

# Principles and methods of synergy modeling of management system at oil and gas sector's enterprises

## Principios y métodos de modelización sinérgica del sistema de gestión en las empresas del sector de petróleo y gas

Lyutsiya Mugtabarovna GAISINA [1](#); Marina Lvovna BELONOZHKO [2](#); Nina Alekseevna TKACHEVA [3](#); Nail Khaditovich ABDRAKHMANOV [4](#); Nadezhda Vladimirovna GROGULENKO [5](#)

Received: 30/05/2017 • Approved: 15/06/2017

### Content

- [1. Introduction](#)
  - [2. Methods](#)
  - [3. Results](#)
  - [4. Discussion](#)
  - [5. Conclusion](#)
- [References](#)

#### ABSTRACT:

The oil and gas complex comprises the entities such as social subsystems which are carrying out not only economic, but also social tasks, and constitute, finally, the social system having specific social features. Within conceptual transition to socially oriented management in the oil and gas industry, implementation of changes to management systems is required. Introduction of corresponding changes will ensure a socially oriented management concept on the principles of synergetics. In turn, gradual change of the management system's components will cause companies to adapt in an evolutionary way to economic and social transformation of the Russian society, through the creation of social institutions of management within the organizational environment. The present management identifies social organizational environment as the core object of impact and ultimate goal of socially oriented management of the organization. At this stage, skills of self-organization and self-training need to be developed, forming readiness for changes of the environment in employees. Not resources but people as agents of complex

#### RESUMEN:

El complejo de petróleo y gas comprende las entidades tales como los subsistemas sociales que están llevando a cabo tareas no sólo económicas, sino también sociales, y constituyen, por último, el sistema social con características sociales específicas. Dentro de la transición conceptual a la gestión socialmente orientada en la industria del petróleo y del gas, se requiere la implementación de cambios en los sistemas de gestión. La introducción de los cambios correspondientes garantizará un concepto de gestión socialmente orientado sobre los principios de la sinergia. A su vez, el cambio gradual de los componentes del sistema de gestión hará que las empresas se adapten de manera evolutiva a la transformación económica y social de la sociedad rusa, a través de la creación de instituciones sociales de gestión dentro del entorno organizacional. La gestión actual identifica el entorno organizacional social como el objeto central del impacto y el objetivo final de la gestión socialmente orientada de la organización. En esta etapa, las habilidades de auto-organización y auto-formación deben desarrollarse,

dissipative system come forth in this approach. The principles and methods of synergy modeling of the management system provided in this paper for the oil and gas sector's entities offer basic provisions to implement the purposes of socially oriented management.

**Keywords:** synergy modeling, bifurcation, principles and methods, oil and gas sector, socially oriented management, staff, self-organization, self-education

preparándose para los cambios del entorno en los empleados. No recursos sino personas como agentes de complejo sistema disipativo vienen en este enfoque. Los principios y métodos de modelización de sinergias del sistema de gestión que se presentan en este documento para las entidades del sector de petróleo y gas ofrecen disposiciones básicas para implementar los propósitos de la gestión socialmente orientada.

**Palabras clave:** modelado de sinergias, bifurcación, principios y métodos, sector de petróleo y gas, gestión social, personal, autoorganización, autoeducación

## 1. Introduction

According to synergetics, organization is a complex open dissipative system which is distinguished by the following properties: tendency to self-development and self-organization; adaptability to the external environment, aspiration to "survival" in the changing conditions; development through crises ("bifurcation point"); combination of structure (at formal, technological level) and chaos (at the level of interpersonal interactions) which significantly increase its adaptability to the external environment. Synergy approach to management assumes controllability as an objective social quality of staff or organizational environment which theoretically cannot be imposed from the outside by leadership or management consultants. Synergy effects in staff have the social nature, are based on controllability as a property effected by management of self-organization and self-education. Basic categories of synergetics, such as: system's openness, nonlinearity of development, dissipation, dissipative structures, bifurcation, attractor are possible to be represented as properties of management system, used to describe the management processes. Socially oriented management in oil and gas sector can be realized, using the principles of synergetics, in that case management is implemented within social organizational environment with the minimum changes of the operating management structure (Gaisina, Gareev, Valitova, Khairullina, Ustinova, 2015; Gaisina, Bakhtizin, Mikhaylovskaya, Khairullina, Belonozhko, 2015). The management system of a company can be respectively provided as a model of synergy management within the socially oriented concept. Therefore, the management system, keeping own integrity, provides development and change of company's social structure by impact not on staff but on evolutionary development of social groups, tracking points of bifurcation and coordinating dynamics of working groups. Within synergy approach, many habitual functions of the management system are transformed (Tkacheva, Silin, 2015; Tkacheva, Fokina, 2015; Valitova, Gareyev, Grogulenko, Kostyleva, 2016), components of the management system are concentrated around the created management systems via communicative space of the entity, organizational social environment, management system's motivation and social activities of employees.

