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**Article**

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METHODOLOGY

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# System of dynamic norms as a basis for sustainable development management of territories of innovative development

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## Abstract

The aim of the research is to develop a system of dynamic norms providing an assessment of the projects of territories of innovative development for the purposes of their control and management.

Using the functional approach we conducted a study of effective organization of territories of innovative development which is a subject of research. On the basis of selected its main functions we suggested the purposeful creation of the individual components that characterize its activities.

The study is based on the data of Russian Federation regions but this method can be freely transformed for other countries.

The system of indicators highlights in the work and comprehensively characterizes the territory of innovative development. It is the basis for the system of dynamic norms representing the ratio of main indicators growth.

The system allows to detect deviations from the target vector of development for a regional and individual economic subjects and it is used to manage the sustainable development of territory.

The need of sustainable development issues research due to objective conditions of limited resources, evidence-based cycles of economic growth and a number of other negative factors which together can become the reason of not achieving of objectives in project of creation of territory of innovative development.

In the study we showed the construction of the dynamic norms of main components of territories of innovative development for purposes of sustainable development identification. Each dynamic norm meets to function of territory of innovative development. The compliance of date to the etalon dynamic norm indicates the right vector of development to ensure its sustainability.

The study shows that the management at the regional level should be focused on addressing imbalances designed dynamic norms and provides specific activities that contribute to sustainable development of the territory.

**Keywords:** Dynamic norm, Territory of innovative development, Sustainable development, Innovation, R&D, Indicator, Growth rate

## Background

Currently high rates of economic growth will be possible only in case of gradual replacement of resource development vector on innovative one the priorities of which should be new prospective products and technologies. Under the conditions of

economic development' stagnation in the Russian Federation aggravated political and financial crisis the issues of import substitution, creation own competitive industries based on domestic research and development became fundamentally important.

According to modern research the most effective platform for implementing of innovative scenario are specifically dedicated regional areas called territories of innovative development (TIDs) which provide the possibility of implementation of full innovative cycle (Aksenova, 2013; Maltseva & Sukhanova, 2014; Ivanov, 2015).

In the author's papers the theoretical bases of creation of these territories were studied and main areas of activities creating conditions for the emergence of synergies from the mergers of innovative process' association in the same area were highlighted with the use of the functional approach.

In the author's interpretation outlined in earlier works (Maltseva, 2014a, 2014b, 2015), the key components of the TID were highlighted according to the stages of the innovation process at the regional level. Also the functions that are associated with system of indicators characterizing their implementation were highlighted.

The questions of effective development of TID are fundamentally important due to the fact that the projects of their creation in some cases are very expensive for the budget systems of different levels, requires mobilization of various types of limited resources. At the present stage besides concept and program of the implementation of TID' project the development of monitoring and control systems at the regional level that can ensure the ongoing development of TID as a socio-economic system in the direction of its predetermined vector is required.

The objective condition of limited resources, science-based cyclicity of economic growth and a number of other negative factors together may cause a failure of performance targets during the creation of TID that demands preventive work on issues of its implementation taking into account the factor of stability.

The issues of territory's sustainable development actively work out in modern scientific literature. Researchers proved the fact that the strategic planning of trend's equation of socio-economic systems and their progressive development commitment to the forward-looking long-term results and achievements are a basic priority for regional development.

The urgency of the issue of sustainable economy development consists of the fact that in conditions of limited resources it is impossible to fulfill the growing needs of humanity which can lead to an unstable state not only in the economic sphere but also in social, environmental and political sphere.

Zeinalov (2011) gave to the issue of sustainable development the global universal context. The meaning of Russia's transition to sustainable development is not so much in a balanced solution of political, economical, social and environmental problems as in the creation of a fundamentally new system of spiritual and moral values of society focused on the formation of the sphere of mind called the noosphere.

Bokarev et al. (2004) noted that the concept of sustainable development clearly shows that it has limits outlined the limited global resources of vital change of all parameters, mechanisms, laws and way of life of mankind. Assessment of the role and place of Russia's region from the perspective of sustainable development characterized by sustainable development of its economy while minimizing consumption of non-renewable

natural resources, their replacement by renewable and restoring resources to the level that necessary for the preservation of the environment in a stable condition.

According to Ursul and Romanovich (2003) the stability in a crisis situation is the survival and the achievement of progressive process in a future at least in major areas of life.

Dzhereshtieva (2010) says that the establishment of clearly defined strategic priorities of sustainable development taking into account local specifics will contribute to the definition of the motion vectors of region's economy with the assessment of successful pursuing goals. The currently objective need is creation of theoretical and methodological foundations of the management of sustainable region's development based on the experience taking into account available area's resource potential, structure of the economy, etc. which in addition to guiding the final and intermediate objectives should include reasonable use of appropriate tools for the implementation of the stated objectives, coherence all levels of government and economic entities on the controllable areas.

Thus, the study of the stability of TID developing the system of its assessment and recommendations to smoothing of development disparities caused by many objective and subjective factors is one of the top priorities in the issue of creation and further functioning of such territories.

The basis of TID's study as a sustainable socio-economic system should be a general scientific methodology of sustainable development as well as scientific and theoretical and methodological foundations of stability of meso-level economic entities. The author conducted a comprehensive theoretical study of the source base on sustainable development which was the basis for the design of own theoretical and methodological insights of problems of TID's sustainable development.

For the purposes of the study we made the analysis of literature on the problem of sustainable regional development.

Schleicher-Tappeser et al. (1997) published a study containing a comprehensive approach to sustainable regional development. They discussed about a concept of sustainability from different points of view (ecological, economical, sociological), methods, issues and implications of defining sustainable development.

From an economic perspective Driesen (2006) addressed the most important economic instruments of sustainable development which are price-based, quantity-based, and informational-based instruments. Price-based instruments fall into three basic categories: those offering negative incentives; positive incentives; or mixed incentives.

Zuindeau (2006) examined sustainable development by spatial approach and considered two challenges of equity and efficacy and tried to specify the variables that influence each of them in a spatial approach. He studied the following indicators: external sustainability, surplus sustainability, imported sustainability, financial compensation, territorial equity, efficacy of sustainable development policies. He highlighted the differences in treatment depending on the approach and also stressing the weaknesses.

Veisi et al. (2012) studied mechanisms and instruments of sustainable development. They used a descriptive survey research method to collect data from managers of seven government ministries. They found out that the rules and devices of public participation, voluntary environmental certification systems, scientific cooperation and education were all priorities for moving towards sustainable development. The results also

showed that institutional development, social capital and education, economic instruments for environmental protection, monitoring and informing, a clean development mechanism, and sustainable government are key means for encouraging sustainable development.

de Wit & Blignaut (2000) investigated why the capital-theory approach didn't adequately account sustainable development and tried to find out a different approach to sustainable development. de Wit & Blignaut compared the capital-theory approach and the integrative, dynamic approach to sustainable development and made the conclusion that neither the capital-theory approach nor an integrative, dynamic approach to sustainable development in itself provides an exclusive framework for approaching policy for sustainable development. Different approaches are useful in different cases depending on the purpose of an analysis on policy for sustainable development. But they highlighted that sustainable development can best be described as a complex, dynamic system. Therefore the dynamic approach has a number of advantages.

The basics listed above can be use for study of TID's problems but they needs in further specifications and transformations due to specific character of such territories.

## Methods

The essential characteristics of sustainable socio-economic system identified during terminological analysis are the system's abilities (Emas, 2015; Stoddart, 2011; Roberts, 2006; Konoplyanik, 2007; Deneviziuk, 2006; Krasnova, 2000; Basiago, 1995; Gale & Cordray, 1994; Khan, 1995; Nijkamp et al. 1992; Thierstein & Walser, 1997; Thierstein et al., 1997; Wilson, 2004): to maintain its integrity during the changes of external environment;

- to remain stable in spite of the internal and external influences on it;
- to return to equilibrium after a shock (the growing influence of external and internal environment);
- to provide movement along the selected path in spite of external disturbances;
- to ensure positive growth of targets;
- to deploy resources effectively;
- to eliminate the problems influenced on its development.

These features of stability ensure socio-economic systems by special characteristics which are very important for TID. So, in a rapidly changing external and unstable internal environment equilibration and ensuring movement along the selected path is the significant prerequisite for the effective implementation of TID's project.

According to studies exactly the lack of capacity to offset adverse external effects caused negative activity results of a number of large infrastructure projects. The growth of targets and increasing resources are important directions of TID's project which are also characteristics of sustainability.

