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Article

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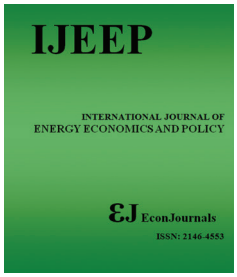

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Principles of Strategy Formation and Tools for the Analysis and Forecasting of Work of Organizations Engaged in Energy Sales Activities

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ABSTRACT

The paper shows the urgency of the development of methodology and tools of strategic management for the organizations engaged in energy sales activities. These organizations' principles of strategy formation are listed here, and their priority is shown. The following tools for the analysis and forecasting of the functioning for the organizations performing power sales activity are offered: methods of the theory of probability, mathematical statistics, and rank analysis. The authors present the results of these methods' application in assessing the effectiveness of the indicator of guaranteeing suppliers' (GS) net profitability of sales in 2017. Analysis of the net return on sales of GS, as one of the performance indicators, showed that the mathematical expectation of this value decreased from 0.97% in 2012 to 0.41% – in 2017. The authors also propose an adapted algorithm for predicting the net profitability of the sales for the organizations involved in energy supply activities.

Keywords: Mathematical Statistics, Adapted Algorithm, Development
JEL Classifications: Q40, Q47, C02

1. INTRODUCTION

The international community pays special attention to sustainable development, which contributes to the efficiency of the economy and the prosperity of society (Report on Growth..., 2009, Porter, 2008; Neve, 2007). Foreign (Collins et al., 2017; Lokeshkumar et al., 2018; Ukko et al., 2019; Mulamula and Amadi-Echendu, 2017) and domestic scholars (Popkova and Rostopchina, 2010; Kleiner, 2015; Kazieva, 2009) have devoted many works to the issue of sustainable development, including regions, cities (Zaripova, 2012), and businesses (Yarullina, 2011; Khomiachenkova, 2011; Sergunyaev and Trubetskov, 2011; Zinger, 2010; Vakhromov and Markaryan, 2008; Barmuta, 2009; Bazarova, 2007; Alekseyenko, 2009; Erokhin, 2013; Melnik, 2009; Koryakov, 2012; Korchagina, 2011). Russia has adopted several legal acts contributing to the development of the economy, including national standards, providing the methodological basis for sustainable development (Presidential Decree..., 1994; Presidential Decree..., 1996; Order of the Government..., 2015; Order of the Federal Agency..., 2011; Order of the Federal Agency..., 2013; Order of Rosstandart..., 2015).

The sustainable development of energy enterprises as the basic industry of industrialized countries is of particular importance for the world economy as a whole, and each country individually. The transition of Russian energy to the market mechanisms of functioning (Resolution of the Government..., 2012) requires improvement of the methodology and tools for assessing the functioning, forecasting, and planning of enterprises in this industry, considering their reorganization implying separate functions for the generation, supply, and sale of electricity. At the same time, for generating companies and enterprises of the electric grid complex for almost a century, such a methodology was

developed (Kushnarev et al., 2001; Makarov et al., 2007; Basova et al., 2004), and for newly created energy sales organizations (ESO) (Federal Law of the Russian Federation…, 2003), it is not possible to use these developments unchanged due to the specifics of their functions and the key role in the implementation of market mechanisms.

2. FORMATION OF ESO STRATEGIC MANAGEMENT METHODOLOGY BASED ON THE PRINCIPLES OF SUSTAINABLE DEVELOPMENT

The development of the methodology and tools of strategic management, which ensures the implementation of medium-term and short-term plans on the basis of the formed long-term plans, is of paramount importance for improving the efficiency of the ESO. At the same time, the approaches used in the development of methodology and tools should consider the principles of sustainable development, and the methods should be based on the theory of probability and mathematical statistics, successfully developed in the works of the following scientists: Kolmogorova, A.Y. Hinchin, B.V. Gnedenko, V.M. Zolotarev (Zolotarev, 1983; Gnedenko and Kovalenko, 1966), widely used in the power industry for more than 70 years in forecasting power consumption (Makoklyuev, 2008; Demura, 1998; Nadtoka, 1998; Sedov and Nadtoka, 2002).

