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ORGANIZATION OF CLUSTER STRUCTURES POTENTIAL DEVELOPMENT MANAGEMENT WITH BALANCED SCORECARD TOOLS

UDC 658.012.32

**A. Pylypenko
O. Duda**

Relevance of forming clusters development management contours used as their available potential development level management levers has been proved. The approach to representation of cluster structures as a system of atomic elements has been offered. The theoretical and methodological grounds of approach to the multiagent modeling of business entities interactions. These entities are involved in several chains of value creation. Cluster structure is represented as logistic chains aggregate. Balanced scorecard system and viable systems model have been chosen as tools of management organization.

Key words: quasiintegration, cluster structure, balanced scorecard, management organization.

ОРГАНІЗАЦІЯ УПРАВЛІННЯ РОЗВИТКОМ ПОТЕНЦІАЛУ КЛАСТЕРНИХ СТРУКТУР ЗАСОБАМИ ЗБАЛАНСОВАНОЇ СИСТЕМИ ПОКАЗНИКІВ

УДК 658.012.32

**Пилипенко А. А.
Дуда О. В.**

Доведено доречність формування контурів управління розвитком кластерів, що використовують як важелі управління рівень розвитку наявного у них потенціалу. Кластерні структури запропоновано подавати через систему атомарних елементів. Наведено теоретико-методологічне обґрунтування підходу до мультиагентського моделювання взаємодії суб'єктів господарювання, що беруть участь у декількох логістичних ланцюгах створення вартості, сукупність яких становить кластерну структуру. Як інструментарій організації управління обрано збалансовану систему показників та модель життєздатних систем.

Ключові слова: потенціал, квазіінтеграція, кластерна структура, збалансована система показників, організація управління.

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**ОРГАНИЗАЦИЯ УПРАВЛЕНИЯ РАЗВИТИЕМ ПОТЕНЦИАЛА
КЛАСТЕРНЫХ СТРУКТУР СРЕДСТВАМИ
СБАЛАНСИРОВАННОЙ СИСТЕМЫ ПОКАЗАТЕЛЕЙ**

УДК 658.012.32

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Доказана уместность формирования контуров управления развитием кластеров, использующих в качестве рычагов управления уровень развития имеющегося у них потенциала. Кластерные структуры предложено представлять через систему атомарных элементов. Представлено теоретико-методологическое обоснование подхода к мультиагентскому моделированию взаимодействия субъектов хозяйствования, принимающих участие в нескольких логистических цепях создания стоимости, совокупность которых представляет собой кластерную структуру. В качестве инструментария организации управления избраны сбалансированная система показателей и модель жизнеспособных систем.

Ключевые слова: потенциал, квазиинтеграция, кластерная структура, сбалансированная система показателей, организация управления.

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In recent years several new trends have that describe up-to-date phenomena and processes have appeared in economic research. Correspondingly, a large quantity of papers is devoted to their consideration. On the other hand, scientists ignore basic economics and management postulates, which have

to adapt to new characteristics and requirements of business environment. Thus, we will consider the issue of management organization of cluster structures potential development in the context of updating the existing experience concerning up-to-date requirements. We suggest to use the concept of

Balanced Scorecard, developed by R. Kaplan and D. Norton [1; 2] as tools. Today this concept is considered as versatile tool, which can solve all possible problems of any enterprise. That is not entirely true. Nevertheless, unification of different theories of the company and the management concept by the authors of Balanced Scorecard deserves special attention.

It should be noted that there is no unity of scientists' views about issues of management organization of cluster structures potential development and the corresponding relevance of research in this direction. First, there are differences in interpretation of the category "cluster". Most researchers [3; 4] use the definition of cluster, given by M. Porter [5]. Thereby, the identification of the cluster is mainly based on the criteria of interconnection and geographic proximity. However, this approach ignores the trends of information and communication technology development, which allows leaving out the territorial aspect. Therefore, it is more appropriate to use the phrase "cluster structure". There is no unanimous and lasting position for its understanding. The European cluster memorandum [6] confirms the relevance of cluster initiatives activation and the need of innovation basis of cluster formation, but does not give clear definitions.

