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To cite this article: R G Zaitsev *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **272** 032196

View the [article online](#) for updates and enhancements.

Development of Coal Industry as a Resource and Raw Material Base of the Region

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Abstract. Sector-specific issues of coal industry and its place in the regional economic system are defined in the context of utility theory since for any region it is important to balance the subjective and objective development priorities while implementing the investment process in the development of particular industries' production companies. Structural logical concept of the development strategy choice for coal mining enterprises is based on their expected utility or their results value taking into account the interests of all participants in the process and considering the needs to integrate the development priorities of the industry and the region as the resources and raw materials base. Strategy development process for successful operation and effective development of coal mining enterprises is offered to be implemented in accordance with Markov chains theory presented in the article. The methodology described provides more efficient use of the enterprise innovative potential consistent with their industry specifics.

1. Introduction

Over the past decades regional policies to stimulate innovation growth have become a popular topic among both researchers and politicians. The reason for such popularity is that there is often a need for coordination between various activities in order to solve actual problems efficiently, which necessitates in systemic nature of innovation policy. Specific needs of the region and the industry should be taken into account when developing and implementing innovative policies. [1, 2, 3]. Moreover, there are significant differences between types of regions (for example, peripheral regions, lagging regions, urban areas, cluster regions, fragmented regions, etc.). Thus, regional, including sectoral, policy development requires recognition of regional peculiarities and its economic structure. At present, such an approach becomes more and more popular where innovation systems are also criticized for failing to provide sufficient practical recommendations for decision-making. The article considers the question of how innovation policy can be adjusted to the interests of both the region and the industry. The paper offers a basis for analysis of innovation system problems, functions and activities and, on that, ideas on the role of actors and institutions (for example, policies) as innovation system coordinators are proposed. Herewith we combine functional and structural analysis of the system in accordance with the emphasis on the system functional model, as well as on its structural properties.

In Russia and in other European countries, there is a trend in which the ability and authority to influence industry development are passed from national to regional governments [4, 5, 6]. This trend is not surprising, given the high degree of regional authorities' autonomy to work out specialized



policies aimed at regional systems development. Considering the central role of knowledge dissemination from the regional perspective, innovative strategies are becoming preferable. Great contribution to the development of conceptual approaches for regional innovation policy making has been made by such economists as M.M. Avdayeva [5], S.A. Agarkov [6], K.G. Volkonitskaya [7], M.O. Gryaznova [6], E.S. Kuznetsova [6], S.Yu. Lyapina [7], O.A. Chernova [8], A.N. Shchitova [9], etc.

The article proves necessity of innovative processes activization at coal mining enterprises. The processes are supposed to be implemented on the basis of coal mining companies' innovative potential taking into account the factors that impede the implementation of such processes at coal industry enterprises [10, 11].

The need to implement a number of strategies for coal mining enterprises development in Eastern Donbass based on Markov chains is proved in order to establish priorities for investment activity described within the framework of utility theory and implemented in the form of possible states matrix.

2. Relevance

The part of Eastern Donbass territory which constitutes a part of Rostov region should become a target for regional initiatives as the regional economic sector taking into account the historical advantages of traditional production facilities currently facing renovation problems in order to avoid the danger of being blocked by outdated technologies.

Evolution of methodological approaches to research and analysis of industries refers to national (macro level) and regional (meso level) markets, which as systems possess a high degree of openness, conditional access and multi-agent competition. It is obvious that the model of external market describes general methodological patterns and correlations of regional market resources factors from the national point of view considering the possibility of its regulation by macro level management [12, 13]. In this case, the model of external market constitutes the methodological basis for the regional resources intra-firm market, which is characterized, unlike the external market, by a greater degree of closeness [14]. If the external market describes the movement of regional resources between business entities under the influence of external economic factors, the internal market is a process of moving regional resources within a single cluster. Within the above-mentioned cluster, vertical movement of regional resources takes place due to the change in functional structure, profitability structure, etc. and at the same time horizontal movement of regional resources due to the territory specification transformation and market requirements is observed. Since external market model provides for the inflow of regional resources from external environment, national interests such as energy interests should be taken into account here. Internal market is focused on preparation and use of regional resources directly on the region's territory. [15].

