Model of the assessment of the implementation of public administration in the regions of Russia

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Abstract — In the article the characteristics of the assessment of the implementation of the public administration in the Russian region are constructed on the basis of the use of contemporary mathematical methods of the classification and prognostics which based on the method of “cross verification” are studied. The use of the model will allow realizing the monitoring of the maturity of the public administration in the regions, the results of which can be used for the increase of the efficiency of the interaction between the government, regional and municipal structures, non governmental associations and citizens in the regions of Russia.

Keywords — *public administration, mathematical model, monitoring of the maturity of public administration, regions of Russia*

I. INTRODUCTION

The solution of the problem of the economic instability in contemporary Russia is possible only by means of the implementation of the innovative model of social and economic development created on the basis of the use of the latest results in science and technology.

The main production technologies the use of which is capable of providing the economic growth are mentioned in the List of critical technologies (Perechen' kriticheskikh tekhnologiy) adopted by the Decree of the President of the Russian Federation on July, 7th 2011 № 899. However in this list the critical social technologies which “simplify” (and increase the efficiency) the procedures and forms of interpersonal social contacts on the basis of their direct communicative interaction are absent [1].

The critically important social technologies which contribute to the creation of the innovative model of development are presented in our opinion by the technologies

of the modern public administration which provide the interaction of citizens, non governmental associations, entrepreneurial communities and government institutions realized by means of global and local social nets for the establishment of the balance of interests in case of the goals of social and economic development.

The problems of the interaction between the state and the citizens determining the problems of social welfare and the construction of an ideal model of the state have always excited interest of the researchers. Even in the works of Plato and Aristotle two methodological approaches to the construction of an ideal state (elite one by Plato and egalitarian one by Aristotle) were suggested. The main distinctions of these approaches are determined by a difference in the characteristics of the subjects of the state management and the definition of their functional roles.

Since the beginning of the XXth century through to the end in the scientific research the priority had the state and legal (elitary) theories. In compliance with them an active subject in the system of the state administration is the state and its institutes which by means of legal acts organize and control the process of use of public resources. The citizens in this logical construction were seen as an object of the influence.

Despite the fact that the term “public administration” for the first time was introduced into the scientific use in 1887 already by W. Wilson the public administration becomes in fact “public” (egalitarian) only in XXIth century when thank to an increase of the socialization of economic and political processes and also thank to the development of the Internet technologies which allow communicating in real time and at the absence of the spatial limitations the opportunities of the

population to take part directly in the administrative decision making and in the control over their implementation appeared.

Consequently for the provision of the conditions of the solution of the problem of the innovative model construction of economy in modern Russia it is indispensable to develop the system of public administration. For this goal it is necessary:

- to isolate the structural elements of the system of the public administration;
- to determine the system of indicators characterizing the elements of public administration;
- to develop a model which allows determining the relations and interconnections between these indicators;
- to implement regularly the control of the condition of structural elements of public administration for their correction on the basis of the formed system of indices and a developed integrated model of the assessment of their indices.

In order to activate the process of the formation of the system of public administration at the regional level it is indispensable to assess the presence of the conditions necessary for that in the municipalities being part of a region. Especially at the municipal level the conscious support «by the society of the efforts of individuals in the process of the achieving by them of a well-deserved social existence» is only possible [2, p. 6].

II. MATERIALS AND METHODS

The authors found that in its essence the public administration is a personified, inclusive management or the management taking into account the goals and the interests of every citizen and every business organization and also implying their participation in the process of the adoption and implementation of managerial solutions of both citizens and separate enterprises and also citizen associations and business organizations [3].

The implementation of the public administration takes place under the influence of the following determining factors:

- resources which determine the presence in the region of social, economic and technological potentials the implementation of which creates the conditions for the creation of the system of public administration;
- institutions which allow assessing the presence and the degree of the maturity of necessary foundations and conditions for the participation and control of the citizens over the solution of the problems which affect their interests;
- infrastructure which characterizes the technical opportunities which allows the subjects of the public administration, includes together with government, regional and municipal authorities the citizens, public associations and entrepreneurial communities to communicate in the process of the decision making and the implementation of these managerial decisions.

In the system of public administration under the influence of institutional factors the process of the use of available

resource factors takes place. Their results are assessed by qualitative and quantitative characteristics of the resulting factors. At the same time the interactions directed on the managerial decision making are implemented under the influence of infrastructural factors.

Thus the maturity of the public administration is determined by the resulting factors as their quantitative values reflect the degree of the interaction between the subjects of public administration in the process of the decision making and the implementation of these managerial decisions.

For the assessment of the resulting factors it is suggested to use the following indices characterizing the application of the technologies of the public administration.

