RISK FACTORS ASSESSMENT MODEL IN THE REGIONAL OPERATIONAL MANAGEMENT SYSTEM

V.V. Stepanova, Doctor of Economics, Full Professor
I.A. Sivobrova, Ph.D. in Economics, Associate Professor
A.V. Nikolaev, Senior Lecturer
Northern Arctic Federal University named after M.V. Lomonosov, Russia

The article defines the necessity of taking into account the impact of risk-factors on the socio-economic situation in the region while making operational management decisions. Authors bring attention to the risk-factors assessment model and calculation formulas describing aggregate indicators of individual risk-factors. Based on initial testing of the model it shows the results of risk assessment and general regional situation in five regions of the European North of Russia where negative development trends are traced and risk level rises.

Keywords: aggregated risk-factor indicator, risk-factors assessment model, regional operational management system, current socio-economic situation of the region.

Conference participants,
National championship in scientific analytics

Digital Object Identification: http://dx.doi.org/10.18007/gisap.ejm.v0i7.883

Functioning of countries and regions occurs in the acceleration of qualitative changes generated by interdependence, uneven development and intensification of competition between countries and regions. It increases the probability of negative trends in socio-economic development of territories.

Restrictive feature of manageability and stability of any socio-economic system is the uncertainty. All economic agents have to take quite serious decisions under risk and uncertainty. In order to make optimal decisions government should have a certain program of action reducing the risk not only at federal level but also at the level of regions and municipalities.

Assessment of regional risks impact on the territory sustainability should be implemented in operational management.

Complexity in the development of optimal model of regional risk management is defined by significant interregional differences in population, regional economy specialization, infrastructure development, socio-economic development level in general.

Various global institutions develop appropriate tools to respond to the manifestation of uncertainty in the functioning of socio-economic systems. But their systems of indicators are not universal and are the subject to serious changes and adaptation to diverse types of territorial systems.

Regional risks management should be based on the determination of basic blocks of the system:
- actual, target and forecasting indicators of regional risks;
- model analysis of regional risks: subject, object, influence;
- collection of information and data processing;
- regional risk management algorithm.

In general risk means the probability of some negative events entailing various types of losses [1]. Regional risks defined as the probability of occurrence of certain factors, conditions or trends that may have an impact on carried out economic activity and regional system functioning.

In general risk means the probability of some negative events entailing various types of losses [1]. Regional risks defined as the probability of occurrence of certain factors, conditions or trends that may have an impact on carried out economic activity and regional system functioning.

From the perspective of regional economic system of risk management can be defined as activities related to overcoming possible deviation of current socio-economic parameters under the influence of exogenous and endogenous factors of planned indicators claimed in regional development strategy. Under the risk in this model we understand «direction and factors forecasting the significant deterioration of socio-economic situation in regions of Russian Federations» [2].

To define the required set of indicators that characterizes risks of regional socio-economic development on the basis of which assessment model of regional risks will be based we will analyze the composition of economic, investment, business and social risks.

REGIONAL ECONOMIC RISK is the probability of occurrence of destructive processes in the regional economic system that reduce regional economic potential under the influence of changes in economic conditions and trends, living standards characteristics.

REGIONAL INVESTMENT RISK is the probability of occurrence of negative impact on investment activity in the region that characterizes qualitative and quantitative possible losses within the investment process reducing or increasing regional investment activity.

REGIONAL ENTREPRENEUR RISK is the probability of occurrence of adverse business conditions in the region caused by restrictions of economic freedom, violation of sustainable development of market relations and economic ties of businesses in the region.

REGIONAL SOCIAL RISK is the probability of occurrence of social crises in the region development manifested in the potential for deterioration in the quantitative characteristics of living standards.

On the base of proposed definitions of risks the main indicators of their assessment are identified and aggregated. General risk classification within the developed model of advanced management is shown on Picture 1.

In general risk means the probability of some negative events entailing various types of losses [1]. Regional risks defined as the probability of occurrence of certain factors, conditions or trends that may have an impact on carried out economic activity and regional system functioning.

Indicators measuring one or the other risk parameter of regional development can be varied depending on the purpose of achieved results.