## 2. Methods

Oil and gas sector's companies need to follow the principles of synergy modeling of management system:

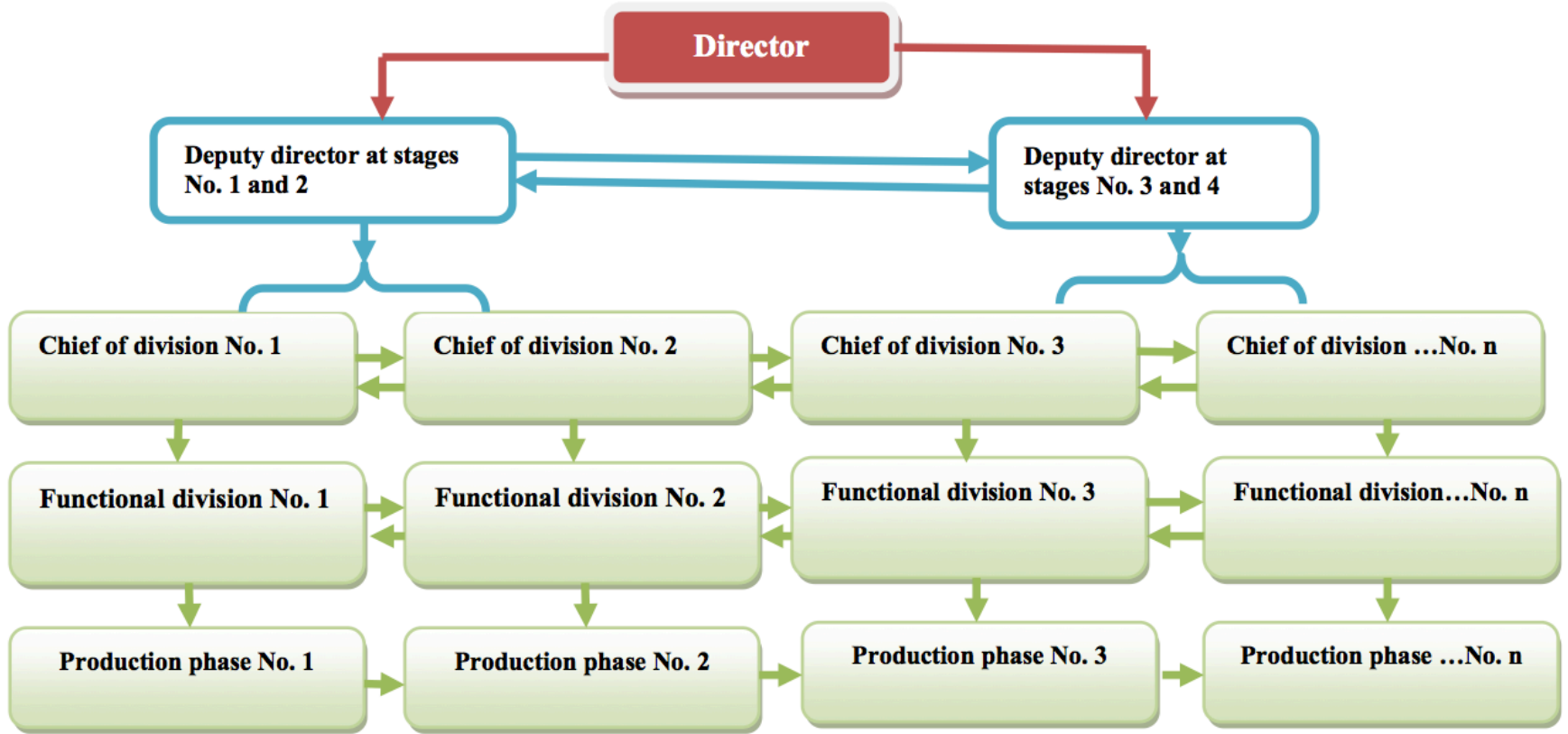
- principle of compliance of system of social management with organizational structure;
- accounting principle of oil and gas sector;
- principle of increase in stability and adaptation of production structures;
- principle of production safety;
- principle of scientific justification (postulates of synergy approach in line with the organization of management process);
- principle of complexity and systemacity (implementation of synergy approach cover all structural links of management systems and affect the staff);