A. Continuously resulting indices:

- number of organizations of territorial public self administration characterizes the implementation of the principle of the subsidiarity in the system of public administration as it allows assessing the efficiency of the organization and the preparedness of the citizens to take powers and responsibilities for managerial decisions connected with the use of public resources within a specific territory;

- number of participants in the realization of the government purchasing policy (number of the applications) allows assessing the preparedness of the business structures to take part in the purchasing activity of the state under the suggested conditions or it reflects the participation of the business in the implementation of the managerial decisions directed on the use of public resources and consequently can be used to characterize the resulting factors of public administration.

B. The binary resulting index: the public discussions of the legislation drafts in the Internet. The analysis of the activity of the citizens, public organizations, business organizations and entrepreneurial unions at the discussion of the legislation drafts allows determining the degree of the participation of these subjects of public administration in the law making firstly, by means of the implementation of the functions of the public control over the state (participation) and secondly, via the common discussion of the suggestions directed on the improvement of the adopted laws (collaboration).

In order to find the determining factors which influence most the implementation of the system of public administration in the regions of the Russian Federation the mathematical model of the assessment of the public administration was constructed [4].

For the construction of the model the contemporary mathematical methods of classification and prognostics based on the method of the “cross check” or “cross validation” were used [5].

In contrast to classical regression models working only on the use of the primary data the regularized regressions with a cross check allow using the constructed models using the new data which were not included into the calculation of the parameters of the model. As for the construction of a model a finite set of observations was used so their division many

times at random into the learning and testing parts with the help of the Python computer language allows getting a set of models of the dependence of the resulting and explanatory factors. The averaging of the results and the final mathematical model are made with the package scikit-learn.

In the research carried out earlier [4] the authors selected the explanatory factors of the model influencing the largest impact on the process of the creation of public administration. For a qualitative assessment of the explanatory factors the following indices were used.

The indices characterizing the resource factors are:

- share of the population with secondary vocational education and the share of the population with scientific degrees. The values of the given indices allow assessing the availability of expertise, knowledge and skills and also the preparedness of the citizens to communicate with the help of modern technical gadgets;

- income level necessary for the realization of the expenditures for net connections (incomes of the budgets of municipal regions and city districts per capita and nominal monthly wage calculated per 1 worker) determines the opportunities of the municipal authorities and the inhabitants of municipalities to invest into the communication process based on the use of contemporary information and communicative technologies;

- investment into the fixed capital per 10 000 of city population. This index characterizes the investment activity in the municipality which determines the conditions for a widened reproduction of fixed assets;

- expenses of organizations for net technologies characterize the readiness of the business starting to use modern information technologies for the communication.

Indices characterizing the institutional factors are:

- competitiveness of political elections (parliamentary competition). This index characterizes the degree of the domination of some political forces in legal or representative regional authorities. It is calculated as the percentage of ballots given for the party nominees and political movements minus the share of the nominees from the party winner [6, p. 153];

- voter turnout of citizens characterizing the inclusiveness of citizens into the elective process. The numeral value of the mentioned index is determined as a percentage of people who took part in the elections;

- participation of the citizens in the activity of public organizations is calculated as the number of public organizations per 10 000 people of a municipality and this allows assessing the preparedness of people to unite for the achievement of shared objectives.

The indices which characterize the infrastructural factors are:

- number of subscribers of the Internet allows determining the availability of technical opportunities of the citizens to have electronic communications;

- number of subscribers of the mobile Internet characterizes the most active part of the Internet users having the net communications via the mobile phones;

- intensity of use of the Internet by the organizations characterizes the use of the Internet communications by the businesses located in the municipality;

- presence in the organizations of the automatic data exchange between their own and external informational resources assesses the activity of the Internet communication in the organizations located in the municipality.

Let us set the matrix of the input data and express them in terms of an X (every line in it is the result of the observation of the explanatory factors in the regions and the municipalities of the Volgograd region and every column is the explanatory index) and the vector of the resulting values let us express in terms of Y . The goal of the classical regression [7] consists in the search of the vector "share" b^* :

$$b^* = \operatorname{argmin}_b |y - Xb|^2,$$

i.e. this is the vector minimizes the variation of the line combination of the explanatory attributes from the resulting variable. At an ordinary regression the best approximation of the educating data is made. This can lead to the retraining or to a mistake on the basis of new data. In order to avoid the retraining in the paper the contemporary methods of the calculation of coefficients for models are used. These methods are the so called "regulatory regression" or "regression with penalty" and ARD regression.

The regularization denotes that we look for not only a best approximation but also we take into account the structure of the vector b .