The formation of the ESO strategy on the basis of the principles ensuring sustainable development (involvement, management responsibility, transparency, compliance with ethical standards) (Report on Growth..., 2009) is a necessary and mandatory condition for the functioning of electric power organizations, which include organizations engaged in energy sales activities, including ESO. Their application in the formation of the ESO strategy is not only a reflection of the continuity of international law but also an element of the methodology that ensures the effective development of determining the choice of the tools: indicators of sustainable development, including an integral indicator, etc.

The possibility of applying other principles along with the principles of sustainable development, which include the principles of the quality management system, the principles of cost-based management (Copeland et al., 2008), indicates the need to prioritize the principles and their interconnection. When forming the ESO strategy, the principles of the system approach are the basis for the implementation of the principles of sustainable development, which are based on the principles of the quality management system, customer-oriented approach, cost-oriented management, as well as the proposed (Kravchenko, 2016) directions of development of energy organizations (cost increase, quality, reliability), as presented in Figure 1.

The creation of a methodology for the ESO strategy formation requires the development of tools for the assessment of the efficiency of their functioning. Currently, the most accessible indicators for the analysis of the ESO performance are those that characterize the direct (or indirect) growth of their cost, published annually in the form of reports on financial results on the official websites of the organizations.

3. ANALYSIS OF THE GUARANTEEING SUPPLIERS' (GS) OBTAINED PROFITABILITY INDICATORS AND PLANNING THE INDICATORS OF THEIR FUNCTIONING

The analysis of economic indicators of the functioning of 102 organizations from the Federal Information Register of GS (Kravchenko, 2017a) is carried out, and at the same time, the preference was given to the choice of not less than one GS (Federal Law of the Russian Federation…, 2003) from each subject of the Russian Federation. To analyze the effectiveness of organizations that have received the status of GSs (Resolution of the Government..., 2012), selected return on sales, operating return on sales, and net return on sales (Kravchenko, 2017a; Nadtoka and Kravchenko, 2017). At the same time, seven organizations were excluded from the obtained sample, whose average net sales profitability for the last 6 years (2012-2017) was < 10%, due to natural and geopolitical factors.

The following formulas were used to calculate the profitability indicators (Savitskaya, 2004) (Eq. 1-3):

$$\text{Profitability of sales} = \frac{\text{Profit (loss) of sales}}{\text{revenue}} \times 100\%, \quad (1)$$

$$\text{Operating return on sales} = \frac{\text{Profit (loss) before tax}}{\text{revenue}} \times 100\%, \quad (2)$$

$$\text{Net return on sales} = \frac{\text{Net income}}{\text{revenue}} \times 100\%, \quad (3)$$

As noted above (Kravchenko, 2017a; Kravchenko, 2017b), the most effective for the analysis of GSs' relative profitability indicators are the methods of mathematical statistics and rank analysis. The main numerical characteristics of the ESO performance indicators are as follows (Eq. 4,5):

$$m_x^* = \frac{1}{n} \times \sum_{i=1}^{n} x_i \quad (4)$$

$$D_x^* = \frac{1}{n-1} \times \sum_{i=1}^{n} (x_i - m_x^*)^2 \quad (5)$$

where m_x^* – mathematical expectation; i – organization's ID; n – the number of organizations; x_i – organization's performance indicator (ESO); D_x^* – dispersion (Wentzel and Ovcharov, 2000).