For the goal of the research TID's stability as a condition of an area wherein the dynamic equilibrium preserves and the balanced progressive development of main subsystems (research, transfer-implementation, innovative, industrial, infrastructure, marketing, social and human capital) provides within the path of innovation-driven growth

and its constant saving in terms of internal and external impacts is proposed to determine.

The main objectives of TID's sustainable development are the growth of the target indicators of innovative development, preservation and increasing resources, achievement of a high quality social standard of population on this area.

Ensuring of sustainable development of any system must be based on the results of the analysis in which assessment of its current and retrospect sustainability had been made after which measures aimed at improving the system's stability will be developing.

One of the first evaluating systems of sustainability was D. Forrester's global dynamics model which became the basis for the famous forecast made by scientist in 1972 about the depletion of natural Earth resources in 75 years which requires the development of measures to control of population growth. Forrester's model is based on the following indicators: the world's population, fixed assets, the proportion of assets in agriculture, the level of pollution, the number of non-renewable natural resources. The rate of resources change was determined by the equations coefficient for which were found on the basis of the analysis of indicators dynamics for the period from 1900 to 1970.

Analysis of recent publications on the assessment of sustainable development allowed to identify the main approaches to formation of sustainability indicators that apply at the global level and serve as a guide in identifying the positions of countries and territory in the overall rankings.

Graymore et al. (2008) listed the following sustainability assessment methods (Table 1.)

Study on the stability of regional systems (territories) should be based on scientific methodology but, as shown above, it has its own specifics, i.e., a transformation of methodical approaches from macro- to meso-level which carried out the work of individual scientists and sustainability of the regional socio-economic systems specialists is required.

The study of recent publications showed that the most comprehensive analysis and systematization of existing methods and tools for sustainable regional development conducted in the work of Jinping et al. (2010) define the following groups of methods:

**Table 1** Sustainability assessment methods

Method	Description
Ecological footprint	This method propose to calculate the integral index, based on determination of the amount of land required to support the population's activities. (Wackernagel et al., 1993). The method used for the ecological footprint evaluation was described by Simpson et al. (1998).
Wellbeing assessment	This method was developed by the World Conservation Union (Guijt and Moiseev, 2001; Prescott-Allen, 2001). This is a method of assessing sustainability that gives people and the ecosystem equal weight. Wellbeing Assessment can be used at any level from municipality to the world.
Quality of life	Quality of life is measured in a variety of contexts, including such indicators as crime, participation in cultural and recreational activities, health, education, income, housing affordability, unemployment, water quality, air quality and amount of open space.
Ecosystem health	This method of assessing sustainability is similar to quality of life assessment, where conditions and trends measured by environmental indicators (air; land; inland water; coastal and marine systems; and ecosystem services) are used to measure ecosystem health.
Natural resource availability	The approach propose to use a group of single indicators that measure the amount of selected resources available in a region.

- Social-economic methods (Environmental and economic accounting, Input–output accounting, Human development index);
- ecological methods (Ecological footprint model, Emergy analysis, Relative carrying capacity of resources, Material flow analysis);
- systematic methods (Weighting method, Index system, Fuzzy mathematics, Statistical method, System dynamics, Spatial information technology, Grey system model);
- emerging methods (Nonlinear model, Linear combination model, Optimization algorithm).

The author conducted a comprehensive analysis of above approaches to the identification of the level of territory's sustainable development which are the basis of design of management system aimed at improving its level and the achievement of an optimal system's development with the available resources.

Statistical methods were accepted as the most appropriate for the purposes of this study. In some cases they are more labor intensive, yet provide the ability to monitor and control the parameters under study for sustainable development of territories. We propose to apply the methods of system dynamics because of the need to improve management of resistance in the dynamics.

Possibility to build more sophisticated methodological foundations of measuring sustainability of socio-economic systems provides by the theory of dynamic norms. This is approach to the evaluation of the actual operation mode based on the creation of a specific set of indicators regulatory arranged in dynamics relative to each other. The method was first proposed by Syroezhin (1980) to improve system of indicators of effectiveness and quality.

The theory of dynamic norms is based on principles of dynamic comparability and subordination of development indicators that is incomparable in the statistics characteristics of the economy became comparable in dynamic.

Revealing the essence of the theory, it is noted that there are two kinds of economic criterion – the static and the dynamic criterion. The static criterion involves a state to which the system should strive. A feature of solving problems of static criterion is that only at the last iteration one can obtain the optimal solution. The materialization of such decision in the actual economic reality is problematic because it is almost impossible to foresee all the options that arise in the course of economic activity in the model. In any case, during the construction of the model a number of processes have to be considered simplistic and some processes are not taken into account due to their excessive complexity or formalizability.

In turn, unlike the static characteristics, the dynamic criterions are much more complex in nature. They define the trends of the economic system showing at each moment the state to which it should aspire. One of the properties that distinguish the dynamic criterion from static criterion is a form of representation as dynamic vector which characterizes the state taken as a reference, the ideal. This condition determines the order or change the ratio of the parameters of functioning of the economic system in time. Each parameter reflects a process that occurs in the system in a certain plane that isolation from the structure of the economic system. In this regard, a set of parameters reflects the state of the structure of all the measurement time and at the same time

determines the mode in which the system is functioning optimally (Mazhazhikhov and Mishozhev, 2012).

Taking into account the heterogeneity of indicators it is difficult to make a comparison if we consider them as a static value. Dynamic reflects a certain order which is able to demand to the regime of activities and allows to act as a control value during ranking by rates of growth. The growth characteristics of the system in dynamic have some natural order and can be ranked and subordinated to each other (Deshina, 2009).

For the purposes of studying of the sustainable development the methodological approaches of the theory of dynamic norms were used in papers of Tretyakova (2014), Deshina (2009), Mazhazhikhov and Mishozhev (2012). Especially for purposes of TID's research the application of the method to the problem of strategic stability control of region which is designed by Zolotarev, et al. (2011) is interesting. We consistently put in and applied the algorithm for dynamic norms constructing on a concrete example of regional social and economic system:

1. Definition of indicators system on which base a dynamic norms will be formed.
2. The economic interpretation of the ratio of indicator's rate of growth.
3. Indicators ranking based on the correlation of rates of growth.

A graphical representation of dynamic norms can be a graph the arrows directions of which show the correlation between normative rates of indicators.

The study of real dynamic of investigated characteristics and the degree of its approximation to the standard is a source of information about the level of regional management as well as about the directions of management actions in order to enhance sustainable regional development.

The methodology also allows to determine the integral assessment index of conformity normative and actual development through rank correlation coefficients, i.e., it enables comparative analysis of similar socio-economic systems (regions, municipalities) and their ranking as well as studying the stability of a system over time.

Features of TIDs as meso-economy subjects not allow completely take advantage of some methodological approach as well as the diversity complexity and transformability of the theory of dynamic norms determined its choose as the most appropriate for the purpose of studying the stability of TID.

## **Results and discussion**

The set of dynamic norms will be a system of inequalities from growth rates of indexes of individual components of TID. As shown by theoretical studies the sustainable development of the area providing upon condition the rational use of resources, following predetermined path of development, growth of results and increasing the potential of TID. The ratios between indexes in dynamic norms are designed to ensure rapid area's growth, i.e. outstripping growth of performance indicators compared with an increase of consumed resources.

Each of the following dynamic norms describes some function within the allocated components of TID. Together the theoretical foundation and their structures that gave below create a system of inequalities characterizing stability of TID. Failure to follow certain ratios in most cases will not be critical herewith it indicates an insufficient



activity's effectiveness of the formation and development of TID and requires the development of specific measures aimed at achieving the stability of relations (Tables 2, 3, 4, 5, 6, 7, 8, 9).

#### **Function 1**

In the considered dynamic norm growth rate of the personnel's number occupied with researches and development on 10 000 population has to be the greatest indicator as personnel potential is the most significant not only in the field of basic scientific researches but also to provide a gain of all resultant indicators of TID. Human development is recognized dominant for innovative economy in view of the fact that a source of scientific and commercial effectiveness is the new knowledge as attribute is in most cases attached to its bearer who is the researcher.

The resultant indicators characterizing efficiency of basic scientific research are articles and patents. It is obvious that into the forefront quality of these results therefore the next according to the incremental amount has to be growth rate of an average impact-factor of articles published for the period. This indicator has to be higher than growth rate of number of articles published in the reviewed journals as otherwise researchers will be guided by a quantitative but not qualitative component of the conducted researches that finally will lead to research capacity's degradation of the territory.

In most cases the invention's creation which is the basis of the patent is more labor-intensive process, and their quantity can't exceed number of the published articles therefore on comparison with printing indicators of patent activity have a little smaller growth rates. In turn, the number of the taken-out patents for inventions has to have not smaller growth rate than number of patent applications that shows growth of inventive activity's efficiency.