- principle of optimization of centralized impacts and decentralization of management;
- principle of legitimacy (compliance with the current regulations);
- principle of management feedback (monitoring results of corrective actions).

Let's consider these principles in more detail.

**1. Principle of compliance** of management system with organizational structure of entities, first of all, implies that the organizational structure cannot be chosen or changed randomly. It is determined, first of all, by entity's production structure corresponding to the nature of the completed tasks. Schematically, the influence of production nature on the structure of corporate management system can be provided as follows (figure 1).

**Fig.1.** Influence of production nature on management structure



In fig.1. the elementary linearly-functional structure is provided. It is obvious that in case of various ratio of stages/phases and production functions the production structure can be significantly more complex. Respectively, it will also inevitably lead to complication of management system. That is, the principles of synergetics is possible to apply, taking into account complex production and functional structure of oil and gas entities in case of implementation of separate elements of organic structures (project, matrix, etc.), without loss of functional feasibility of divisions.

**2. Accounting principle of industry features** designates that the offered socially oriented concept will not cover the industry-specific features. Among them it is possible to emphasize the following:

- prevalence of large and huge enterprises;
- narrow specialization of productions which, as a rule, is one or several stages of work with raw materials (for example, part of entities is engaged only in raw materials production, other – in primary conversion and preparation for transportation, the third – transportation, some – in secondary conversion, some – in production of finished goods, etc.);
- merging of the entities performing different stages of handling raw materials within complex structures – companies, corporations (vertical integration);
- geographical dispersion of industrial complexes by various arrangement of sources of raw materials and their end-users(horizontal integration);
- production, environmentally hazardous at most stages, requiring maximum accuracy of safety

regulations compliance, where the whole complex of research, production and experimental works shall precede implementation of each innovation;

-impact on key employees of the severe climatic, harmful, ecologically dangerous production factors requiring application of individual and collective remedies and regularly improving rehabilitation actions, and additional measures of motivation to work.

Synergy approach assumes that the management system should not just consider these features, but also optimize their practical implementation.

**3. Principle of increase in stability and adaptation of production structures** assumes that implementation of the management systems constructed within the requirements of synergy approach should not break financial and economic stability of entities. On the contrary, it should increase resistance of entities to impacts of the external environment, mainly:

- instability of the political situation in the country;
- instability of international and domestic raw markets;
- growth of competition from small private oil and gas companies;
- social and economic instability in the country;
- instability of currency rates;
- instability of staple prices, etc.

**4. Principle of production safety** designates preserving technological quality of production processes and labor discipline of employees in case of implementation of the managerial techniques seeking to develop creative potential of employees and ensure innovative potential of production.

That is, creative initiative of employees should not cover production discipline and safety regulations. The new ideas and suggestions on improvement should be checked via mathematical and pilot models in the beginning, before taking root into production.

Any thoughtless initiative is also harmful to production process, as well as creative stagnation which inevitably leads to working with obsolete technologies.

All improvement/innovative suggestions should be checked not only for economic feasibility, but also for technological and ecological safety.

**5. Principle of scientific justification** assumes that implementation of the socially oriented management concept by oil and gas entities should be based on scientific provisions of the general management theory, classical theories of sociology of work, sociology of organization, sociology of management, and postulates of the synergy approach considering organization as a spontaneous open complex dissipative system.

**6. Principle of complexity and systemacity** assumes that the socially oriented management concept shall cover all levels of the complex management system: from sector management and regional development, before management of separate structurally functional divisions. Besides, implementation of this concept requires a clear understanding and active participation of employees. Non-management employees as recipients ("consumers") of socially oriented approach to management should at early stages actively be involved in restructuring management process. The principles and requirements of management system shall be accurate, transparent, clear to each employee. Otherwise, they will encounter hidden resistance from employees, or will lead to open confrontation. Therefore, implementation of the concept should include working not only with administrative staff, but also training non-management employees.