The presentation of statistical data in the form of rank distributions (Table 1) underlies the methods of the price science approach (Kudrin, 1993; Kudrin et al., 2008; Gnatyuk, 2005). Rank distributions have the following form (Eq. 6):

$$H(r) = A_1 / r^{\alpha}, \quad (6)$$

Figure 1: The Interconnection of the ESO strategy formation principles

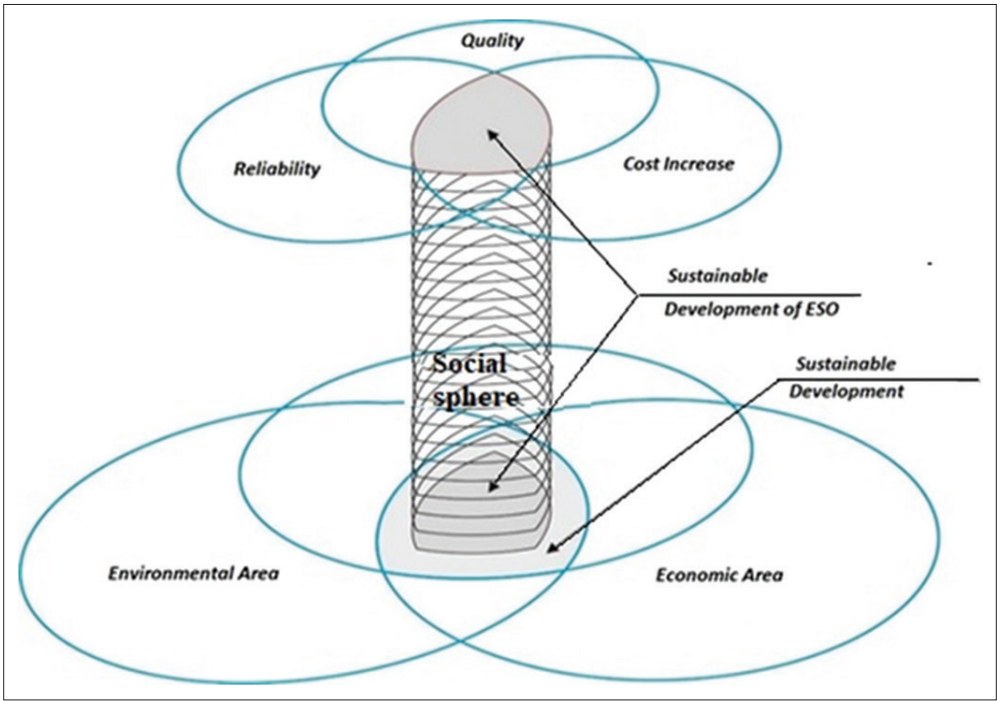
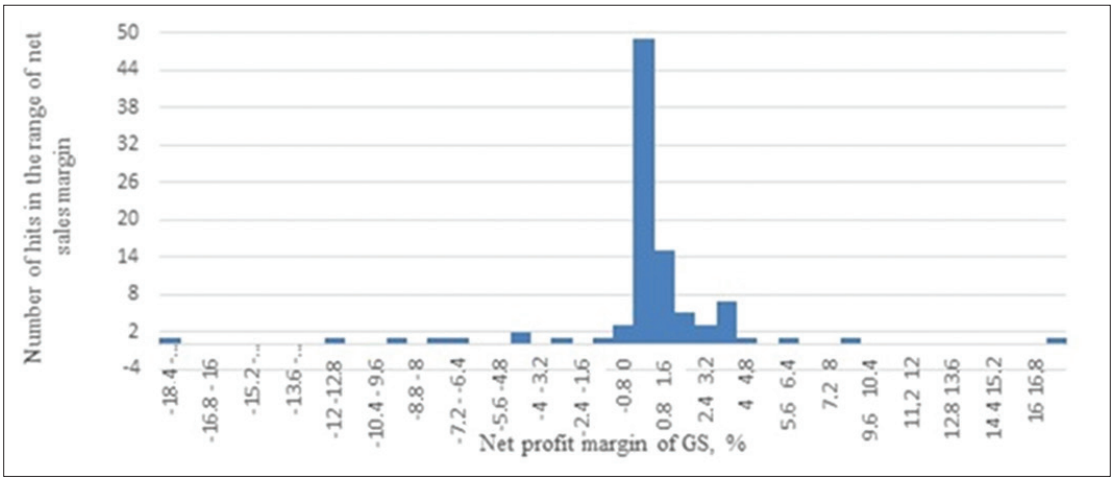


Figure 2: Histogram of the distribution of net sales profitability of guaranteeing supplier in 2017



where r – 1,2, …is the rank; for r = 1 is the first point, A_1 is the organization with the highest value of the performance indicator; α – rank coefficient characterizing the degree of sharpness of the distribution curve (usually 0.5 < α< 1.5 (Gnatyuk, 2005)).

