Development of a methodology for evaluation of the intellectual human capital of a region

Marina Fedotova, Olga Loseva, Raisa Fedosova

Financial University under the Government of the Russian Federation, Moscow-city, Russia
frn-professor@yandex.ru

Abstract: The article presents findings of a research devoted to justification, development and trial application of a methodology for evaluating the intellectual component of the human capital of a region to estimate the efficiency of its innovative activity. So far, the problem in question has not been reflected in the foreign and domestic scientific literature. The article describes the suggested methodological approach, indicators, calculation formulae, the algorithm and the results of the proposed methodology application for measuring the intellectual human capital (IHC) of a region. Specifically for the Penza Region, recommendations on prospective directions of the IHC development are offered.
[Fedotove M., Loseva O., Fedosova R. **Development of a methodology for evaluation of the intellectual human capital of a region.** *Life Sci J* 2014;11(8):739-746]. (ISSN:1097-8135). http://www.lifesciencesite.com. 109

Key words: intellectual human capital (IHC), region, methodology for evaluation of the intellectual human capital of a region

1. Introduction

The above-mentioned problem has been the focus of multiple activities in the recent years. Foreign sources include works of different modern researchers (Subramaniam, 2005; Bozbura, 2007; Hormiga, 2011; Phusavat, 2011; Cinquini, 2012). However, their studies are mostly concerned with the corporate intellectual capital while the regional specifics have been so far ignored.

In the domestic literature, problems of the intellectual component of the human capital viewed at the regional level (Bobylev, 2012; Gusev, 2013; Dmitrieva, 2010; Kalenskaya, 2007, Kamaltdinova, 2009; Leskina, 2013; Onoprienko, 2004; Sagdeyeva, 2012; Filippova, 2007; Sherkunov, 2010). The above authors focus mainly on theoretical aspects of the problem such as concepts, contents and categories. At the same time, they do not address issues of evaluating the intellectual component of the human capital.

Therefore, the analysis of foreign and domestic sources shows that until now the scientific problem of development of a methodological approach and methodologies for evaluating the intellectual human capital of a region has not been given due consideration.

2. Definition of the Research Goal and Objectives

The main goal of the research was the definition of the theoretical basis, justification of the methodological approach and development of a methodology for assessment of the intellectual human capital of a region on the rating basis. In accordance with the main goal the following problem-solving objectives were put:

– definition of the nature and content of the intellectual human capital of the region;

– justification and selection of a methodological approach to evaluating a regional IHC;

– justification and definition of indicators for an integral assessment of a regional IHC;

– measuring the impact of individual indicators that characterize IHC functional spheres on the cumulative change of the IHC status;

– trial application of the proposed tools through the example of the Penza Region.

3. Description of the Main Research Findings and Their Substantiation

The intellectual human capital (IHC) in a broad sense is understood as production of intellect by a socio-economic subject that provides its owner (an employer, organization, region) with a capability of effective functioning and development in the process of the intellectual innovative activity (Loseva, 2011).

The IHC of a region is a synergic combination of intellectual capitals of authorities, business organizations, scientific, educational and cultural institutions. The synergy can manifest itself through both the vertical interaction of social and economic subjects, e.g. company administration ↔ employee, regional administration ↔ company, and the horizontal interaction, in particular, employee ↔ employee, company ↔ company, region ↔ region (Fedosova, 2012).

The intellectual human capital of a region directed at innovative development consists of:

– the intellectual core (the IHC of authorities and businesses accounting for a sizable proportion in the sectoral regional structure);

– the IHC in the R&D sphere;

– the IHC in the innovation-entrepreneurship sphere (small-scale businesses and infrastructure of the intellectual-innovative activity);

– the IHC in the culture-and education sphere.

For the IHC evaluation a structural-integrated approach has been used that allows the IHC to be characterized as a single whole and identifies individual problem areas and constraints. The structural approach helps identify evaluation constituents and form selection criteria for creating a system of performance indicators. The integrated approach ensures bringing together various characteristics, often disparate and dissimilar, and selection of a form for building a composite index of indicator dynamics.