**7. Principle of optimization of centralized impacts and decentralization of management** implies, first of all, accurate differentiation of functions and tasks of various links of management system. So, the zones of responsibility and power of top management shall be accurately outlined, limits of individual responsibility for the decisions made by heads of

intermediate and lower links who are directly making orders to employees are determined. Besides, the responsibility of each employee onsite entrusted to him/her assuming a possibility of adoption of independent decisions shall be determined. And, within synergy approach this principle shall be considered, first of all, as recognition of need for reasonable restriction of authority of the top management due to development of incentives by the lower links, and self-organization, self-training and self-checking of each staff member. Only complete awareness by each employee of individual responsibility, high importance of results of own work on the achievement of production progress, transparency, openness, fairness of management system can provide the necessary level of adaptation of the organization to operation under the conditions of crisis (Gareyev, Kostyleva, Grogulenko, Valitova, 2014; Grogulenko, 2016).

**8. Principle of legitimacy** (compliance with the current regulations) assumes observance of the labor, administrative, industry, regional, federal regulations during the development of provisions of the concept.

So, in case of development of economic motivation of employees, the stimulating payments should not be performed for the account of the social minimum of compensation and regulations on salary accrual accepted at the entity guaranteed by the legislation of the Russian Federation (price-work, price-work and bonus, on a scale of charges, district coefficients, etc.).

In case of development of non-material incentives only those measures of disciplinary impact which are provided by the labor law can be applied to employees. Any additional measures worsening the situation of employees in comparison with the current legislation should not be applied (Belonozhko, Tkachyova, 2013).

**9. Principle of management feedback** assumes that the management system in connection with the structure and functions cannot be excessively static. For ensuring high level of adaptation to unstable socioeconomic conditions it should be rather flexible and react sensitively to any changes of external and internal environment of the organization.

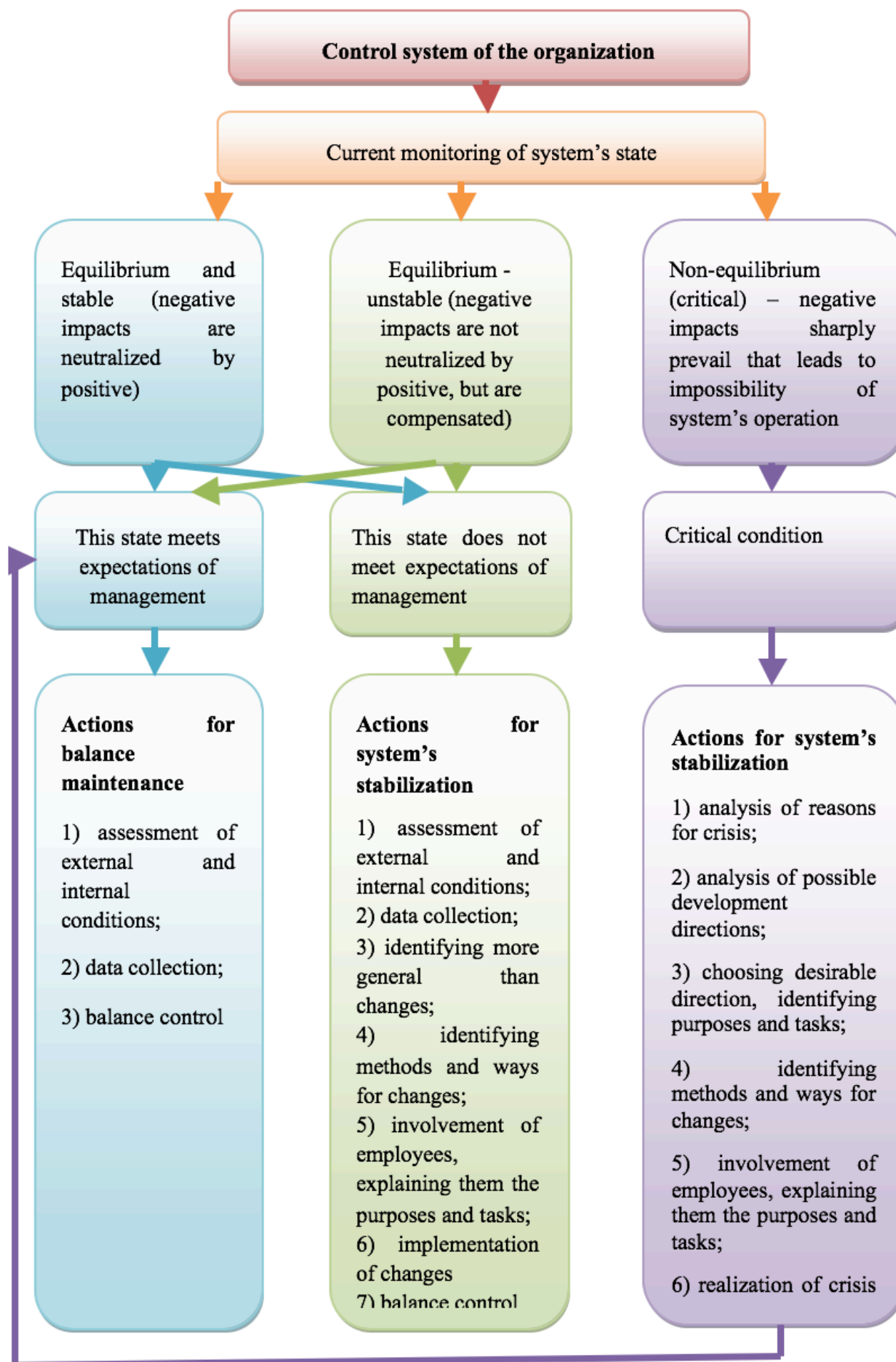
In this regard, special value is assigned by the structure of information exchange providing operational feedback not only between all control links, but also the staff, being the most important sales term of socially oriented approach to management systems.