The regional risk system represents a set of interconnected structural elements aimed to give general integral assessment of all risk factors of socio-economic development of the region (SEDR). In order to minimize the influence of individual risks on the region it is needed to consider the complexity of the system. Regional risk assessment and management is impossible without internal and external relationships of economic, investment, entrepreneur and social risks.
Underestimation of mutual regional risks influence may adversely affect on risk assessment and lead to uneffective management decisions.

General scheme of regional risk correlation in developed model of operational regional development is presented at Picture 2.

Economic-mathematical model of operational management of regional socio-economic development includes the following modules: input data module, analytical module of mathematical models and output data module.

Analytical module of mathematical models includes:
- SEDR Monitoring and Assessment Module on a certain date including the assessment and analysis of quantitative ties between regional development indicators;
- Short-term Forecasting Module on the basis of trends and linear regression functions;
- Module of Determining the Managerial Parameters (on specific date and forward-looking perspective);
- Region Differentiation Module by level and potential for development is built on the basis of the Monitoring Module;
- Region Differentiation Module allows to specify Regions Ranks submodule;
- Module for evaluation and analysis of Risk-factors for Socio-Economic Development of Regions;
- SEDR Assessment Module based on Risk-factors.

The structure of economic-mathematical model of operational management is shown on Picture 3.

System of modules interaction is designated by arrows which show data movement and analytical processing between modules. Input data come for processing to External Environmental Factors Module, SEDR Monitoring Module, Regions Ranks Module, Risk-factors Module.

Functional calculations of the Monitoring Module allow to determine managerial parameters, to build forecasting models as well as to differentiate regions and evaluate indicators of risk-factors.

Analysis of risk impact on the socio-economic development of regions is carried out by 12 risk-factors: industrial, management, poverty, unemployment, criminal, innovative, market, budget, credit, environmental, infrastructural, institutional.

Values of the twelve risk-factors received by data analysis are aggregated into the assessment of regional socio-economic development which takes into account risk-factors.

Complex assessment of current socio-economic situation of the region has 4 levels: «Normal», «Pre-crisis», «Crisis», «Collapse».

Complex assessment as itself is carried out by 12 aggregate indicators of risk-factors and their color indication which determine the appropriate level of risk for each region.

Each indicator can be one of three states:
- Good (green);
- Acceptable (yellow);
- Adverse (red).

Aggregated indicators of each risk-factor are calculated using formulas that include selected indicators of socio-economic development monitoring which can serve as signals of possible threats.

Methods of forming aggregate indicators of risk are based on recommendations identifying regulations of calculating target indicators and indices in State Program of Russian Federation «Regional policy and federative relations» [3].

Calculation of aggregate indicators is represented on example of three risk-factors: unemployment, credit risk and managerial risk.

The input data to calculate the risk of unemployment are:
- Total number of unemployed according to the ILO methodology (UnE);
− Number of workers needed for vacancies (W_Vac);
− Number of employees slated for liberation (E_Lib).
Assessment of risk of unemployment level in the region is based on the measurement of the corresponded risk-factor:

\[ R_{unemployment} = \left( \frac{UnE_{Wac}}{Wac_{2013}} \right) \times \left( \frac{Wac_{2013} + E_{Lib}}{Wac_{2012}} \right) \]

The input data to calculate the credit risk are:
− Overdue accounts payable of organizations (Over_AccPay);
− Overdue debt on loans for individuals in rubles (Over_DebtInd);
− Overdue debts of workers wages (Over_DebtWage);
− Average nominal monthly wages per employee (Wage_perE);
− Size of the economically active population (EAcP);
− Profit of profitable organizations (Pr).
Assessment of credit risk level in the region is based on the measurement of the corresponded risk-factor:

\[ R_{credit} = \frac{Over_{AccPay} + Over_{DebtInd} + Over_{DebtWage}}{Wage_{perE} \times EAcP + Pr} \]

The input data to calculate the managerial risk are:
− Foreign investments (ForInv);
− Volume of fixed capital investments (FCI);
− Dynamics of the official U.S. dollar exchange rate (USD);
− Share of loss-making enterprises and organizations except small businesses (LmE);
− Share of Russian Federation budget expenditures formed through targeted programs in total budget expenditures in fiscal year (BE_tpy).
Assessment of managerial risk level in the region is based on the measurement of the corresponded risk-factor:

\[ R_{managerial} = 0,2 \times \left( \frac{ForInv \times USD}{FCI} \right) + 0,4 \times LmE + 0,4 \times BE_tpy \]

Similarly indicators of eleven risk-factors for all regions of Russian Federation for the period 2009-2013 are calculated. They are based on statistical data with monthly and quarterly periodization. The assessment of institutional risk-factor is rather difficult only with statistical data so as there are no adequate monitoring indicators. Therefore it requires additional sociometric measurements to calculate institutional risk-factor.