To assess the development priorities consistency for the industry and the region as the resource and raw materials base, Markov chains theory is used.

3. Method

The coal industry specifics and its place in the regional economic system are defined in the context of utility theory. Based on the thesis that a particular region is interested in raising budget revenue, increasing employment, etc., since it is connected to the production component improvement in general, but the region is not always motivated to improve the structural level of regional economy due to high diversity of regional characteristics, it is necessary to strike a balance between objective and subjective utility of region and enterprise development strategies implementation. In contrast to the known models, in this theoretical scheme, the costs or investments and the value (utility) received by the region and the industry from the strategies coordination process are taken as the determinant [16].

Modernized function of investment utility for an organization is as follows:

$$P_{\text{reg}} = a_2(I_{\text{reg}})^2 + a_1(I_{\text{reg}}) + a_0,$$

where P_{reg} – is regional utility;

I_{reg} – is investments of the region in the industry development;

a_2, a_1, a_0 – are the coefficients of a quadratic polynomial; they describe the shape of the parabola characterizing P_{reg} .

Let us introduce the concept of regional process utility, applicable to Eastern Donbass territory. Regional process utility is a successive change in the utility degree for additional characteristics of enterprises production and economic activities, which influences the industry according to the law of industry needs saturation. Process utility is a subjective category of the object states in relation to static external conditions of activity.

Based on the definition above, we can estimate the regional utility of cumulative decisions making process on the use of resources in a particular region, Eastern Donbass in this case, by presenting it as the following function: $L=f(l_1; l_2; l_3; \dots l_i)$, where l_i – is process utility.

Nevertheless, regional utility is not considered as an elementary sum of individual usefulness of specific processes, since in this case synergy effect takes place due to the systematic dependence of the proposed function. It is important to note that the function of organizational utility includes a component that is a subjective evaluation of utility. In the region resources formation process Eastern Donbass is provided with utility both for the particular territory and for optimized enterprises under consideration. For the particular region, the utility is reflected in the following economic categories:

- tax revenue growth;
- socio-economic indicators of enterprise increase;
- profitability growth.

Solving the problem of strategic development of the industry structure is one of the main tasks in the process of regional market regulation. Investment planning accuracy is an important parameter in forecasting production and regional budget development [17,18].

The proposed model allows determination of the regional investments amount in the industry development provided that the organizational utility and the ratio of organizational and subject utility are maximized. For the particular region, the utility under consideration is reflected in the following economic categories: tax revenues growth; increase of social and economic performance of enterprises; profitability increase. The developed approach implies the mechanism of industry transition from one state to another through the management planning process and regional resources utilization. Herewith the transition mechanisms have the form of Markov queue when each operation passes through only one maintenance operation. This allows to identify them as single-phase operations. At the same time, it is advisable to assess industry dynamics for all enterprises in the assessed region x_n , and for the industry as a whole at a certain point of time. The calculated data reflect the category and state of the industry of the particular region [19].

4. Results

In the particular case of Rostov region and Eastern Donbass, 9 discrete states are considered (see Table 1).

Table 1. Industry Strategy Discrete States Structure.

Strategy	Innovation Level	Notation
1. Price growth strategy	Average	1
2. Unprofitable mines conservation strategy	Absent	2
3. Maintenance strategy	Absent	3
4. Selective support strategy	Low	4
5. Cost-cutting strategy	Low	5
6. Integrated growth strategy	High	6
7. Horizontal integration strategy	Average	7
8. Diversification strategy	Average	8
9. Innovation strategy	High	9

For more convenient work with the program, the data is represented in the form of a graph in which the vertices are the states, and the arcs are transitions between states [20]. The values above the arcs are the probability of transition from one state to another (Fig. 1).