Having considered the main objectives, tasks and principles of the offered concept, we will pass to the characteristic of its key requirements to management, organizational structure and information exchange in the oil and gas sector (Abdrakhmanov, Abdrakhmanova, Vorohobko, Shaybakov, 2015).

Developing basic provisions of the socially oriented management concept for the oil and gas industry, the attention was focused on insufficiency of methodical practices of application of synergy approach. Supporting the basic principles of synergy approach and developing them concerning socially oriented management, most of researchers identify it rather as philosophy of the organization than as management to restructure inefficient and obsolete processes. The developed adapted concept allows realizing modeling of management system, considering the basic principles of synergy approach to the research of the social phenomena.

In the declared concept of synergy modeling, the main source of changes and further development is the organization as a complex dissipative system which, reacting with factors of the external environment, responds to them with some changes (condition of unstable balance) which, accumulating to a critical mass, provoke crisis and further high-quality system when passing a point of bifurcation.

At the same time, the role and tasks of management system is fixed monitoring of system's condition for the purpose of timely forecasting and prevention of the critical phenomena, or, on the contrary, strengthening and provocations of crisis, directing it to the course determined by the global strategy of the organization (Shaybakov, Abdrakhmanov, Kuzeev, Simarchuk, Rakhimov, 2008; Wo, Baytenov, Grogulenko, 2014; Gareyev, Grogulenko, 2014).



**Figure 2.** The offered concept of modeling of a management system by the organization within synergy approach

The main methods of management's impact on the organizational environment offer the following: observation, interviewing, poll of workers and administrative staff, experiment and laboratory training. If needed, the management makes the decision on calling third-party consultants, organizing corporate internal department of development, or can work independently. In the synergy concept, it is not the basic moment; rather, organization without outside influence is capable of self-development, and management system's role is only directing it within the owners' course (Abdrakhmanov, Abdrakhmanova, Vorohobko, Shaybakov,

### 3. Results

The offered implementation methods of the marked-out principles are provided in table 1.