Growth of number of the granted patents and articles in many respects is defined by quantity and qualitative structure of researchers, i.e. the researchers' number having an academic degree in fact is the indicator characterizing the resource capacity of the territory. Growth rate of number of researchers with academic degrees on 10,000 population has to be positive thus from positions of resource efficiency to be slightly lower than a key results' increase which are articles and patents, i.e. high-quality researchers' growth of the superior grading has to be provided.

Foreign patenting of development is carried out mainly by the organizations which are adjusted on development of the foreign markets i.e. is the additional indicator of high competitiveness of the patented innovations and the image characteristic of authors, thus complexity of procedure and its high cost don't allow to demand the advancing growth of quantity given foreign to the International Patent System applications counting on one researcher in comparison with the Russian patents. Need of ensuring steady growth of an indicator at a low annual gain is supposed.

Growth rate of number of the realized scientific directions is offered to designate as non-negative, the indicator characterizes diversification of researches that in some cases is necessary, and in others is excessive. More often for creation and development of TID is expedient to support the available specialization of science and production as cardinal change of a profile of activity can appear very expensive and risky action. The

**Table 2** Functions, scorecard and dynamic norms of the research component

Function	Scorecard	Dynamic norm
1. Organization of globally competitive fundamental researches that can provide the scientific foundation for actual applied researches	<p><i>Diversification of fundamental researches</i>The number of implemented scientific fields (H<sub>11</sub>)  <i>Staff sufficiency</i>The number of employees engaged in research and development per 10 000 of population (H<sub>12</sub>)  <i>Patent and publication activity</i>The number of researchers with scientific degree per 10 000 of population (H<sub>13</sub>)  <i>Patent activity</i>The number of patent applications for inventions per 1 researcher (H<sub>14</sub>)  <i>Patent activity</i>The number of granted patents for inventions per 1 researcher (H<sub>15</sub>)  <i>Patent activity</i>The number of foreign PCT-applications per 1 researcher (H<sub>16</sub>)  <i>Patent activity</i>The ratio of domestic expenditure on research and development to the number of granted patents (H<sub>17</sub>)  <i>Patent activity</i>The number of articles published in peer-reviewed journals per 10 researchers (H<sub>18</sub>)  <i>Patent activity</i>The average impact factor of articles published during the period (H<sub>19</sub>)</p>	<p>Gr (H<sub>12</sub>) &gt; Gr (H<sub>19</sub>) &gt; Gr (H<sub>18</sub>) &gt; Gr (H<sub>15</sub>) &gt; Gr (H<sub>14</sub>) &gt; Gr (H<sub>13</sub>) &gt; Gr (H<sub>16</sub>) &gt; Gr (H<sub>11</sub>) ≥ 1 &gt; Gr (H<sub>17</sub>)  <i>Gr -growth rate</i></p>
2. Creating of new technological solutions based on the results of applied research for priority economic activities of the country	<p><i>Diversification of applied researches</i>The number of areas in which R&amp;D are carried out (H<sub>21</sub>)  <i>Patent activity</i>The number of patent applications for utility model per 1 researcher (H<sub>22</sub>)  <i>Patent activity</i>The number of granted patents for utility model per 1 researcher (H<sub>23</sub>)  <i>The effectiveness of applied researches</i>The number of advanced industrial technologies per 1 organization that performs research and development (H<sub>24</sub>)</p>	<p>Gr (H<sub>24</sub>) &gt; Gr (H<sub>23</sub>) &gt; Gr (H<sub>22</sub>) &gt; Gr (H<sub>21</sub>) ≥ 1</p>
3. Ensuring of qualitative growth of research results in the board of territory	<p><i>The extent of research</i>The share of organizations designed research and development (H<sub>31</sub>)  <i>Financial security of researches</i>The share of allocations for science from the consolidated sub-federal region's budget in total expenditures (H<sub>32</sub>)  <i>Financial security of researches</i>The share of regional and local budgets in total expenditures on technological innovation (H<sub>33</sub>)  <i>Financial security of researches</i>The share of costs for fundamental and applied researches in the total amount of internal current costs on research and development (H<sub>34</sub>)  <i>The degree of relevance and innovative attractiveness of research and development</i>The share of high technology products corresponding with the priority development areas of science, technology and engineering of the Russian Federation in the total production (H<sub>35</sub>)  <i>The degree of relevance and innovative attractiveness of research and development</i>The share of research and development carried out in the framework of federal and regional programs results of which meet or exceed the world level in their total volume (H<sub>36</sub>)  <i>Equipment security</i>Capital-labor ratio of employees engaged in research and development (H<sub>37</sub>)  <i>Equipment security</i>The cost of scientific equipment in the centers of collective using (H<sub>38</sub>)</p>	<p>Gr (H<sub>36</sub>) &gt; Gr (H<sub>35</sub>) &gt; Gr (H<sub>32</sub>) &gt; Gr (H<sub>38</sub>) &gt; Gr (H<sub>37</sub>) &gt; Gr (H<sub>33</sub>) &gt; Gr (H<sub>31</sub>) &gt; Gr (H<sub>34</sub>) &gt; 1</p>

last in the standard is an indicator which rate of a gain for TID's sustainability has to be negative which is the attitude of internal costs for scientific researches and development towards to the number of the granted patents. Decrease in a ratio of costs of the conducted R&D and their productivity is an important factor of efficiency of scientific activity and as a result of stability growth of TID.

**Function 2**

The growth of all indicators of group has to be positive for ensuring of TID's sustainability, thus, using the mentioned above logic of ensuring the advancing growth of results in comparison with the consumed resources. It's represented that the greatest value in the dynamic standard has to have the indicator of number of advanced industrial technologies per 1 organization that performs research and development. This

**Table 3** Functions, scorecard and dynamic norms of the transfer and implementation component

Function	Scorecard	Dynamic norm
1. Creation and support of system of focused concentrated inflow of advanced technologies and scientific and technical solutions from external and internal sources	<i>The level of concentration of innovation's inflow from domestic sources</i> The share of scientific and technical products (works, services) in total output (T <sub>11</sub> )The number of innovative projects of incubation and post-incubation period (T <sub>12</sub> )The share of research and development designed by educational institutions of higher education, research organizations (T <sub>13</sub> ) <i>The concentration's level of the innovations inflow from external sources</i> The share of technology and technical services' import in its overall value (T <sub>14</sub> )	Gr (T <sub>12</sub> ) > Gr (T <sub>11</sub> ) > Gr (T <sub>14</sub> ) > Gr (T <sub>13</sub> ) > 1
2. Organization of implementation of new technologies and products design in the producing sector of an area	<i>The intensity of innovation</i> Internal costs on research and development in the turnover of enterprises and organizations (T <sub>21</sub> )The number of used advanced industrial technologies average revenue per organization (T <sub>22</sub> )The ratio of technological demands of enterprises and organizations in the region which are completely satisfied (T <sub>23</sub> ) <i>The effectiveness of innovation</i> Increase of production of new and improved high-tech products through the application of created advanced technologies (T <sub>24</sub> )	Gr (T <sub>21</sub> ) > Gr (T <sub>23</sub> ) > Gr (T <sub>24</sub> ) > Gr (T <sub>22</sub> ) > 1
3. Comprehensive support of commercialization process of applied researches results by created innovative companies	<i>Innovative infrastructure's development</i> The number of innovative infrastructure's organizations (T <sub>31</sub> )The share of innovative infrastructure's organizations in the total number of innovative active organizations (T <sub>32</sub> ) <i>The effectiveness of the innovation infrastructure</i> The volume of innovative products, created and implemented with the assistance of the innovative infrastructure's facilities in the total volume of innovative products sold (T <sub>33</sub> )	Gr (T <sub>33</sub> ) > Gr (T <sub>31</sub> ) > Gr (T <sub>32</sub> ) > 1
4. Creation and ensuring the functioning technological exchange system inside the territory and with external stakeholder environment with priority of technology's export over import	<i>The effectiveness of the system of technological exchange</i> The ratio of advanced created industrial technologies to used technologies (T <sub>41</sub> )The ratio of export and import of technology and technical services (T <sub>42</sub> ) <i>Development level of co-operation</i> The number of joint R&D of companies and organizations of academic, university, industrial science, aimed at creating breakthrough areas of scientific and technological development (T <sub>43</sub> )The share of organizations conducting joint research and development projects in the total number of innovative active organizations (T <sub>44</sub> )	Gr (T <sub>43</sub> ) > Gr (T <sub>42</sub> ) > Gr (T <sub>44</sub> ) > 1 > Gr (T <sub>41</sub> )
5. Creation of conditions for faster implementation of new products and services	<i>The level of financial support of innovation</i> Expenditures on research and development per 1 employee (T <sub>51</sub> )The ratio of domestic expenditures on research and development to investments in fixed assets (T <sub>52</sub> ) <i>The intensity of the development of innovations</i> The average time of innovation's introduction (T <sub>53</sub> ) <i>The impact of created conditions on the possibility of innovative activity development</i> The index of business confidence of innovative active organizations (T <sub>54</sub> )	Gr (T <sub>51</sub> ) > Gr (T <sub>52</sub> ) > Gr (T <sub>54</sub> ) > 1 > Gr (T <sub>53</sub> )
6. Ensuring the investment's inflow into the development of innovative activity of the economy' subjects of territory	<i>The level of development of investment activity</i> Investments in fixed capital per capita (T <sub>61</sub> )The index of physical quantity of investment in fixed assets (T <sub>62</sub> )The average rate of return on investment for region's economy (T <sub>63</sub> ) <i>The level of development of investment in research and development</i> The share of extra-budgetary funds in the cost of research and development (T <sub>64</sub> )The ratio of internal expenditures on research and development to investments in fixed assets (T <sub>65</sub> )The ratio of expenditure on technological innovation to investments in fixed assets (T <sub>66</sub> ) <i>The level of attractiveness for foreign investors</i> The share of foreign investment in its overall value (T <sub>67</sub> )The amount of finance from foreign sources to the total amount of internal expenditures on research and development (T <sub>68</sub> )	Gr (T <sub>63</sub> ) > Gr (T <sub>61</sub> ) > Gr (T <sub>62</sub> ) > Gr (T <sub>65</sub> ) > Gr (T <sub>66</sub> ) > Gr (T <sub>64</sub> ) > Gr (T <sub>68</sub> ) > Gr (T <sub>67</sub> ) > 1