Another problematic situation is the issue of identifying the essence of the term "cluster structure potential". On the one hand, there are many research works devoted to the consideration of multifaceted and multidimensional category "potential" (even adapted to unpredictable environmental conditions [7]). However, in most cases scientists conduct research at the level of an individual company or a region, ignoring mild integration structures. There are only a few works, which consider the potential of aggregate enterprises. For example, S. Sachs and co-authors [8] emphasize the necessity to define and manage the potential of enterprise interaction with its stakeholders. At the same time there is no approach to potential quantitative measurement. European Cluster Memorandum [6] only states the need to consider cluster potential as something more than the sum of cluster members' potential (can be defined as the need to potentials synergy achievement). At the same time, it says nothing about the tools and mechanisms of such potentials synergy achievement.

Thirdly, there are differences in the interpretation of the phrase "management organization". On the one hand, management as another process should be organized in a specific mode. Such organization should consider the achievements of the organization theory [9; 10]. On the other hand, organization is one of the management functions. This fact complicates the final understanding of the phrase "management organization". In any case, within the classical organization theory the management of an individual business entity can be organized. As regards cluster structures and their potential management, it is necessary to supplement classical approaches

with the achievements of other theories, focused on regulating cooperative and integration interaction.

In the authors' opinion the concept of organizational ecology [11] and evolutionary and institutional approach should be referred to such theories [12]. The concept of organizational ecology will determine the features of cluster members' behavior, and the institutional theory will regulate the formal and informal rules and regulations of such interaction. We separately mention the study [13], which is dedicated to the features of business ecosystem formation (presented as a network of customers and suppliers, who interact in a specific social and economic environment and are the subject of its own legal framework). Although these studies do not deal directly with potential management or cluster formation, this approach allows us to determine the architecture and subordination of the contours feedback. Only this feedback will ensure the realization of cluster structure management processes through the criterion of maximizing its member's potential.

The objective of the article is to develop theoretical and methodological basis and appropriate tools for cluster structures potential development management organization. The article is based on such authoring as the spiral of business entities integration development (ID). It bases on a widespread approach to reflection of evolutionary development flow (presented in the V. W. Ebeling's works [14, p. 12]), but with the addition of bifurcation points and revolutionary stages. This spiral, represented in Fig. 1, has been sufficiently expounded in other author's publications. It is based on the idea of individual actors' presence within the cluster (given by the set {A}), the interaction of which occurs within certain system of integration restrictions ({IR}).

It is clear that the operation of a cluster needs specified regulation. To organize such regulation we offer to use such element of institutional economic theory as the Concept of Control (formalizing the appropriate set {CC}). The elements {CC} will contain the institutionalized system of rules and regulations of cluster members' joint activity. The components of the set and {CC} regulate the transition of the cluster and its members along the spiral, represented in Fig. 1.

To provide the manageability of individual enterprises and their associations it is necessary to establish a quantitative criterion. In the authors' opinion, this criterion should be the cluster structure potential, which is calculated on the basis of consolidating cluster members' reporting indicators (to eliminate double accounting of the remainders of mutual debts and unrealized profits on intra-group transactions, which are not included in the calculation). To manage organization of cluster development, it is necessary to use different kinds of potential. Therefore, we offer to present it in the form of an appropriate set {P}.

The condition of development, as shown in Fig. 1, will be the potential nondecreasing during the transition between stages of evolutionary and revolutionary development. To ensure realization of this condition we

offer to use the concept of Balanced Scorecard (BSC). We decided to use the BSC tools because of its perfect compliance with the resource paradigm of strategic management and the concept of dynamic capabilities (initially developed by D. J. Teece [15]). Considering the multiplicity of approaches to understanding the essence of the category of "potential" (their analysis is not the objective of the article), we focus on the resource paradigm (considering the D. J. Teece's works [15]). Within this paradigm, potential is considered on the basis of the existing resources of the business entity and the possibilities of their use (concerning the objective of the

article – on the basis of allocation in a particular area). It is appropriate to use the idea of another strategic management concept – the concept of Core Competencies [16; 17]. We propose to consider the competencies in the context of exclusive and distinctive capabilities to process available resources (we consider cluster activities in the context of available resources transformation processes or in the context of benefit of their presence). We offer to correlate the spiral of development and the concept of Core Competencies in accordance with the scheme, shown in Fig. 1. In this case, BSC becomes a tool of implementing this correlation.