**Table 1.** Methods of the marked-out principles

<b>Principle of socially oriented concept of management</b>	<b>Implementation method</b>	<b>Result of the synergetic effects</b>
Correspondence principle	Organizational and administrative methods implementations of elements of matrix/project organizational structures. Managerial consulting through mutual training	<p>As a result of the divisions created by internal efforts consultants are invited as experts, realizing mutual training of employees and management. As a result, managerial functions are performed by specialists in separate production tasks.</p> <p>Training process implies direct interaction with heads of such managerial and administrative social platforms to reduce social uncertainty as participation in such the joint studying project creates single social space of employees and management.</p> <p>The organizational synergy effect implying creative atmosphere and autoregulation of innovative processes which can become a part of a daily labor activity is formed as a result</p>
Principle of accounting for sector's features	Motivational methods of preserving and strengthening the existing corporate social structure	<p>Objectively difficult working conditions can be alleviated with a special system of support of certain actions by employees, properly adjusted labor motivation management system.</p> <p>It ensures increasing the strength of domestic social relations, forms of technical and technological effect to reduce the monotony of labor operations, to simplify the technological cycle of preparation and analysis of input/output data, creating manuals to address possible emergencies and to simplify design/algorithms</p>
Principle of increase in stability and adaptation of production structures	Implementation of system of sociological diagnostics of staff-related problems	<p>Allows learning timely about possible social problems and difficulties experienced by both certain employees and all staff, timely proposing the solution. Such system determines a possibility of impact on bifurcation points, identifying <b>the demonstration of excessive intellectual</b></p>

		<p><b>potential.</b></p> <p>The social synergy effect which is determined by increase in qualification level of employees including communicative, managerial competences is as a result formed</p>
Principle of production safety	Forming and maintenance of corporate culture promoting staff values	<p>Timely diagnostics of reference points and values of staff's social groups can form the basis of management strategy, supporting labor efforts of employees to achieve <b>voluntary management</b></p> <p>Economic effect, in view of understanding of organizational actions by employees based on own performance</p>
Principle of scientific justification	Formation of administrative leadership consulting system	<p>Competences, necessary for management, can be developed within the educational environment created especially for management. The training format can be provided in the form of seminars, trainings, and interactive technologies. Modern, classical innovative management theories in training process will add problems of managerial knowledge of management. Here, the effect of <b>voluntary acceptance of innovations</b> at the leadership level is implemented.</p> <p>As a result, "the lost profit effect" when innovative methods of management are implemented is gained, the natural resistance to changes is minimized.</p>
Principle of complexity and systemacity	Monitoring of maintenance of the existing social order at all corporate levels; focus on employees participation	<p>Forming of similar platforms for free discussions allows realizing the effect of activity of all links of system when any employee can take part in discussion of debatable questions.</p> <p>The social effect (increase in level of managerial and communicative qualification), system effect (integration of employees, heads into the single organizational environment and high-quality change of social communications) is formed</p>
Principle of optimization of the centralized influences and decentralization of management	Organizational and administrative methods of powers distribution	<p>Expansion of degree of responsibility of employees due to increase in external relations quantity, strengthening external responsibility. Thus, the scope of management among employees is identified, expressed in organizational effect which provides autoregulation of processes of integration and updating of social system</p>



Principle of legitimacy	Control system of motivations applying social control ensuring social regulation of desirable elements of behavior and elimination of undesirable	Development of the management system, based on motivational system within which the accent is made on the value of employees and their requirements, resulting in the maximum <b>flexibility of management and economic synergy effect</b> ensuring creation of innovations to more rational accomplishment of labor transactions by employees
Principle of management feedback	Modeling of system of communicative interactions (information management)	Creation of optimum communications system based on communicative opportunities of employees, information on team strengths/weaknesses. <b>Emotional negative potential (entropy)</b> is as a result <b>liquidated</b> and system and social effect as qualitatively new condition of system is formed

## 4. Discussion

Forming and maintenance of staff's natural social environment was initiated in (Belonozhko, Silin, 2014; Belonozhko, Scythian, 2011; Abdrakhmanov, Solodovnikov, 2015). Combination of self-organization of each participant based on general motivation and integration into a single social value system of the organization determines success in achievement of synergy effect. Here it is important to stop on the complex analysis of use of synergy management model in an industry which can proceed only from modern realities of social management at the entities. Implementation of such concept in an industry acquires the nature of complete reorientation of management strategy, high-quality change of leadership's role and many subsystems, in particular systems of labor motivation. It is important to note also that changes are made in a comprehensive way, a lot of things will concern not only social environment and management system of an entity, but also in general all oil and gas industry in the country. Here, the study of methodology of implementation of the concept in the conditions in which the entity exists, matters and functions. Within synergy approach many habitual functions of management system are transformed (Tkacheva, 2011; Abdrakhmanov N., Abdrakhmanova, Vorokhobko, Abdrakhmanov R., Basyrov, 2015), components of a management system are concentrated around the created management systems by communicative space of the entity, organizational social environment, management motivation system and social activities of employees.