L1-regularized regression is usually called LASSO (Least Absolute Shrinkage and Selection Operator), and a L2 regularized is called a ridge regression. The combination of these two methods gives the model of an elastic net [5]. Both LASSO and a ridge regression give smaller values of coefficients upon the absolute value than the regression without a penalty. Herewith a part of coefficients turns out to be equal to zero what leads to the selection of attributes. In the library scikit-learn the classes Lasso for penalty L1 is used, Ridge for L2, ElasticNet for elastic net are used.

In the work the two basic penalties are used: L1 и L2 [5]. Penalty L1 was used for the optimization of the equation [1]:

$$b^* = \operatorname{argmin}_b \left(|y - Xb|^2 + \alpha \sum_k |b_k| \right)_{[1]}.$$

In case of penalty L2 the expression was optimized [2]:

$$b^* = \operatorname{argmin}_b \left(|y - Xb|^2 + \alpha \sum_k b_k^2 \right)_{[2]}.$$

For the study of the ratio “public discussion of the draft legislation in the Internet” which have the values 1 and 0, let us use the logical regression which is usually used in the classification problems [7]. Let us introduce into the analysis the probability of the fact that this index takes on the value equal to one $p=P(y=1)$.

Further when analyzing the logarithm of the relation of the chances (so called “logit”)

$$\ln\left(\frac{p}{1-p}\right),$$

we get a monotonous continuous function of “p”.

In order to get the value of “logit” by the method of the maximum likelihood analysis we select the coefficients “b” from the model of the linear regression Xb . We solve the equation $\ln\left(\frac{p}{1-p}\right) = Xb$

in respect to “p” and we get the prognostic values

$$p = (1 + \exp(-Xb))^{-1}.$$

The whole the procedure mentioned above is realized in the scikit-learn library of the Python language.

Also in the work the method of the Bayesian statistics ARD (Automatic Relevance Determination) is used. This method was suggested in 1992 by David MacKay [8]. In ARD for every coefficient a posterior assessment of the dispersion and then the coefficient with a small dispersion are set to zero. ARD is extremely complicated from the point of view of the calculation. In small data volumes (several dozens of observation) ARD works fast (fractions of a second) but it needs a huge volume of the short term memory.

Between the factors “Number of subscribers in the Internet” and “Number of subscribers of the mobile Internet” and also between “Business enterprises using the Internet” and the “Automatic exchange of data between their own and external information systems” a high correlation exists. The correlation is observed between the resource factors “Revenues of budgets of municipal districts and the city districts per capita” and “Expenditures of the organizations on net technologies”. That’s why for overcoming of problems of autocorrelation and of heteroscedasticity of regression residuals at the research we made the elimination of the explanatory variables.

The quantitative social and economic indices necessary for the solution of the model which characterize the resource, infrastructure, institutional and resulting factors of the public administration in cities and municipalities in the municipal regions of the Volgograd region were obtained from the statistical review “City districts and municipal regions of the Volgograd region” of the territorial organ of the federal service for state statistics in the Volgograd region for 2014-2016, from the data of the territorial organ of the federal service for state statistics in the Volgograd region about the distribution and the directions of use of informational and communicative technologies by the organizations of the Volgograd region, from the data of all Russian census of the population in 2010, from the data of the Electing Commission

of the Volgograd region and by means of the content analysis of the official sites of municipalities of the Volgograd region. The systematization and the structural classification of the statistical data characterizing the value of resource, infrastructural and institutional factors which determined the conditions of the implementation of the public administration in the cities and municipalities of the Volgograd region was carried out on the basis of the use of the developed theoretical model of the assessment of the realization of public administration [9].

III. RESULTS AND DISCUSSION

A. *On the basis of the qualitative assessment of the parameters of the model on the basis of the data of municipalities and city districts of the Volgograd region the following conclusions were made:*

- The most important impact on the resulting variable the “number of participants in the realization of the state purchasing policy” give the “participation of the citizens in the activity of non governmental organizations”, “number of the subscribers of the mobile Internet” and the “share of the population with scientific degrees” and also the “fiscal revenues of municipalities and city districts per capita”;
- The heaviest impact on the resulting variable “number of the organizations of territorial self government” have the ratio “participation of citizens in the activity of public organizations” and the “number of the subscribers of the mobile Internet”.
- The heaviest impact on the binary variable “public discussion of the draft legislation in the Internet” has the “revenues of the budgets of municipal regions and city districts per capita”.