The distribution of net sales profitability of GS in 2017 is presented in Figure 2.

Net sales margin of the majority of GS does not exceed 0.8 %, in 2012 – 36 GS, and in 2017 – 49 GS, i.e. net sales margin of 49 GS is positive but does not exceed 0.8%. The number of GS with this indicator above 0.8% decreased from 39 in 2012 to 34 in 2017. The expectation of net sales profitability of GS decreased from 0.97% in 2012 to 0.41% – in 2017 (Figure 3), the variance increased approximately 1.5 times from 8.31% 2 in 2012 to 13.67%2 in 2017 (Figure 4). At the same time, the number of organizations with negative values of the net sales profitability indicator for seven years remains almost unchanged: in 2012, 2013 – 13 organizations, in 2014-2017 – 9,9, 10 and 12 organizations, respectively.

Such a change in values, the net cost of sales suggests that the majority of suppliers plan their operation so that the net profit margin has never exceeded 0.8% considering the break-even operation.

When performing the GS rank analysis on the net sales profitability index of 40 GSs, the negative values of indicators, as well as those missing in the considered period (for two organizations), were replaced by the minimum positive values achieved by GSs in the considered period, i.e. by 0.001%, since the rank analysis uses only positive values as the characteristics of the system (Kudrin, 1993; Kudrin et al., 2008; Gnatyuk, 2005). When determining the maximum value of net sales profitability, the indicators of organizations that in the reporting period have profit

Figure 3: Mathematical expectation of net return on sales of guaranteeing supplier

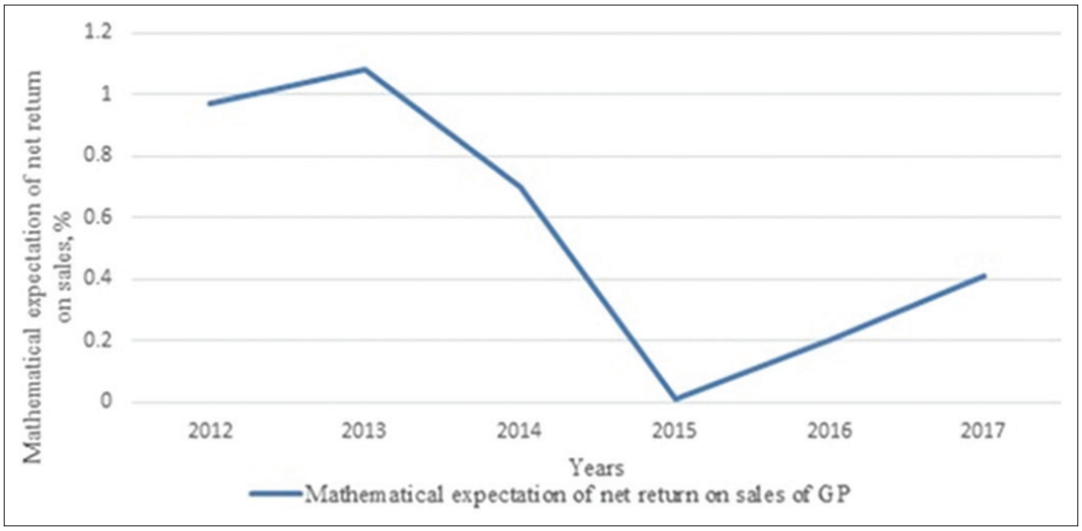
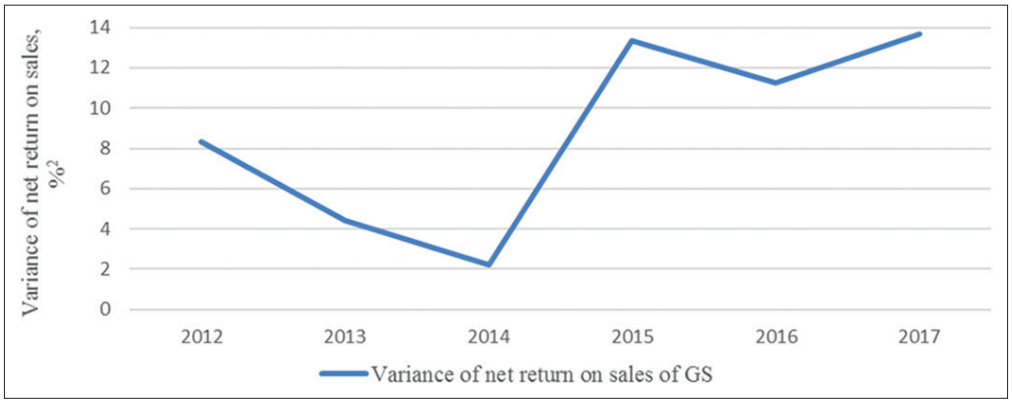


