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# Neural Networks as a Tool of Forecasting of Socioeconomic Systems Strategic Development

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**Abstract**

When forecasting socio-economic processes it is essential to choose a forecasting method that will objectively reflect the tendencies in development of socio-economic systems. The most common forecasting methods - linear, quadratic, exponential, the autoregressive model and the Holt-Winters forecasting method - are based on extrapolation, i.e. extension of a tendency observed in the past and present to the future. The principal non-linearity in the development of the socioeconomic systems that are managed under conditions of uncertainty and partial observability of the functioning processes, has helped to formulate the expediency of their forecasting based on neural networks. Comparative evaluation of the effectiveness of different forecasting methods is implemented using the example of the Astrakhan region socioeconomic development forecast for 2014-2015. The initial data has been compiled of the GRP (gross regional product), the volume of industrial production, gross agricultural product, the amount of investments in fixed assets, the scope of construction work, the average monthly salary, the CPI (consumer price index) and the unemployment rate in 2001-2012.

The minimum value of errors in the regional socio-economic development forecast based on neural networks has showed the higher degree of objectivity in the results of neural network forecasting in comparison with other methods.



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*Keywords:* forecasting, socioeconomic system, forecasting models, neural networks, nonlinearity.

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## 1. Introduction

Forecasting as a specific management function sets a number of nontrivial methodological problems for the researchers. These problems are mainly caused by the fact that forecast suggests studying an object that does not exist so far. It requires a justified choice of methods and a forecasting model based on the characteristics of an object and the statement of the basic principles that enable creation of a constructive basis for the development of the applied forecasting methods.

## 2. Problem statement

Forecasting in the general is an extrapolation of the past and present on the future. Extrapolation assumes finding levels outside the studied series, which means extension of the tendencies observed in the past to the future (prospective extrapolation). Since the tendency of development in fact remains unchanged, the data obtained by means of extrapolation of the series should be considered as probability assessments. Therefore, the traditional approach to the economic forecasting is based on two assumptions:

- The applied model is an adequate reflection of the economic system;
- The economic structure will remain constant in the future.

Practical development of a quantitative model involves construction of a general tendency of level changes of time series based on the analytical alignment of dynamic time series. The main point of the analytical alignment method in dynamic time series is that the general tendency of development is calculated as a function of time (1):

$$Yt = f(t), \quad (1)$$

where Yt stands for the levels of the dynamic series, calculated accordingly to the appropriate analytical equation at time t.

Determination of the theoretical (estimated) levels of Yt is implemented on the basis of an adequate mathematical model that approximates the basic tendency of dynamic time series in the best way.

The most common methods of construction for the time series forecasting are: linear, quadratic, exponential, the autoregressive model and the Holt-Winters forecasting method, which are based on different approaches to the estimation and determination of the factors that affect the system in the past and present and on the assumption that they will have the same impact in the future (G.A. Parsadanov, V.V. Egorov, 2002, Erich Jantsch, 1974, G. Box, G. Jenkins,1974, J.D. Hamilton, 1998, G. Kantorovich, 2002, John E. Hanke, Arthur G. Reitsch, Dean W. Wichern, 2003, J. Scott Armstrong, 2001, E. Karlina, 2013).

Using these methods we can extrapolate the quantitative characteristics of economic, scientific and productive capacity, the performance data of scientific and technical progress, the characteristics of the ratio of the particular subsystems, blocks and elements in the index system of complex systems, etc.

This brings up the question: is it proper to transfer the patterns describing the past and the present on the future? This question becomes especially important when it comes to forecasting socio-economic systems that are managed under conditions of uncertainty and partial observability of the functioning processes (V.N. Tsygichko, 2007; O.V. Zaborovskaia, E.V. Plotnikova, E.E. Sharafanova, 2014). The applied methods of socioeconomic systems forecasting are based on the idealization of reality, i.e. the cause in different circumstances leads to the same effect. That assumes the linearity of development and does not consider the internal processes of self-development, initiating new situations and new effects unrelated to the previous causes.

Non-linearity of the world development, including socio-economic systems, is the basic principle of neodeterminism, considering the socio-economic processes as fundamentally non-linear (I. Prigozhin, I. Stingers, 1986, G. Deleuze, 1998), which does not deny the existence of determinism in the development of nature and society