The obtained results for five regions of Russian Federation (Arkhangelsk, Vologda and Murmansk regions, Republics of Karelia and Komi) in 2012 and 2013 are presented in Tables 1, 2.

Results of risk-factors assessment in years 2009-2013 carried out on a monthly basis are not encouraging. So the situation of socio-economic development of northern regions from late 2012 till the end of 2013 has deteriorated: in the

### Tab. 1. Assessment of risk-factors influence on socio-economical development, December, 2012

| Regions of Russian Federation | Poverty | Unemployment | Criminal | Innovative | Industrial | Managerial | Market | Budget | Credit | Ecological | Infrastructural | Status |
|------------------------------|---------|--------------|---------|------------|------------|------------|--------|--------|--------|------------|----------------|--------|
| Arkhangelsk Region          |         |              |         |            |            |            |        |        |        |            |                | Normal |
| Vologda Region              |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Murmansk Region             |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Republic of Karelia         |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Komi Republic               |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |

### Tab. 2. Assessment of risk-factors influence on socio-economical development, December, 2013

| Regions of Russian Federation | Poverty | Unemployment | Criminal | Innovative | Industrial | Managerial | Market | Budget | Credit | Ecological | Infrastructural | Status |
|------------------------------|---------|--------------|---------|------------|------------|------------|--------|--------|--------|------------|----------------|--------|
| Arkhangelsk Region          |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Vologda Region              |         |              |         |            |            |            |        |        |        |            |                | Crisis |
| Murmansk Region             |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Republic of Karelia         |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
| Komi Republic               |         |              |         |            |            |            |        |        |        |            |                | Pre-crisis |
Arkhangelsk region in 2012 assessment showed normal but at the end of 2013 rating has changed to «Pre-crisis». Vologda region assessment showed «Pre-crisis» in 2012 and «Crisis» in 2013. Wherein separate risk factors have changed for the better. For example, risk assessment of infrastructure in 4 of 5 regions of Russian Federation (except Arkhangelsk region) from a situation of «Crisis» went to «Pre-crisis».

Mechanism of regional risk matrices formation taking into account time characteristics (calculation in dynamics for several intervals) makes it possible to construct dynamic models which reflect the movement of region in the space of socio-economic risks.

Ultimately, scenario of crisis management of regional development and action plan of risk management activities could be developed on the basis of risk types, their level of influence on each other, sensitivity of complex index of regional risks to the changes of particular risk-factors, seriousness and impact level on the socio-economic processes.

Risk assessment and analysis of results allow to identify critical changes in internal and external environment of region development which may require the need to revise accepted administrative decisions and problem areas that should be given special attention. For example, in Arkhangelsk region such areas are labor market, innovative processes and infrastructure development.

References:
1. Lopatnikov L.I. Economic and mathematical dictionary: Dictionary of modern economics. – 5th ed., rev. and add. – Moscow., Delo, 2003. – 520 p.
2. On Approval the Requirements for the strategy of socio-economic development of regions of Russian Federation. Order of the Ministry of Regional Development of Russian Federation. February 27, 2007. No. 14. – URL: http://www.bestpravo.ru/rossijskoje/hu-zakony/k8r.htm
3. State Program of Russian Federation “Regional policy and federative relations”. – URL: http://www.gosprogrammy.gov.ru/Main/ClientBin/Passports/33/Государственная программа 2033.pdf

Information about authors:
1. Vera Stepanova - Doctor of Economics, Full Professor, Northern Arctic Federal University named after M.V. Lomonosov; address: Russia, Arkhangelsk city; e-mail: v.stepanova@narfu.ru
2. Irina Sivobrova - Ph.D. in Economics, Associate Professor, Northern Arctic Federal University named after M.V. Lomonosov; address: Russia, Arkhangelsk city; e-mail: v.stepanova@narfu.ru
3. Andrey Nikolaev - Senior Lecturer, Northern Arctic Federal University named after M.V. Lomonosov; address: Russia, Arkhangelsk city; e-mail: v.stepanova@narfu.ru