen F. When can we call a system self-organizing? [Web resource]. Available:<http://pespmc1.vub.ac.be/papers/WhenSelf-org.pdf>
10. Dessein W, Garicano L, Gertner R. Organizing for synergies: A theory of hybrid organizations. [Web resource] Available:http://www.econ.ed.ac.uk/papers/abstract_Dessein.pdf
11. Lysenko G, Egorov V, Kravchenko V. Distribution management. Donetsk. 2010; 239.
12. Olynych D. Organization theory. Rostov n / Dony. 2008;408.
13. Orlov A. Organizational-economic modeling of the theory of decision-making. - M.: KNORUS. 2010;568.
14. Ashby W. Principles of the self-organizing system. Pergamon Press. 1962;255-278.
15. Usov L. Investigation of entropy as a tool for analysis and forecasting of innovative activity efficiency (the concept). Innovations. Special Edition. 2009;1:38-43.
16. Prangishvili I. Entropy and other systemic regularities: Issues of complex systems management. Moscow. 2003;428.
17. Chumak O. Entropy and fractals in data analysis. M-Izhevsk. 2011;164.

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