B. *Analysis of the qualitative values selected in the process of the solution of a model allowed getting the following results [10]:*

- For the largest part of the municipal regions and city districts of the Volgograd region a considerably high educational level of population living in them is typical, i.e. the population has sufficient knowledge and skills for the participation in the decision making and the monitoring of the administrative decision connected with the use of the public resources. All the municipal regions and all the city districts, the expenses of the organizations on net technologies exceed 100 million rubles what provides the technical opportunity for the application by the business of the technologies of public administration. Unfortunately in three municipal regions the investments into the fixed capital exceed 1 billion rubles per 10 000 of population and in four municipal regions and in four city districts the revenues of municipal budgets exceed 1 billion rubles what allow drawing the conclusion about the fact that the biggest number of municipal regions of the Volgograd region do not have sufficient economic potential for the development of the technologies of

public administration. The average monthly earnings calculated per 1 worker in the largest part of municipal regions and in the half of city districts is lower than in average in the Volgograd region what negatively characterizes the economic potential of the region. The highest provision with the resources indispensable for the implementation of the technologies of public administration proves the efficiency of resource factors.

- The analysis of the infrastructural factors showed that in the municipal regions of the Volgograd region the most active Internet users are the businesses and in city districts it is the citizens (population). The leader upon the net subscribers in the region is the city district (Uryupinsk) for which a high value of all four indices of the infrastructural factors is typical. The leaders are also the municipal regions for which a high value of all three indices is typical: Kotelnikovskiy and Pallasovkiy regions.
- Practically all the municipal regions and city districts of the Volgograd region (excluding the Kumylzhenskiy, Nekhaevskiy regions and Uryupinsk) are characterized by a considerably high level of a parliamentary competition as more than one third in the representative bodies of municipalities has opposition parties. But unfortunately only in nine municipal regions the voter turnout for the elections makes up more than 50% what speaks about a low political activity of the inhabitants of the largest part of municipal districts and all the city districts of the Volgograd region. A low number of public organizations in municipal regions and city districts (except Chernyshkovskiy region, Volgograd and Volzhskiy) shows the unpreparedness of the cities to unite for the solution of common goals. Thus the analysis of institutional factors allows drawing the conclusion about a low enough quality of the institutional environment in the region what naturally becomes the limitation for the development of the public management.
- The qualitative analysis constructed on the basis of the selection of municipal regions and city districts in which the value of the indices of the resulting factors is maximal one and it allowed isolating the municipal regions of the Volgograd region with a higher degree of the introduction of technologies of public administration into the municipal management. It implies a high business activity at the participation in the state purchasing activity and it is typical of the following municipal regions and city districts of the Volgograd region which are shown according the decreasing activity: Olkhovskiy region, Nikolaevskiy region, Frolovo, Kotelnikovskiy region, Kamyshin, Mikhailovka, Uryupinsk, Kuyzhenskiy and Kikvidzenskiy regions. The inhabitants of the following municipal and city districts are ready to a greater extent to be organized and ready for taking the powers and the responsibility for managerial decisions: Kotelnikovskiy, Nekhaevskiy, Staropoltavskiy,

Rudnyanskiy, Kikvidzenskiy, Alekseevskiy, Kletskiy, Danilovskiy, Kamyshinskiy regions, Uryupinsk, Kalachyovskiy, Uryupinskiy, Olkhovskiy, Dubovskiy, Elanskiy and Svetloyarskiy regions. The use of all three basic technologies of the public management in the municipal administration is typical of the city district (Uryupinsk and Kotelnikiy municipal district) what is explained by the leadership of these municipalities upon the provision with resource (Kotelnikovskiy region) and infrastructure factors (Uryupinsk).

IV. CONCLUSION

For the creation of the innovative model of social and economic development of modern Russia it is indispensable to create the conditions before all at the level of regions and municipal districts at which the citizens and their associations and also business community can be included into the process of the administrative decision making by means of the system of public administration.

The monitoring of the values of the indices characterizing the condition of the factors institutionalizing the system of public management (resource, infrastructure, institutions) of explanatory factors and also the control of the indices which allow evaluating their impact on the realization of the public administration in the regions of Russia or resulting factors will contribute to the creation of these conditions

For the monitoring the authors developed the model of the assessment of the degree of the public management in municipalities of modern Russian regions which allows assessing the resource, institutional and infrastructural factors mainly influencing the resulting variables. For the solution of this task the methods of the mathematical statistics and contemporary methods of the machine training which allows constructing models of relations for a precise forecasting of the target variables for a number of factors were used. As the tool of the model construction and the analysis of the data the computer programming language Python and its library were used [4].

The results obtained in the course of the monitoring can be used for the development of target measures for the implementation of public administration in the Russian Federation what will ensure the growth of the efficiency of use of public resources at the expense of growth of the transparency of processes of the decision making and the implementation of decisions in the system of government and municipal administration and consequently will provide the prerequisites for the transition to an innovative model of the country development.

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