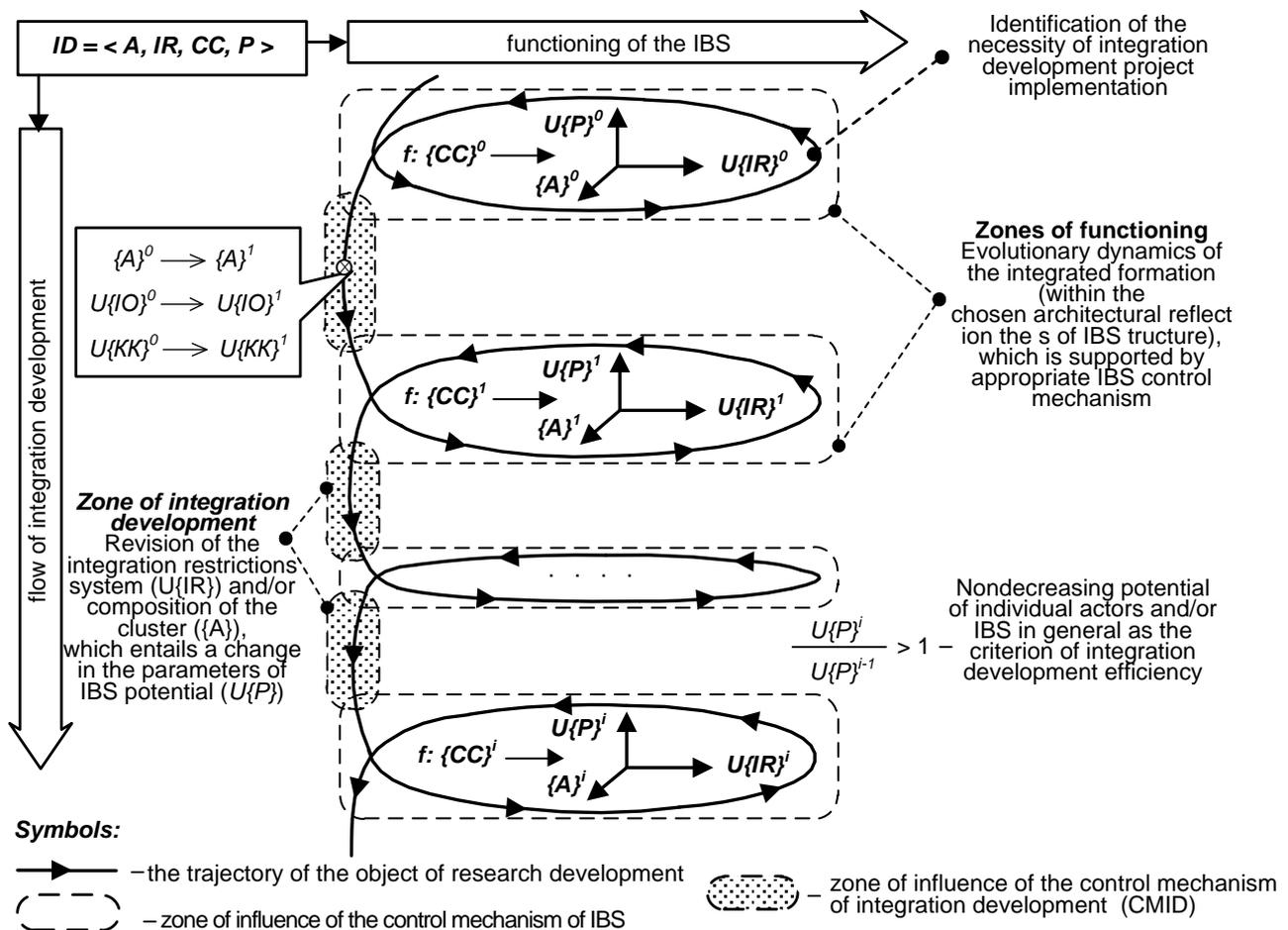


Fig. 1. Spiral representation of the process flow of cluster development

Adoption of the approach, shown in Fig. 1 and Fig. 2, allows to avoid the theoretical inconsistencies, mentioned earlier in this article. Firstly, the cluster structure identification will be based on determining the strength and structure of the integration restrictions (IR). Secondly, the parameters of BSC will be clearly correlated with core competencies of the cluster, which is complied with the requirements of [1; 2]. In this case,