indicator being dominant result of applied scientific researches has to grow quicker than the indicator of the granted patents and a number's indicator of patent demands, and growth rate of the first indicator has to be not less, than the second that will

**Table 4** Functions, scorecard and dynamic norms of the industrial component

Function	Scorecard	Dynamic norm
1. Promotion the development of material and technical base of industrial companies, the flow of new technology, high-tech equipment	<i>The level of costs for the development of material and technical base</i> The average value of costs on technological innovation per 1 organization (P <sub>11</sub> ) <i>The costs of information and communication technologies per 1 organization</i> (P <sub>12</sub> ) <i>The level of development of ICT</i> The share of organizations used information and communication technologies (P <sub>13</sub> ) <i>The share of organizations with web site</i> (P <sub>14</sub> ) <i>The number of personal computers per 100 employees</i> (P <sub>15</sub> ) <i>The degree of renewal of material and technical base</i> The coefficient of renewal of fixed assets (P <sub>16</sub> ) <i>Efficiency of material and technical base using</i> Capital productivity (P <sub>17</sub> ) <i>The level of average industrial capacity using in innovative active organizations</i> (P <sub>18</sub> )	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) > Gr (P <sub>18</sub> ) > Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) > Gr (P <sub>15</sub> ) > Gr (P <sub>14</sub> ) > 1
2. The organization and development of efficient production based on advanced technology solutions	<i>Quantitative characteristics of enterprises and organizations</i> The grow of number of enterprises and organizations (P <sub>21</sub> ) <i>The share of innovative active organizations in its total number</i> (P <sub>22</sub> ) <i>The effectiveness of innovation-active companies</i> The volume of innovative products, works and services per capita (P <sub>23</sub> ) <i>The ratio of the volume of innovative products and imports</i> (P <sub>24</sub> ) <i>Profitability of innovative products sales</i> (P <sub>25</sub> )	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) > Gr (P <sub>24</sub> ) > Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) > 1
3. Ensuring companies competitiveness growth within the territory	<i>Efficiency level of companies</i> The share of profitable organizations (P <sub>31</sub> ) <i>The labor productivity</i> (P <sub>32</sub> ) <i>The level of innovative products competitiveness</i> The share of sales of innovative products and services outside the region in its total volume (P <sub>33</sub> ) <i>The share of exports of innovative products and services in the total value of exports</i> (P <sub>34</sub> ) <i>The impact of innovations on company's efficiency</i> The share of companies in which innovations caused a significant reduction in labor costs (P <sub>35</sub> ) <i>The share of companies in which innovations have significantly reduced material and energy consumption</i> (P <sub>36</sub> )	Gr (P <sub>32</sub> ) > Gr (P <sub>31</sub> ) > Gr (P <sub>33</sub> ) > Gr (P <sub>34</sub> ) > Gr (P <sub>36</sub> ) > Gr (P <sub>35</sub> ) > 1

provide an efficiency's growth of inventive activity: the great share of the submitted applications will complete with receiving of the patent.

As it was shown above, diversification of the scientific directions isn't always justified but in most cases reduction of their quantity testifies to negative processes in system of scientific researches of the territory. It is advisable that the number's increase of the research and development directions in TID for ensuring its stability was non-negative.

**Function 3**

Growth rate of share of research and development carried out in the framework of federal and regional programs results of which meet or exceed the world level in their total volume has to be the highest in this dynamic norm because the sustainable development of the territory of innovative development is possible only with a growth of the researches and development corresponding to world level and the maximum

**Table 5** Functions, scorecard and dynamic norms of the infrastructure component

Function	Scorecard	Dynamic norm
Creation of an advanced infrastructure for effective smooth functioning of economic entities of territory	<i>The level of development of energy infrastructure</i> Production and distribution of electricity, gas and water per 1 people (I <sub>11</sub> ) <i>The level of development of transport infrastructure</i> The density of public railways (I <sub>12</sub> ) <i>The density of public hard-surface roads</i> (I <sub>13</sub> ) <i>The share of hard-surface roads in a total length of public roads</i> (I <sub>14</sub> ) <i>The level of development of information infrastructure</i> The length of the fiber-optic data networks (I <sub>15</sub> )	Gr (I <sub>11</sub> ) > Gr (I <sub>13</sub> ) > Gr (I <sub>12</sub> ) > Gr (I <sub>15</sub> ) > Gr (I <sub>14</sub> ) > 1

**Table 6** Functions, scorecard and dynamic norms of the human capital component

Function	Scorecard	Dynamic norm
1. Depopulation reducing, maintaining of demographic and labor resources	<i>Availability of demographic resources</i> The rate of natural increase (decrease) of the population (C <sub>11</sub> ) <i>Availability of labor force</i> Dependency ratio (C <sub>12</sub> )The share of the economically active population in the total population (C <sub>13</sub> ) <i>Employment rate</i> The ratio of the average annual number of employed in the economy to economically active population (C <sub>14</sub> )	Gr (C <sub>14</sub> ) > Gr (C <sub>13</sub> ) > Gr (C <sub>11</sub> ) > 1 > Gr (C <sub>12</sub> )
2. Creation the conditions for the total qualitative growth of the human capital	<i>The level of costs for the development of human capital</i> The costs for education per 1 person (C <sub>21</sub> ) <i>The share of costs for education in the consolidated budget</i> (C <sub>22</sub> ) <i>The level of development of qualified personnel training system</i> Graduating of specialists with higher education per 10 000 population (C <sub>23</sub> ) <i>The share of organizations training graduate students</i> (C <sub>24</sub> ) <i>The ratio of university graduates and post-graduates students</i> (C <sub>25</sub> ) <i>The level of qualified personnel</i> The share of population with higher education in the economically active population (C <sub>26</sub> )	Gr (C <sub>26</sub> ) > Gr (C <sub>23</sub> ) > Gr (C <sub>25</sub> ) > Gr (C <sub>21</sub> ) > Gr (C <sub>22</sub> ) > Gr (C <sub>24</sub> ) > 1
3. Providing targeted inflow of qualified professionals	<i>Characteristics of inflow of qualified professionals</i> (C <sub>31</sub> ) <i>The share of researchers among arrivals to the region</i> (C <sub>32</sub> ) <i>The share of candidates of science and doctors of science among arrivals to the region</i> (C <sub>33</sub> ) <i>The degree of involvement of youth in science</i> The ratio of persons under 39 years among researchers (C <sub>34</sub> ) <i>The average age of researchers</i> (C <sub>35</sub> ) <i>Characteristics of created conditions for the inflow of researchers</i> The ratio of the average monthly salary of researchers to the average monthly salary in the economy (C <sub>36</sub> )	Gr (C <sub>34</sub> ) > Gr (C <sub>36</sub> ) > Gr (C <sub>32</sub> ) > Gr (C <sub>33</sub> ) > Gr (C <sub>31</sub> ) > 1 > Gr (C <sub>35</sub> )
4. Development of interregional and international relations for the qualitative development of the human capital of territory, advanced training in the framework of "education throughout life" concept	<i>The level of development of "education throughout life" system</i> Capture rate by systems of continual education per 100 people aged 25–64 (C <sub>41</sub> ) <i>Average period of education</i> (C <sub>42</sub> ) <i>The level of development of career development system</i> The share of workers received professional training or improved their skills in their total amount (C <sub>43</sub> ) <i>The number of organizations providing professional training and retraining for their own staff</i> (C <sub>44</sub> ) <i>The level of interregional and international mobility</i> The share of professionals improved their skills outside the region in their total amount (C <sub>45</sub> ) <i>The number of foreign training on an average per 1 innovative active organization</i> (C <sub>46</sub> )	Gr (C <sub>41</sub> ) > Gr (C <sub>42</sub> ) > Gr (C <sub>43</sub> ) > Gr (C <sub>44</sub> ) > Gr (C <sub>45</sub> ) > 1 > Gr (C <sub>46</sub> )