Figure 4: Variance of net return on sales of guaranteeing supplier



from operating and non-operating activities mainly due to the reflection in the income, benefits and subsidies received from the budgets of different levels for compensation of electricity tariffs for individuals and legal entities are not considered, which, as a rule, is reflected in the explanations to the balance sheet and the report on financial results.

The value of the rank coefficient (α) calculated from the approximated curve in 2012-2016 is not <0.5 and does not exceed 1.5, that is, the condition $0.5 \leq \alpha \leq 1.5$ is fulfilled (Table 2).

Similarly, it is possible to predict the rank coefficient (α) of the distribution of net sales profitability of GS based on available data for 2012-2017 (Figure 5). As noted in (Nadtoka and Kravchenko, 2017; Kravchenko, 2017b) rank analysis reveals a wide range of opportunities for analyzing structural changes in the composition of GSs and forecasting the performance characteristics of energy organizations, since rank coefficients located in time form ordered series, their dynamics can be studied in the long term (more than 10 years), medium term (5-10 years), short term, while the time series of rank coefficients are stable in time (Kudrin et al., 2008).

Based on the methodology presented in the works (Kudrin et al., 2008; Nadtoka and Berezkina, 2009), based on the time series of energy consumption, considering the price science approach, it is

Table 1: Statistical points of guaranteeing supplier net sales profitability

Statistical points	Years					
	2012	2013	2014	2015	2016	2017
Mathematical expectation, %	0.97	1.08	0.7	0.01	0.2	0.41
Dispersion, %²	8.31	4.44	2.21	13.33	11.27	13.67

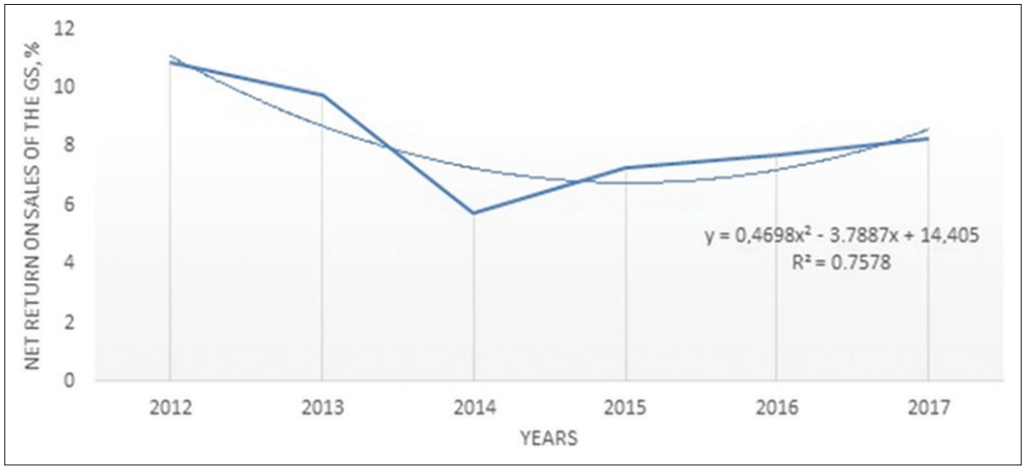
Table 2: The highest value of net return on sales of guaranteeing supplier (Parameter of Rank Distribution)