core competencies are identical to such element of BSC concept as Key Success Factor (KSF). However, it is necessary to take into account the structural heterogeneity of the cluster and different variants of its organizational design. Depending on cluster organization features will vary the approaches to potential development management organization and to implementation of cascading procedures, which are the BSC tools.

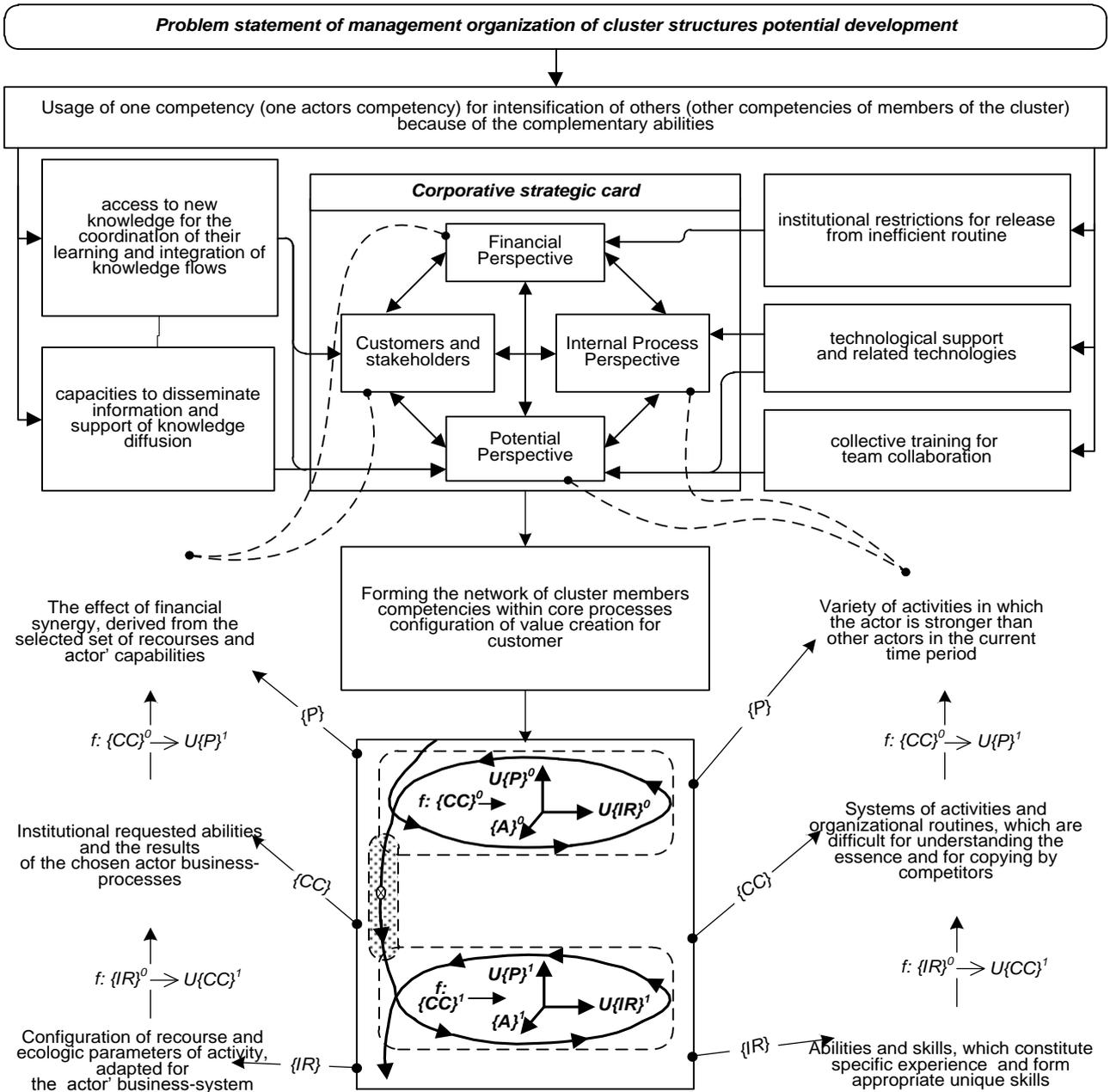


Fig. 2. The concept of core competencies in the development of cluster structure Balanced Scorecard