**Table 7** Functions, scorecard and dynamic norms of the marketing component<sup>a</sup>

Function	Scorecard	Dynamic norm
1. Creation and development of an efficient market of technologies and intellectual capital within the territory and complex assistance to the promotion of market outlet of innovative products and services of industrial sector of territory	<i>The level of development of the innovative products' market</i> The share of innovative products in the total volume of shipped products (M <sub>11</sub> ) <i>The level of development of the technology market</i> The number of concluded license agreements (M <sub>12</sub> ) <i>The number of implemented technological innovation</i> (M <sub>13</sub> ) <i>The level of development of the venture capital market</i> The number of venture capital transactions (M <sub>14</sub> ) <i>The volume of venture capital investments in its overall value</i> (M <sub>15</sub> )	Gr (M <sub>13</sub> ) > Gr (M <sub>12</sub> ) > Gr (M <sub>11</sub> ) > Gr (M <sub>16</sub> ) > Gr (M <sub>14</sub> ) > Gr (M <sub>15</sub> ) > Gr (M <sub>17</sub> ) > 1
2. Complex assistance to promote the development of market outlets of innovative products and services of the manufacturing sector of territory	The share of organizations engaged in non-technological innovation in the total number of organizations (M <sub>16</sub> ) The number of regional innovation forums, exhibitions, fairs (M <sub>17</sub> )	

<sup>a</sup>Due to the limited number of quantitative indicators the dynamic norm creates on two functions of marketing components at once

**Table 8** Functions, scorecard and dynamic norms of the social component

Function	Scorecard	Dynamic norm
1. Increasing employment of population and the average wage	<i>The income level of the population</i> The average income of the population (S <sub>11</sub> ) <i>The Gini coefficient</i> (S <sub>12</sub> ) <i>Employment rate</i> The unemployment rate (S <sub>13</sub> ) <i>The share of created new jobs in its total number</i> (S <sub>14</sub> )	Gr (S <sub>11</sub> ) > Gr (S <sub>14</sub> ) > 1 > Gr (S <sub>12</sub> ) > Gr (S <sub>13</sub> )
2. Ensuring the growth of quality life of population of the territory	<i>Level of health protection</i> Life expectancy at birth (S <sub>21</sub> ) <i>Maternal mortality</i> (S <sub>22</sub> ) <i>Sufficiency of health care institutions</i> (S <sub>23</sub> ) <i>Level of life of population</i> The gross regional product per capita (S <sub>24</sub> ) <i>The consumer price index</i> (S <sub>25</sub> ) <i>The ratio of average income to the subsistence minimum</i> (S <sub>26</sub> ) <i>Security Level</i> The number of registered crimes (S <sub>27</sub> ) <i>Fixed capital investments aimed at environmental protection and rational use of natural resources</i> (S <sub>28</sub> )	Gr (S <sub>24</sub> ) > Gr (S <sub>26</sub> ) > Gr (S <sub>28</sub> ) > Gr (S <sub>23</sub> ) > Gr (S <sub>21</sub> ) > Gr (S <sub>25</sub> ) > 1 > Gr (S <sub>22</sub> ) > Gr (S <sub>27</sub> )

involvement in innovative process of subjects of the region’s microeconomics. This indicator characterizes results of the scientific researches realized in the territory of TID in a greatest extent.

Increase of R&D share will promote to growth of the knowledge-intensive production’s share as one of main results of TID, increase of the indicator defining its share has to be second-largest in the norm.

Basic source of means for development of fundamental and applied science are budget funds, thus regional budgets can purposefully finance R&D with most acutely a need in the region.

As a result, share of allocations for science from the consolidated sub-federal region’s budget in total expenditures takes a following place in the norm.

The important aspect of fundamental and applied R&D is sufficiency of the equipment, so indicators of increase of an equipment-reserve’s of workers and the cost of the equipment of the centers of collective use are significant.

**Table 9** Dynamic norms of industrial component on regions of the Russian Federation

Region	Function 1		Function 2	
	2012	2013	2012	2013
Republic of Tatarstan	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) < Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) < Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) > 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) < 1
Samara region	Gr (P <sub>17</sub> ) < Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) > Gr (P <sub>14</sub> ) < 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) > Gr (P <sub>14</sub> ) < 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) > 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) < 1
Nizhny Novgorod region	Gr (P <sub>17</sub> ) < Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) < Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) > 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) < 1
Tomsk region	Gr (P <sub>17</sub> ) < Gr (P <sub>11</sub> ) < Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) > Gr (P <sub>14</sub> ) < 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) < 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) < Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) < 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) < 1
Krasnodar region	Gr (P <sub>17</sub> ) < Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) < Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) > Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) < Gr (P <sub>22</sub> ) > Gr (P <sub>21</sub> ) < 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) < Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) < 1
Moscow region	Gr (P <sub>17</sub> ) < Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) > Gr (P <sub>16</sub> ) < Gr (P <sub>13</sub> ) < Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>17</sub> ) > Gr (P <sub>11</sub> ) > Gr (P <sub>12</sub> ) < Gr (P <sub>16</sub> ) > Gr (P <sub>13</sub> ) > Gr (P <sub>15</sub> ) < Gr (P <sub>14</sub> ) > 1	Gr (P <sub>25</sub> ) > Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) > 1	Gr (P <sub>25</sub> ) < Gr (P <sub>23</sub> ) > Gr (P <sub>22</sub> ) < Gr (P <sub>21</sub> ) < 1

Taking into account dominant condition of the growth employees engaged in research and development growth rate of the scientific equipment's cost in the centers of collective use has to exceed growth rate of equipment-reserve of workers that is traced in the dynamic norm.

The following in the dynamic norm is growth rate of the share of regional and local budgets in total expenditures on technological innovation. Its positions are defined by those that the incurred expenses not always provide necessary result, thus the indicator of expenses characterizes the enclosed resources in development of innovative activity, i.e. its positive increase is necessary but for ensuring of intensive growth of the territory it has to be slightly lower than an increase of the received results.

The indicator of the share of organizations designed research and development has to possess the smaller growth rate that is caused due to the relative arbitrariness of the selection of organizations as actors in the economy, possibility of their rather quickly reorganization, thus involvement of greater amount of companies into innovative activity is important development's criteria of TID.

The last place in the norm is taken by growth rate of the share of costs for fundamental and applied researches in the total amount of internal current costs on research and development because the significant increase of the specified indicator can lower other important structural elements of expenses and finally have an adverse effect on innovative development of the territory.

#### **Function 1**

In this dynamic norm the greatest growth rate is the number of innovative projects of incubation and post-incubation period that is connected with an accurate quantitative orientation of the indicator. Other indicators in group belong to indexes of structure, i.e. dynamics of their growth generally isn't comparable to it. Indexes' share of scientific and technical products in total production as the most significant results has to possess the greatest growth rate from structural indicators. The scientific and technical products are a source of innovative projects.

The share of technology and technical services' import in its overall value has to grow providing thereby the surge of scientific and technical decisions from the outside. For the purposes of efficiency, independence and sustainability of TID the most significant source of innovative projects have to be own development created in the region thus import of technologies in some cases is a source of a benchmarking or promotes a diversification of activities. Occasionally it is the unique method of the separate specific tasks of large regional projects. The growth rate of an indicator has to be reasonably positive.

The share of research and development designed by educational institutions of higher education, research organizations has to have rather smaller positive growth rate. Its increase characterizes growth of an involvement of scientific and educational sector into innovative activity that has to create prerequisites of scientific level's increase of the realized innovations and also high security with qualified personnel. Thus, the considerable growth rate of an indicator will testify to decrease of the activity in the sphere of researches and development of real sector of economy and it is inexpedient.