Years	2012	2013	2014	2015	2016	2017
The highest value of net return on sales (A_1), %	10.88	9.73	5.74	7.27	7.72	8.28

proposed to predict the net profitability of sales of organizations engaged in energy sales activities through an adapted forecasting algorithm:

1. Determination of the analyzed organizations from the register of GSs, indicators of net profitability of sales for the analysis based on the pricing approach, including the exclusion of organizations with a short period of operation
2. The definition of GS, systematically receiving significant losses, the causes of which are not directly related to the

Figure 5: The highest value of net return on sales of the guaranteeing supplier in 2012-2017



performance of their functions in the field of energy sales, due to natural, geopolitical factors and their exclusion from the number of the analyzed ones

3. GS ranking by the value of net sales profitability by years of prehistory in the post-reform period, i.e. since 2012
4. Determination of the parameters of ranking A1i (where i = 1,…, t; t – years of prehistory)
5. When determining the maximum value of net sales profitability for each year, the background t does not consider the indicators of organizations having a profit from operating and non-operating activities in the reporting period mainly due to the reflection in the income, benefits and subsidies received from the budgets of different levels to compensate electricity tariffs for individuals and legal entities
6. Determination of the rank distribution parameter α to obtain a curve smoothing experimental estimates based on the chosen approximation method (least squares, half division, Golden section, etc.)
7. Getting a predictive estimate A_{1i+n}, α_{i+n}, (where n = 1, 2, … – the forecast period) based on available sequences $\{A_{11}, A_{12},\ldots, A_{1i}, \ldots A_{1t}\}$, $\{\alpha_1, \alpha_2,\ldots., \alpha_i, \ldots \alpha_t\}$;
8. Determination of the calculated rank of the organization on the abscissa axis on the obtained curve of the last year of prehistory from the following expression:

$$r_{ti} = \left(\frac{A_{1t}}{A_{ti}}\right)^{1/\infty_t}, \quad (7)$$

where A_{ti} – projected net return on sales for the year *t*;

9. We determine the net return on sales for each GS based on the obtained forecast values (Eq. 8):

$$A_{1i+n}, \alpha_{i+n}. \quad (8)$$

Based on the algorithm of forecasting of net profitability of sales presented above it is possible to plan other indicators of the functioning of the organizations performing power sales activity.

4. CONCLUSION

The emergence of ESO, due to the reform of the power industry, determines the need for the formation of the methodology of strategic management and tools that should be based on the principles of a systematic approach, sustainable development, quality management system, customer-oriented approach, cost-oriented management, and take into account the directions of development of energy organizations (cost increase, quality, reliability).

To analyze and plan the work of organizations engaged in energy sales activities, it is necessary to use the methods of probability theory and mathematical statistics, including rank analysis, considering the specifics of their work in terms of the analyzed characteristics. Analysis of the net return on sales of GSs, as one of the performance indicators, showed that the mathematical expectation of this value decreased from 0.97% in 2012 to 0.41% – in 2017. The majority of GS (49 organizations out of 95 considered) has a positive net return on sales in 2017, but it does not exceed 0.8%, and the value of the coefficient α indicates the stability of the system of GSs, and therefore their chosen direction of planning profitability.

The use of rank analysis as one of the tools for planning performance indicators of organizations engaged in energy sales activities will determine the indicators that consider the peculiarities of the functioning of the system of GSs and analyze structural changes in the composition of GSs.

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