The cluster potential development management organization must consider that a new market entity is not created, but we have the control over the behavior of formal independent agents with no control over their property. This feature makes the appropriate use of the multiagent system concept. As objects of management, it will consider members of the cluster ($\{A\}$) regardless of the industry sector and ownership. Within this set, it is appropriate to allocate a subset of objects of state ownership.

Multiagent approach enables to regard a cluster as a quasiintegrated logistic system (QLS). Appropriately, QLS will be a geographically restricted area of interaction, within which the coordination of the interests

of integrated structures' members occurs. Inherently, QLS is a system of continued mutual training and joint creation of consumer value. The methodology of advanced logistic interaction will form common information and innovation space of knowledge exchange within the cluster. For this, every agent is endowed with a certain set of individual and joint actions, including possible communications and various interaction types. The purpose of such knowledge exchange is to facilitate the search of the most effective combinations of cluster members' resources and competencies. Accordingly, the cluster structure potential development will occur via optimization of this correlation.

In the context of modeling the cluster structure potential development must be determined by the set of environments in which the agents will operate, (their combination will determine the cluster infrastructure). The set of agent types and the corresponding set of agent states, social laws, institutional restrictions and possible strategies must also be defined. This is the only basis on which it is possible to achieve optimum correlation of resources and competencies.

To accommodate these requirements and features of cluster structure potential development management, Table presents the authors' view approaches correlation to BSC implementation and forms of cluster organizational structure. To present the mentioned suggestion as the theoretical basis we used research works [13; 18] about the allocation of atomic elements of

integration interaction (given by the set {AEL}). In the context of these atomic elements the Table was constructed. The hierarchical approach to the integration of business entities in the cluster should be noted. Several integrated structures can function within one cluster. Their cooperation meets the definition of the cluster and the adopted multiagent approach to modeling its activity. As integrated structures can be formed without creating a legal entity, we offer to interpret them as networks of interaction parameters coordination (IPC-networks or NIPC). Under such approach, the cluster will be formed from several IPC-networks, which create similar consumer value of the output. These networks enter the relationships of competition (within interaction with the customers of a cluster) and cooperation (in struggle for positioning the cluster in the global market).

Table

Features of BSC tools usage for different forms of cluster organizational structure