**Function 2**

As well as in the previous case, the dynamic norm is constructed in such a way that the greatest growth rate provides volume but only then structural indicators. The implementation's result of new technologies and products in many respects depends on the size of the used resources, i.e. on that, how many resources are spent for R&D. Therefore, the most significant in the dynamic norm is the indicator of internal costs on research and development in the turnover of enterprises and organizations.

Among structural indicators the greatest is the growth rate of specific weight of technological inquiries of the enterprises and organizations of the region satisfied in full. Debugged system of the research organizations' interaction with real sector of economy, a demand of the proposed scientific and technical solutions allows creating effectively working structure of an innovative orientation within the certain territory which is the simulated TID. Satisfaction's possibility of inquiries of real sector of economy by forces of the research organizations located in the territory of the region characterizes extent of TID's development as harmonious social and economic system thus moderate growth as well as for other indicators of structure is expedient. By achievement of an indicator of the value equal or close to 100 %, its exception from system is possible.

The growth rate of production has to be carried out by the advancing rates in comparison with quantitative characteristics of the introduced advanced technologies. Such ratio will characterize their effective use and to provide the intensive growth therefore a growth's indicator of new and advanced high-tech production's output due to application of the created advanced technologies has to exceed a growth rate of number of used advanced industrial technologies average revenue per organization.

**Function 3**

The highest in the dynamic norm is growth rate of the volume of innovative production created and realized with assistance of innovative infrastructure's objects to the total amount of the realized innovative production. This indicator characterizes innovative infrastructure from positions of its productivity in the region. The indicator determining the capacity of the region is the number of innovative infrastructure's organizations. Growth rates in the dynamic norm are placed in such way that growth of the organizations of innovative infrastructure below growth rates of the innovative production received within their activity, i.e. the increasing results can be received within each created object. Thus, growth rate of a share of innovative infrastructure's organizations in total number of innovative active organizations has to be slightly lower as significant increase in an indicator attracts decrease in a share of other types of innovative active organizations which are the actual generators of innovations.

**Function 4**

The greatest value in the norm occupies an indicator of number of joint R&D of companies and organizations of academic, university, industrial science, aimed at creating breakthrough areas of scientific and technological development as high growth rate of this indicator will provide effective functioning of the innovative sphere in the region and shows innovative activity of subjects of economy.



In the norm the indicator of ratio of export and import of technology and technical services has to have smaller growth rate. The positive growth rate of an indicator will testify to gradual replacement of import technological decisions in the innovative sphere and to expansion of a conclusion of own innovative products to the foreign markets. Thus too high growth rate of this indicator will lead to considerable decrease in import of technologies and services, and refusal of it will counteract surge of advanced technologies and to reduce possibilities of an effective benchmarking.

The lowest positive growth rate has to have an indicator of share of organizations conducting joint research and development projects in the total number of innovative active organizations so it is a structural indicator and in the most general case assumes moderate dynamics, thus realization and promotion of joint projects in the scientific and production environment is the important but not defining factor of sustainable innovative development.

The indicator of ratio of the created advanced production technologies towards the used has to be negative otherwise the condition of intensive growth won't be met: the amount of the created technologies will exceed the introduced in practical activities, i.e. the increase in technologies unclaimed by real sector of economy will be observed.

#### **Function 5**

In the dynamic norm the greatest value has to occupy growth rate of the expenditures on research and development per 1 employee because it is one of the generalizing indicators characterized used resources that not in full measure but defines future result of innovative activity.

A little smaller growth rate has to have indicator of the ratio of domestic expenditures on research and development to investments in fixed assets. In case of significant growth of indicator the advancing growth of internal researches and development in comparison with investments into fixed capital will be provided that on average for TID will mean relative reduction of business assets that finally will have an adverse effect on development production components. The smaller value in the norm index of business confidence of innovative active organizations occupies because the indicator is comparative and is designed on the expected data obtained from the enterprises and the organizations i.e. can describe insufficiently precisely the actual trends in the innovative sphere.

Negative growth rate has to have an indicator of average time of innovation's introduction as this indicator more than more slowly development of new types of production and services.

#### **Function 6**

The basic place in the dynamic norm is allocated for average rate of return on investment for region's economy as it reflects efficiency of investments to the innovative sphere. The following important indicator is investments into fixed capital per capita as its growth provides development of infrastructure of the territory's innovative activity.

Further an indicator of an index of physical quantity of investment in fixed assets is expedient to enter because it also characterizes investment activity in the region but thus it is comparative that in most cases provides a lower growth.

The ratio of internal expenditures on research and development to investments in fixed assets has to grow slowly because such great growth rate will testify to relative reduction of investments that finally will influence on infrastructure's development and business assets of the innovative companies.

The ratio of expenditure on technological innovation to investments in fixed assets have to grow with lower speed because of need of the advancing increase in researches and development in comparison with the technological innovations created on their basis.

A growth rate of share of extra-budgetary funds in the cost of research and development can't be very high because a number of the scientific researches' direction can be financed only by the state. Besides, business structures most often finance researches on stages of research and technological development or implementation, i.e. growth of this indicator is very important for TID's development but it can be only reasonable owing to the objective reasons.

Growth rate of amount of finance from foreign sources to the total amount of internal expenditures on research and development has to exceed growth rate of share of foreign investment in its overall value that is caused by considerable characteristics of indicators, and also higher role of costs of R&D for TID's development. Thus, very high growth rate of indicators will testify growth of the TID's dependence from foreign investments therefore indicators have to take the last positions in the dynamic norm.

#### **Function 1**

The major indicator in the norm is capital productivity as relate to efficiency's indicators and characterizes return from an employment of the fixed business assets, i.e. it has to grow the advancing rates in comparison with indicators of resources and the incurred expenses.

Resource indicators which include the average size of technological innovations' costs are necessary for development of innovative activity but their influence on result has probabilistic character. It causes an indicator place in the dynamic norm. Thus, the probability of successful realization of an innovation increases with a growth of expenses.

The modern economy is based on the advanced information technologies, therefore widespread introduction of information and communication technologies to all spheres which is the most important condition of innovations' development. The following in the norm is the indicator of costs of information and communication technologies on an average per 1 organization.

Further place in the norm is allocated for the level of average industrial capacity using in innovative active organizations which represents an indicator of structure, i.e. its growth rate has to be provided with rather lower rates in comparison with indicators of resources. Thus positive dynamics of capacity's utilization is one of the most significant indicators of development production components. It is known that the in fuller measure capacity is used the volume of production and its prime cost is lower that in shorter terms the producer accumulates means for reproduction of production and improvement of the most production system: replacements of the equipment and technologies, reconstruction's implementation of production and organizational and technical innovations.

In a way lower growth rate has to correspond to dynamics of coefficient of updating of fixed assets in view of the fact that innovative activity assumes regular updating of capacities according to the changing technological decisions and according to requirements of the competition thus their input has to be accurately reasonable as demands capital investments but objectively conducts to decrease in use of already available equipment.

The indicators of the organizations used information and communication technologies, numbers of personal computers for 100 employees and shares of the organizations with web site complete the norm. These indicators by definition are rather great now for production companies in the innovative sphere therefore their high surges can't be reached thus existence of their positive growth rate is proved by the assumption of proliferation of subjects of economy in TID and the high-quality shifts in their activity connected with strengthening of its innovative orientation.

### **Function 2**

As it was already mentioned, for a sustainable development the greatest growth rate has to correspond to efficiency indicators, in this regard first place in the norm is won by an indicator of profitability of innovative products sales.

The growth rate of efficiency has to be provided at the expense of increase in financial results from realization of innovative production therefore volume's growth rate of innovative goods, works, services per capita has to be the following indicator in the dynamic norm.

Less low growth rate has to possess the ratio of the volume of innovative products and imports which characterizes relative increase in outputs in comparison with import analogs. Strategy of import substitution is main for the territories urged to develop innovative type of production thus full refusal of import in the conditions of the global economy at the moment existing isn't possible. It is caused both economic inexpediency in view of a scale effect, and possibility of imitating strategy's realization of separate products (services) of foreign analogs as special type of development of the innovative companies. The growing markets at a sustainable development of TID will cause some growth of import's volumes that will affect a value's activity.

The growth rates of structural indicators revealing dynamics of quantitative characteristics of the enterprises and organizations are put on final places in the standard in view of the fact that it doesn't highlight essential high-quality changes in the region. Growth of number of the enterprises and organizations' number can be caused by subjective factors while not the relative increase in number of the operating companies but scales' growth of activity will be more significant.