## 5. Conclusion

Thus, the provided principles and methods of synergy modeling of management system at the entities of the oil and gas sector offer basic provisions of implementation of socially oriented management. Specifics of sector's entities are considered and the analysis shows that performance indicators of functioning of management systems from the point of view of synergy approach can be improved, but conceptual implementation of provisions of synergetics is required. It is important to note that from the point of view of synergy representation of the organizational environment, the role of management system changes. Many modern theories including the method of organizational development, present the head as the assistant and colleague of the consultants (Gaisina, Mikhaylovskaya, Khairullina, Ustinova, Shakirova, 2015; Gareyev, Kostyleva, 2016; Ustinova, Rudov, Kostyleva, Grogulenko, Kulishova, 2016; Tkacheva, 2011). Keeping organization development within the provided concept the role of the head comes down to the directing impact of unstable fluctuations of the organization, ability of forecasting of crises, and directed impact at the moments of bifurcations. Implementation of

the synergy principles in management implies management system compliance with the criteria, indicators of social phenomena which allow determining the extent of manifestation of the synergy effect in corporate social environment. The maximum manifestation of synergy effects of corporate management system is possible under the corresponding social conditions, as which the indicators of the following social environment's parameters act: stability of management system, lag effect and elasticity. In implementation process of management it is possible to estimate extent of manifestation of synergy of team management, using the following social terms of management decisions: assessment of time expenditure of implementation of management decision; assessment of organizational costs of bringing decision to employees; use of various innovative technologies in case of development and implementation of the decision; ensuring succession of the decision with employees; ensuring diversity, plurality of decisions.

---

## References

- Abdrakhmanov N. H., Abdrakhmanova K. N., Vorokhobko V. V., Abdrakhmanov R. N., Basyrov A. R. (2015). Modeling scenarios of emergencies development for non-stationary hazardous production facilities of the oil and gas complex. *The Online scientific Journal Oil and Gas Business*. Ufa. 5, 516-531.
- Abdrakhmanov N. H., Solodovnikov A. V. (2015). *The Organization of Work of the Office of Labor Protection and Labor Protection at the Entities of the Oil and Gas Industry*. Ufa.
- Abdrakhmanov, N.H., Abdrakhmanova, K.N. Vorohobko, V.V. Shaybakov, R.A. (2015). Creating a System of Real-time Monitoring of Industrial and Environmental Safety of Hazardous Production Facilities. *Industrial safety Expertize and Diagnostics of Dangerous Industrial Object: Scientific - Technical Journal*. Ufa. No. 3. (19-23).
- Bakhtizin R., Evtushenko E., Burenina I., Gaisina L., Sagitov S. (2016). Methodical Approach to Design of System of the Logistics Centers and Wholesale Warehouses at the Regional Level. *Journal of Advanced Research in Law and Economics*, (Volume VII, Spring), 1(15), 16 – 25
- Belonozhko, M.L., Silin, A.N. (2014). *Sociological research in the mechanism of decision-making*. Tyumen: TSOGU.
- Belonozhko, M.L., Scythian, A.L. (2011). *Organizational basis for the functioning of government at the regional level*. Tyumen: TSOGU.
- Belonozhko M. L., Tkachyova N. A. (2013). *Migration Policy and Individual Safety, Society, State*. Tyumen: TSOGU.
- Gareyev E. S., Kostyleva E. G. (2016). Middle Class as Element of Stability of Social Hierarchy of the Russian Society. *Economy and Management: Scientifically - Practical Journal*. 3 (131), 73-77.
- Gaysina L. M., Bakhtizin R. N., Mikhaylovskaya I. M., Khayrullina N. G., Belonozhko M. L. (2015). Social Technologies as an Instrument for the Modernization of Social Space in the Social and Labor Sphere. *Biosci Biotechnol Res Asia*. 12(3), 2947-2958.
- Gaisina, L.M., Gareyev, E.S., Valitova, N.E., Khairullina, N.G., Ustinova, O.V. (2015). Corporate Staff Identity as a Factor of Increasing Labor Productivity. *Mediterranean Journal of Social Sciences*. MCSER Publishing, Rome-Italy. 6(5), 274-285.
- Gaisina, L.M., Mikhaylovskaya, I.M., Khairullina, N.G., Ustinova, O.V., Shakirova, E.V. (2015). The Role of the Media in the Spiritual and Moral Evolution of Society. *Mediterranean Journal of Social Sciences*. MCSER Publishing, Rome-Italy, 6(5) S2, 93-101.
- Gareyev E. S., Kostyleva E. G., Grogulenko N. V., Valitova N. E. (2014). Assessment of International Problems in the Republic of Bashkortostan. *Collection of the Works of the Conference devoted to the 71st anniversary of the Victory in the Great Patriotic War*. Ufa. pp. 103-108.