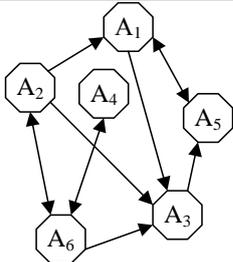
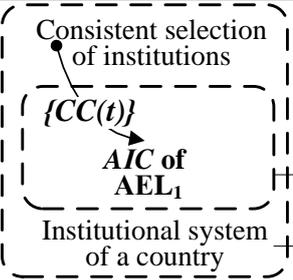
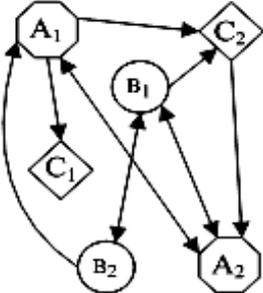
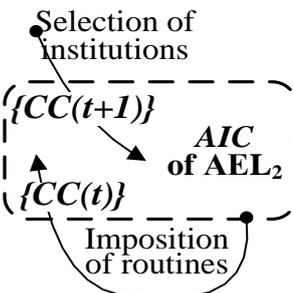
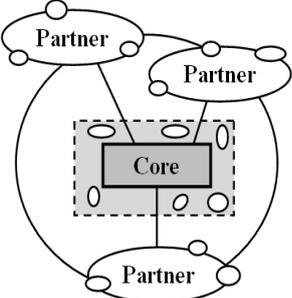
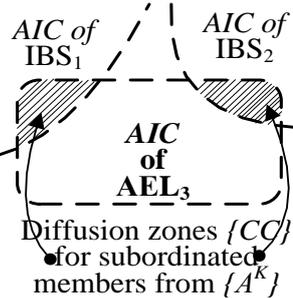
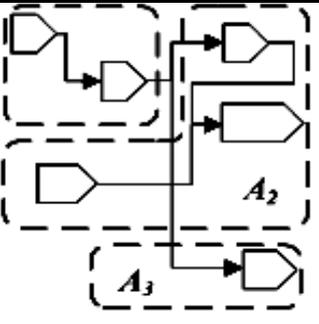
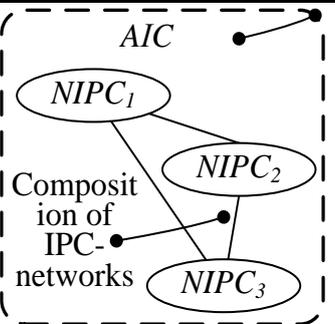
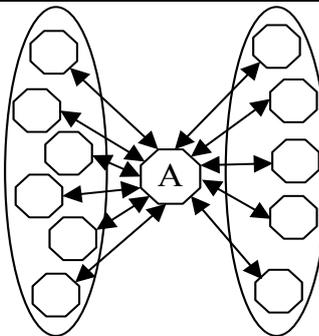
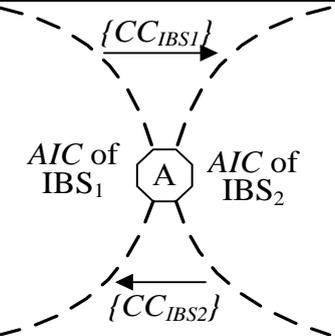
Reflection of the relations of NIPC members	Representation of the cluster area	Characteristics of BSC tools application
<i>AEL₁</i> – homogeneous network of cluster members, which have similar description and parameters (high density of similar relationships of cluster members is observed)		
		A strategic map is created for each cluster member, which has a weak relation with the center and has all powers for independent realization of the strategy. Corporate strategic map typically contains a small set of financial KPI, sufficient to evaluate the efficiency of potential utilization. Bottom-up cascading of indicators occurs
<i>AEL₂</i> – heterogeneous network of cluster members of different types and differentiated in terms of economic power (there is a high diversity and differentiation of the connection strength)		
		A strategic map is created for all members, which differ in strategic directions and cooperate with contractors external to the cluster. For the subjects of infrastructure KPI, is sufficient corresponding to their role in cluster KSF development. There is cascading of mixed type and a small number of divers indicators of potential realization
<i>AEL₃</i> – dynamic focal network ("web of value creation"), when cluster or network formations emerge around a certain central unit		
		The focus on joint value creation allows to create a strategic map only for the members of the cluster core. For the rest SBU only a set of indicators are produced, the composition of which is sufficient for the implementation of operational management of the members that are subordinated in the hierarchical level (it is possible to create for them strategic maps that detail strategic roles and relations of strategy implementation)

Table (the ending)

<p><i>AEL₄</i> – network of value creation (logistic chain of value creation). Cluster initiatives are oriented to the processes of setting and intercompany information processing</p>		
		<p>As a cluster is a composite of IPC-networks, each of which has behavioral and mental models, it provides formation of several levels of BSC strategic maps. At the top level of BSC cascading coordination of interests NIPC occurs. Interests of individual members are coordinated within strategic maps of NIPC)</p>
<p><i>AEL₅</i> – bridge "translator". Cluster structure consists of several integrated networks which are joined with each other by the "central" member of the network</p>		
		<p>A business entity, which is the "bridge", comes within institutional constraints, selected by different cluster members, with which this actor established relations and restrictions. This subject defines guidelines of cluster structure potential development and standards for BSC strategic map indicators. The system of indicative maps, developed by the actor-"bridge", defines directions of potential development</p>

As an example of approach application, shown in Table, we represent the power-engineering cluster of Kharkiv region as a set of atomic elements. This cluster focuses on satisfaction of consumer needs in steam and gas turbines, turbogenerators, electric motors and high power hauling equip-

ment. It should be noted that the cluster core consists of several large enterprises. Therefore, management of its potential development should be organized within core competencies of these enterprises. It is necessary to develop BSC strategy map for every element of the scheme, shown in Fig. 3.