The increase of the share of innovative active organizations in its total number for providing a sustainable development of TID has to be carried out by higher rates in comparison with growth of number of the enterprises and organizations that will mean gradual involvement in innovative activity of those existing companies which earlier related to the conventional type.

### **Function 3**

The intensive way of TID's development will characterize the labor productivity growth which provides increase of main indicators of an industrial complex's productivity.

Being an efficiency indicator it's on the first place in the norm. The share of the profitable organizations represents a structural indicator thus shows indirect productivity of innovative activity in production sector. The profit is own source of development which is necessary for modernization of productions, expansion (improvement) of the range and so forth. It causes need of achievement of an indicator's high gain and its position in the dynamic norm.

Indicator of competitive ability and high demand innovative production of the territory's industrial complex is the volume of the exported production. In this connection a growth rate of share of sales of innovative products and services outside the region in its total volume takes the following position in the dynamic norm.

It's obvious that production's share exported abroad will be lower than total exports out of the region's scope that defines a ratio in the norm between the corresponding indicators characterizing them.

The important direction of innovative activity is search of tools and intensification technologies of production and resource saving therefore the indicator of the companies' share in which innovations have significantly reduced material and energy consumption. It has to be the following in the norm. Growth of this indicator can lead to decrease in prime cost of innovative production and increase in its competitive ability. Thus it's mentioned that the indicator characterizes influence of innovations on the consumed resources, i.e. indirectly influences on result and can't take a position above result indicators.

Decrease in labor costs also objectively reduces prime cost and positively influences on financial results of the companies thus similar tendencies can be connected with the general negative trend in yield production. Existence of a positive growth rate of indicator of share of companies in which innovations caused a significant reduction in labor costs is advisable thus the indicator in the conditions of a social orientation of transformations in TID shouldn't be very elevated.

The highest growth in this norm is the production and distribution of electricity, gas and water per 1 people that is caused by the high importance of the indicator for development of innovative activity. In some cases production of innovative products represents power-intensive process and placement of the perspective productions in the region which aren't power scarce is more possibly.

Effective functioning of economic entities requires ensuring the maximum mobility and in this connection availability of transport infrastructure is very significant. Growth rate of solidity's indicator of public highways with a hard surface characterizes their quality and follows the indicator given above.

The growth rate of the indicator of public railways is also very significant as provides communications at the interregional level thus opportunities on its increase in some cases are limited for the objective reasons.

Quantitative indices of growth rate of length of the fiber-optic data networks also have to be positive thus development of other data transmission's instruments reduces the importance of its positive dynamics in comparison with other elements of infrastructure that causes a little lower positions in the norm.

The growth rate of indicator of a share of hard-surface roads in a total length of public roads characterizes changes in their structure, i.e. relative dynamics and in this connection it objectively has to be slightly lower than the growth rates given above.

**Function 1**

Structural indicators that causes their high comparability are presented in this norm and allows to put on the first place the growth rate of ratio of the average annual number of employed in the economy to economically active population, i.e. characterizes development of TID's economy as creation of new workplaces.

Slightly less growth rate of the indicator of the share of the economically active population in the total population has to possess as it characterizes a human capital's growth rate of territories. In the norm there is following coefficient's growth rate of natural increase (decrease) of the population as it causes the perspective growth of the indicators given above.

The indicator characterizing dependency ratio has to possess a negative growth rate as shows a share of the disabled population, i.e. in the conditions of a sustainable development of the territory for development of its resources an indicator has to decrease constantly.

**Function 2**

The growth rate of indicator of share of population with higher education in the economically active population is put to the first in the norm as reflects the human capital's quality of the territory. On condition of a positive increase in population with the higher education, in particular an employment of TID's university graduates will be one of indirect indicators of stability that causes an indicator's position of graduating of specialists with higher education per 10 000 population.

An indicator of university graduates and post-graduates students ratio has to possess slightly less growth rate that by increase in numerator of university graduates will be provided also by growth of a denominator which is number of graduate students. Thus, some reduction of their quantity in comparison with university graduates will correspond to the economy's extending structure.

Ensuring high-quality growth of territorial human capital requires increase of financial investments in education thus an indicator of costs for education per 1 person being the characteristic of resources has to be behind slightly from the proliferation of result indicators, i.e. number of graduates that shows indicator positions in the norm.

The indicator of share of costs for education in the consolidated budget as a structure's indicator of expenses for education has to be the following in the norm. It shows an investment of public sector's resources in territorial development.

The growth rate of the share of organizations training graduate students also has to be positive, thus its high growth can't be regarded as direct result of TID's development. Besides, in the conditions of the integration processes occurring on the initiative of the Ministry of Education and Science of the Russian Federation in the scientific and educational sphere. The essential growth rate of an indicator is hardly objectively possible and rational.

**Function 3**

The greatest growth rate in the dynamic norm has the indicator characterizing the ratio of persons under 39 years among researchers that shows the perspective personnel capacity of the territory and dynamics of personnel's rejuvenation. Inflow of youth to

science and deduction of already available qualified personnel in this sphere can be provided due to the advancing growth of compensation in this sphere in comparison with the others that causes a place in the dynamic norm of the relation's indicator of the average monthly salary of researchers to the average monthly salary in the economy.

Ensuring the advancing TID's development perhaps only on condition of inflow of the qualified scientific personnel to the region in this connection the growth rate of share of researchers among arrivals to the region is very significant for its sustainable development and defines rather high positions in the dynamic norm.

The general positive migratory growth rate is a basis for inflow qualified personnel and other groups of economically active population. The high level of life quality and availability of workplaces are the main conditions providing a positive migratory growth of the territory, i.e. the considered indicator characterizes indirectly productivity of the region's transformation in TID within the realized strategy.

#### **Function 4**

The indicator of the average period of education has to decrease in dynamics that defines its positions in the dynamic norm and is connected with the ensuring of perspective need for human resources and replacement of personnel capacity of the researches and development's sphere which is fundamentals of innovative economy.

System of continual education and coverage of the regional population by it is one of the most significant indicators characterizing both the TID's personnel potential and the productivity of its development which is expressed in ensuring needs of the growing economy for personnel with actual and unique competences. The indicator's growth rate "capture rate by systems of continual education per 100 people aged 25-64" has to be the greatest in this dynamic norm for the TID's sustainable development. The additional characteristic of an education system in the region is the average period of education thus it's noted that the indicator's growth rate can't be very high owing to features of its measurement that causes the second place of the indicator.

The indicator of share of workers received professional training or improved their skills in their total amount will possess lower growth rate as it's a structural characteristic of dynamics of qualitative structure of the territorial personnel resources.

Indirect influence on training's productivity is an education's availability which dynamics is expressed at the quantitative plan in a growth rate of number of organizations providing professional training and retraining for their own staff. Thus, the indicator more expresses not qualitative result of training and it is rather an organizations' activity in development of the educational environment that defines its positions in the dynamic norm.

Smaller in comparison with the previous growth rate is the indicator of a share of professionals improved their skills outside the region in their total amount. Information exchange between territories including within professional development, training and so forth is the integral condition of innovative development of territories thus essential dynamics of an indicator also as well as in the previous case can't unambiguously provide a good result, i.e. the importance of a growth rate is slightly lower than the indicators standing on the first places in the dynamic norm.

A dynamics of number of foreign training on an average per 1 innovative active organization is also very significant indicator for innovative economy differing high

extent of globalization thus their growth by definition can't be above the indicator characterizing both interregional and international mobility, i.e. within the considered dynamic standard the growth rate of an indicator is the smallest and positive.

On the first place in the norm is an indicator of growth rate of number of implemented technological innovation as it is a result indicator of the territorial innovative activity. Introduction of the created innovations in practical activities is the direct indicator of their demand and correspondence to the necessary qualitative level caused by the competition.

The indicator reflecting number of concluded license agreements has to possess slightly lower growth rate which characterizes transfer of technologies to the third persons, i.e. in comparison with the previous indicator doesn't contain the innovations' quantitative characteristics created and realized within subject of economy. Thus, its importance consists in definition of dynamics of the regional market of intellectual property which level also defines productivity of the TID's strategy and prospects of its development.

The growth rate of share of innovative products in the total volume of shipped products is also the powerful characteristic of TID's development thus being a structural indicator can't provide higher growth in comparison with the indicators given above.

Quantitative innovative development including in the marketing activity can be defined on the basis of a growth rate of share of organizations engaged in non-technological innovation in the total number of organizations. Thus, indicator belongs to the structural group and also its indirect influence on the final result is defined by its positions in the dynamic norm. It's noted that the isolated cases of introduction of not technological innovations in the separate organizations can significantly increase an indicator thus not provide prerequisites of high-quality growth of productivity both at the micro level and within the TID in general.