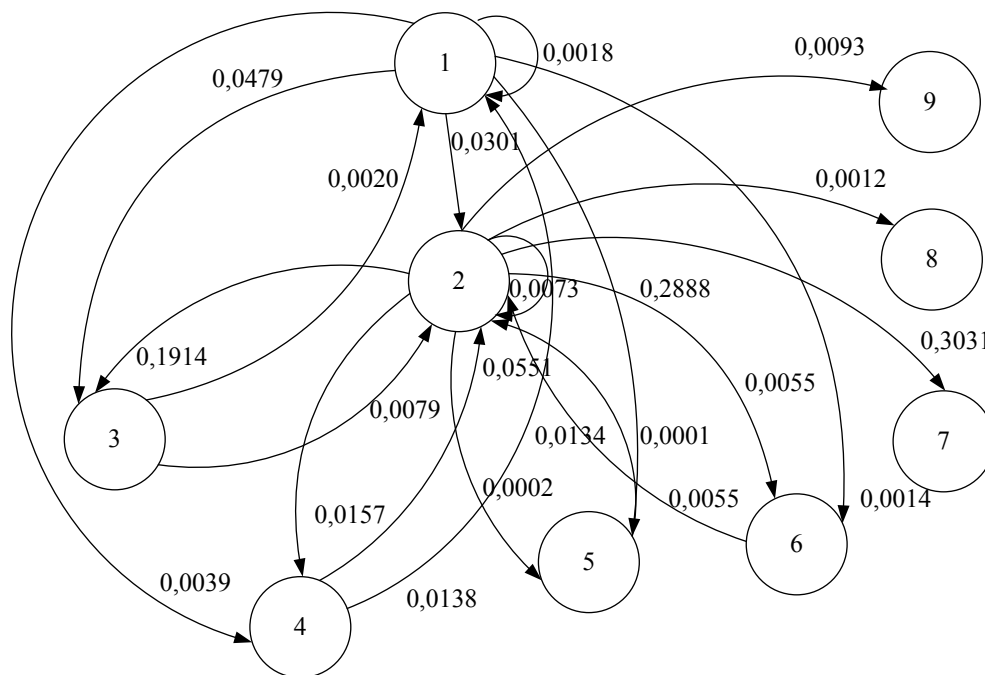


Figure 1. Transition graph.

5. Discussion

This article outlines the methodology for implementing a number of strategies for the development of coal mining enterprises in Eastern Donbass based on Markov chains used to establish priorities of investment activities described within the framework of utility theory and implemented in the form of possible states matrix, which improves energy efficiency, diversifies products produced by coal mining enterprises, and improves the overall management effectiveness at the regional level. The authors present a model of individual return on investment which allows to determine the territory investment amount into the industry development, subject to organizational utility maximization and correlation of organizational and subject utility. The proposed methodical approach to the planning process in the regional resources utilization management involves considering the system of industry transitions from one state to another, based on Markov queue theory.

Markov chain analysis suggests that, given the choice of innovative development strategy, a new enterprise functions actively for more than 8 years on average before its transition into a different state (profitability decrease, for example). The longest duration in operation is 14.71 years; it is predicted for developing enterprises. The shortest operational period of an organization is expected for enterprises using strategies of liquidation, conservation, maintenance, and selective support. This indicates the need of regional industrial policy transformation to the direction of creating conditions for coal industry enterprises innovative development strategies implementation.

6. Conclusion

Each particular territory is interested in raising the level of budget revenue, employment increase, etc., since it is connected to the production component improvement as a whole, and it is obvious that it is necessary to strike a balance between objective and subjective utility of region when particular industry investment strategies are implemented.

The combination of Eastern Donbass high quality coal and low costs of its transportation to clients in the European market, industry restructuring completion prospects and management quality improvement, including foreign trade, constitute leading competitive advantages of Eastern Donbass region. The methodology offered by the authors allows increasing efficiency of strategic decisions making in business integration context within the framework of the industrial policy of the region.

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