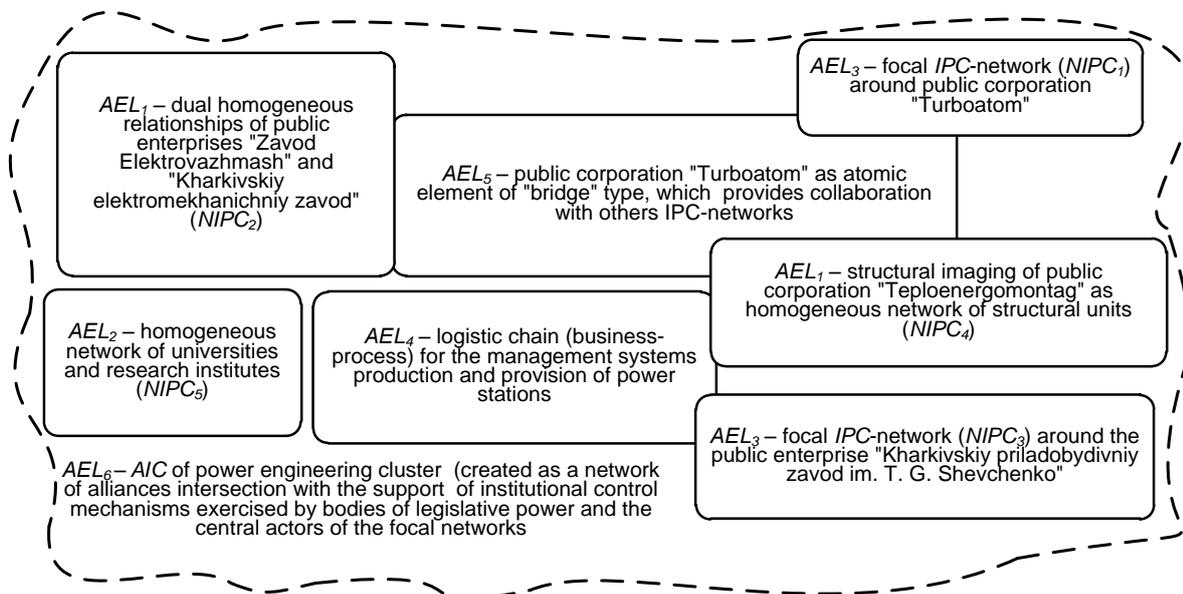


Fig. 3. Representation of the members' interaction within power engineering cluster as a composition of atomic elements of the network integration

In the context of management organization of cluster structure potential development, represented in Fig. 1, we offer to extend tools of BSC concept with achievements of the Viable System Model (VSM), developed by S. Beer [12]. This model can be easily correlated with multi-agent approach that will ensure practical realization of its recursive property. It means that the structure of the management system of cluster structure potential development reproduces within each contour (of each actor).

The basic version of VSM includes five levels of hierarchy in the management system, which is built on the same principles as human central nervous system [19]. Concerning the cluster structure, we suggest that the first level will compose individual enterprises – members of the cluster (elements of the set {A}). Infrastructure subdivisions and operators will compose the second level, which is responsible for regulation of members' logistic activity. The third level will be based on the controlling and monitoring system of the cluster potential development. We refer the specially dedicated control center of cluster structure potential development (it is most rational to form it within governmental authorities) to the fourth level. Developing the policy of logistic interaction will be referred to the fifth level of VSM. Inherently, it will represent regional industrial policy and institutional regulations of cluster members' collaboration.

Thereby, the theoretical and methodological approach to the forming of management contours of cluster structures potential development is offered in the article. These contours are represented through the system of atomic elements. The tools for management contour realization are the concepts of Balanced Scorecard, Viable System Model and Multiagent Modeling. At the same time, it is necessary to ground the procedures of institutionalization of cluster structures members collaboration.

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