The growth rate of number of venture capital transactions is also the characteristic of the high-quality institutional TID's development thus it isn't result and shows indirect influence on perspective result of the regional innovative activity. In this connection the indicator has to possess a positive growth but rather lower in comparison with the indicators given above. Development of the venture industry is also characterized by the growth rate of volume of venture capital investments in its overall value which has a rather lower growth rate because it is a structural indicator and its growth is reached gradually.

The dynamics of number of regional innovation forums, exhibitions, fairs which are platforms for development of information exchange and the market of intellectual property and the TID's venture capital can't be very high objectively that it is connected with cost intensity of similar actions and in some cases very mediated influence on achievement of the final result that defines the last place of an indicator in the norm on condition of its positive value.

#### **Function 1**

The social productivity's indicator of TID has to possess the greatest growth rate of the average income of the population which are defined both workers' compensation and payments of social character from means of the regional budget. Existence of financial

resources of subjects of micro- and meso- level's economy for ensuring positive dynamics of an indicator is as efficiency's result of the chosen vector of territorial development and create prerequisites for its further steady growth.

A very significant social effect in the region is the new workplaces' creation and in this connection growth rate of share of created new jobs in its total number also has to be positive thus it is slightly lower than the previous as the given indicator is structural.

The rate of unemployment has to possess the more higher negative growth rate which should be considered not only from the point of the social importance's view but also from the positions of development of labor market and subjects of the regional economy which are capable to create new workplaces as a result of activity expansion.

The negative growth also has to characterize dynamics of the Gini coefficient reflecting extent of society's stratification. The researches establish that its high value influences significantly the social tension's level and promotes negative trends' development of decrease economic activity of the population thus many examples is observed when the gradual growth of social indicators owing to an effective investment of the capitals in the territorial development by the most well-to-do population's representatives. The specified theses cause indicator positions in the dynamic norm.

## **Function 2**

The crucial indicator in the dynamic norm is the capacity of gross regional product per capita which characterizes not only productivity of innovative development of the territory but also shows perspective opportunities of its growth and, as a result, an improvement of population's life quality that it is a basis of the sustainable development.

The direct indicator of a growth of life quality is the growth rate of average income to the subsistence minimum which follows after the given above indicator in the dynamic norm.

The fixed capital investments aimed at environmental protection and rational use of natural resources grow in case of financial opportunities' existence and existence of purposeful reasonable strategy of life quality's improvement and a population's health-saving as basic components of a sustainable territorial development. To the same group of indicators of life quality which grow has to be provided within the TID's development belongs the sufficiency of health care institutions which being the structural indicator will have rather lower growth reasonably in comparison with the given above indicator. Creation of an available and qualitative system of public health's protection demands essential financial investments which provide the tax income of the effective TID thus it is a basis of the human capital's preservation as the main resource of innovative economy.

An increase of the life expectancy at birth is the most important target indicator of the TID's functioning thus its positive dynamics is objectively limited that defines its positions in the dynamic norm.

Realizing the scenario of TID's sustainable development a certain region can significantly influence on dynamics of meso- economic indicators thus there is no opportunity to exclude completely an influence of inflation factors. It defines a positive growth of a consumer price index which in the dynamic norm has to be minimum.



Indicators have to possess the negative growth rate which increase conducts to deterioration of population's life quality. The number of the registered crimes and maternal mortality concern to them.

The number of the registered crimes as a quantitative index can be objectively lowered by higher rates in comparison with the level of maternal mortality as the indicator characterizing the health system's level of the region and, as a result, life quality.

The proposed system of dynamic norms could become the basis of the TID's management within which the diagnosis of growth ratios of main indicators and the development of management actions aimed at eliminating disparity in socio-economic development of the region has realized.

For operation on the basis of the dynamic norms using the following algorithm is proposed:

1. Determination of target indicators characterizing main components of TID in dynamics.
2. Rationing results to ensure comparability of data
3. The calculation of the growth rate of target indicators.
4. Comparison of attained results with dynamic standards and identify deviations from the norm.
5. Development of the management actions system for each of the identified deviations and their practical implementation.

Using the proposed algorithm is given a chance to control the parameters of sustainable development of the territory and generate actions aimed at growth of indicators.

Currently the testing of the system cannot be made fully due to lack of complete statistical information from economy entities. The subjects of the study should be a separate territories within the regions which are implementing the innovative economic scenario. Monitoring and control of the TID's stability require to collect and systematize more information than the official statistics, at the same time, in our opinion, it is difficult to monitor main elements of the TID without it.

We carried out a conditional validation of the system based on official statistical data of the Russian Federation regions from 2011 to 2013. As an illustrative example in this article we present data on two dynamic norms of industrial component. From the regions that were studied as example we highlighted the most innovation-active ones defined in line with the official ratings (Table 9).

The analysis of table's data shows that the regions in general with high innovative activity does not retain its stability over time. None of the norms in 2012 does not coincide with the data of 2013. Inconsistency these inequalities to the standard highlights the problems in the management of the region in specific areas. The similar trend can be explained as the lack of appropriate baseline data (the average indicators of the regions were studied in which innovation activity is developed unevenly) and features of the dynamics (the significant growth of an indicator in the current period in the most cases entail the lack of its increase in a subsequent period).

The research shows that the greatest number of inconsistencies in the function 1 are fallen within the next element of dynamic norm:  $Gr(P15) > Gr(P14)$ . This demonstrates that in some cases the number of personal computers per 100 employees is

growing more slowly than the number of organizations with a website. While maintaining such a stable trend this element can be adjusted or removed from the dynamic norm. At the moment the private indicators characterizing the prevalence of information technologies at the micro level are increasingly losing its relevance because of the absence of the possibility of its exact calculation.

Similarly, the proposed system can be adjusted within the framework of its use as an example of a particular municipality (territory).

In general, the proposed system of dynamic norms is the basis and can be the basis for the construction of own similar model in the light of specific features of TID.

## **Conclusion**

The paper demonstrated the relevance of the development of methodological basis for sustainable development of the regions. Analysis of publications revealed that the most accurate and reasonable results for the management of the TID gives the statistical methods.

It is shown that dynamic performance can fully characterize the degree of sustainable development of territory in terms of ensuring growth of performance targets.

The author presents a theoretical development of dynamic norms models of allowing identifying the sustainability of TID's development and its individual components. Dependences which were discovered in research have been proved based on the use of theoretical analysis and empirical generalization of the results of functioning territories that can be classified as innovative. Within this publication due to size limits they are not represented but demonstrated in other works of the author (Maltseva, 2014a, 2014b, 2015).

Each dynamic norm is a system of inequalities composed of the most significant development indicators of the TID and shows the relationship between them. Inequalities are designed in such a way that their implementation will demonstrate the rapid growth of the socio-economic system of the region as a whole through the effective use of resources.

The proposed system demonstrates the need of development of such system of TID's management which would provide an opportunity to faster growth of performance indicators as they demonstrate the rational use of various types of resources used in the process of TID's creation.

The mutual dependence of a set of indicators that characterize the TID and their growth rates identified in the study allows constructing a management system at the meso-level ensuring the most rational approach to the creation of territories of innovative development and reducing project's risk.

The system is based on indicators specific to the official statistics of the Russian Federation while it can be freely transformed for the purposes of its use in other countries. Thus, the adaptation of dynamic norms may include the development of method for calculating the proposed indicators or replacement by indicators which are similar in meaning.

The system is intended for use in specific structural divisions of regional governance the key functional responsibilities of which is a strategic planning and monitoring of the TID's program.

The system can be applied under the conditions of the sufficiently developed of TID in which all stages of the innovation cycle are complex realized thus allowed the reduction of the system of dynamic norms or elimination a number of indicators from it due to objective circumstances.

The official statistics is not sufficient to use the system it is necessary to do the additional research and data collection due to a significant number of indicators included in the system and the requirements of assessment of several parameters of development territory that can only be defined using the additional observations.

The author conducted a partial testing of the model on the example of regions of the Russian Federation. This testing showed the lack of development of individual components of the innovation cycle. At the moment, due to the lack of data it's not possible to test the model on the example of the certain TID which includes science cities and special economic zone of technology-innovative type in accordance with the legislation of the Russian Federation.

Further areas of research on this issue are testing and adjustment of the proposed dynamic norms based on data of specific real-life TID which requires an additional collection of statistical data on the issue.

#### Competing interests

The author declares that he has no competing interests.

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