Gareyev E. S., Grogulenko N. V. (2014). Multicultural Education as Prevention of Interethnic Conflicts in the Process of Training of Specialists for the Oil and Gas Industry. (on the Example of Students to FSBEI HE USPTU, Ufa). *The Online Scientific Journal Oil and Gas Business*. 3, 417-434.

Grogulenko N. V. (2016). On the Issue of Civil Identity. *The collection of Articles on the Materials III of the International Scientific and Practical Conference*. Ufa. pp. 146-148.

Shaybakov R. A., Abdrakhmanov N. H., Kuzeev I. R., Simarchuk A. S., Rakhimov F. R. (2008). Investigation of Emergencies: New Methods and Approaches. *Issues of Collection, Preparation and Transport of Oil and Gas Products*. Ufa. 3, 110-121.

Tkacheva H.A., Silin, A.N. (2015). Formation of Human Resources in the Process of Circumpolar Region Development (ISSN: 2146-4138). *International Journal of Economics and Finance*, 5 (Special Issue) 121-127.

Tkacheva N. A. (2011). Migratory safety of the Russian society in the conditions of aggravation of ethnosocial contradictions. *The Bulletin of the Russian Peoples' Friendship University*. 1, 55-648.

Tkacheva N. A., Fokina A. B. (2015). Influence of migration on formation of human potential in the Arctic and Subarctic regions. *Contemporary issues of science and education*. 2; URL access mode: <http://www.science-education.ru/129-21459> (date of the address: 8/28/2015).

Tkachyova N. A. (2011). Influence of migration on social safety of the region. *Omsk scientific bulletin. – Series "Society. History. Present"*. 1(95), 31-34.

Ustinova O.V., Rudov S.V., Kostyleva E.G., Grogulenko N. V., Kulishova N.D. (2016). The Processes of Globalization in the Russians' Views. *Man in India*. 96(7), 2165-2177.

Valitova N. E., Gareyev E. S., Grogulenko N. V., Kostyleva E. G. (2016). Management of international relations in multiethnic regions of Russia (on the example of the Republic of Bashkortostan). *Materials of the international scientific conferences*. Yerevan: Yerevan state university. pp. 28-31.

Wo S. T., Baytenov N. A., Grogulenko N. V. (2014). Political Legal Mechanisms of Regulation of Ethnopolitical Processes. *In Collection: State of the Future: Political and legal Aspect. II International Scientific and Practical Conference*. USPTU. pp. 120-125.

---

1. UFA State Petroleum Technological University, 450062, Russia, Republic of Bashkortostan, Ufa, Kosmonavtov Str., 1. Email: [glmug@mail.ru](mailto:glmug@mail.ru)

2. Industrial University of Tyumen, 625000, Russia, Tyumen, Volodarskiy Str., 38

3. Industrial University of Tyumen, 625000, Russia, Tyumen, Volodarskiy Str., 38

4. UFA State Petroleum Technological University, 450062, Russia, Republic of Bashkortostan, Ufa, Kosmonavtov Str., 1

5. UFA State Petroleum Technological University, 450062, Russia, Republic of Bashkortostan, Ufa, Kosmonavtov Str., 1

---

Revista ESPACIOS. ISSN 0798 1015  
Vol. 38 (Nº 33) Año 2017

[Índice]

[En caso de encontrar algún error en este website favor enviar email a [webmaster](mailto:webmaster)]

©2017. revistaESPACIOS.com • Derechos Reservados