The main criteria for selection and formation of individual indicators are the following (Fedotova, 2012):

1) relevance to evaluation purposes: indicators included into the system should be consistent with a task to be solved; for instance, the indicators should be informative in terms of evaluating the IHC as the key factor of the innovative development and competitiveness of a region;

2) representatives: individual indicators should adequately represent a selected target group of indicators, e.g. the most significant aspects of regional labor performance in the R&D sphere;

3) data limitation: individual indicators should be limited in quantity so as not to complicate data interpretation or increase labor efforts in collecting primary information;

4) data accessibility: values are taken primarily from the Rosstat (Russian Statistic Service) and its branches (directly or based on calculations using official data);

5) preferential use of relative values: relative figures should be taken as individual indicators because absolute figures may be a direct function of the population quantity or the size of the region area and hence distort the real estimate;

6) independence of indicators: individual indicators should not be interchangeable, i.e. duplicating the meaning, nor should they complete one another when one indicator is expressed through another one;

7) co-directivity of changes: a positive change (growth) of individual indicators leads to positive changes in the whole IHC status. This requirement is essential for estimating the overall dynamics of the IHC status based on the analysis of individual factor dynamics.

When building a particular system of indicators, this list of criteria may be supplemented with account for the purpose and application specifics.

When using the integrated approach to the IHC evaluation, the biggest complications arise in building cumulative indicators, which is due, firstly, to the complexity of an evaluated object itself and, secondly, to the necessity to integrate values that are not always uniform or consistent.

Building integrated indicators in the studies of socio-economic phenomena is a disputable issue. It should be noted that some researchers consider the use of integrated indicators as incorrect (Vasilyev, 2004). Their reasoning is that the qualitative difference of indicators subject to evaluation makes it actually impossible to reduce them to a single quantitative index.

In our opinion, however, this problem can be solved with an approach accepted in quality statistics. The approach involves transition from quantitative values of indicators to their qualitative counterparts, which will eliminate incommensurability of dissimilar indicators. The task gets easier if an originally formed system of indicators contains similarly-named relative values. At the same time such an approach makes it possible, if needed (as the case may be), to include into an IHC indicator system absolute values, e.g. the quantity of the R&D personnel, or qualimetric values such as the quality of educational services in the region.

The integrated assessment of the regional IHC by a selected set of indicators may be performed by any of the two methods described below:

First method. Measuring the IHC development level of a region for a given time instance by comparing it with other objects (regions) of the same class, which involves building a composite rating derived from the whole set of indicators.

Assume a system S={Rg, X} consisting of a multitude m of regions Rg that have n common indicators J characterizing the IHC status of a region. It is required to measure the integral (system) quality of each object (region) by all indicators in the aggregate on the rating basis, i.e. its position respective other regions in the system (matrix 1).

$$S = \begin{pmatrix} P_{11} & P_{12} & \dots & P_{1n} \\ P_{21} & P_{22} & \dots & P_{2n} \\ \dots & \dots & \dots & \dots . \\ P_{m1} & P_{m2} & \dots & P_{mn} \end{pmatrix} \qquad (1)$$

where P_{ij} is the IHC performance indicator; $i=1..m$, $j=1..n$.

There are the following groups of ranking methods in the world practice:

1. Expert-scoring methods. A group of peer experts evaluates the significance of every indicator directly or indirectly in points or weight coefficients; then the aggregate indicator for each region is calculated with account for the above evaluation, and, finally, the regions are ranked based on aggregate indicators obtained. The problem with using this method in our situation is that the indicators are not uniform, i.e. they evaluate the intensity of IHC properties from different functional spheres. Therefore, the evaluation of significance (prioritization) of this or that indicator appears incorrect. For instance, how can we determine which is more important for the innovative development of the economy: the number of patent applications filed per 1,000 researchers or the proportion of household incomes from business activities?

2. Ranking statistics methods. The rank (position) of a region respective other regions is defined using the order scale for every indicator according to the scoring principle: the greater the value the smaller the rank. Then the ranks are aggregated (or expressed as a simple or average simple or mean weighted sum) and a region with the least sum is ranked the first, etc. However, the transition from quantity values of an indicator to ranks is impossible unless these values change linearly, i.e. uniformly. But in practice such linearity of values is observed very seldom, therefore ranks obtained do not fully reflect previous quantitative values of indicators. For instance, the ranking will be ill-grounded if a certain indicator has low values in the majority of regions and high values in one or two regions.

3. Topometric methods. The method takes into account the proximity of regions to a benchmark region by comparable indicators. The difficulty is in choosing a proper benchmark. The benchmark may be an arbitrary region with maximum values of all indicators, however, it is not always possible because the economic content of many indicators does not imply a clearly defined upper limit; for instance, it is difficult to quantify the required maximum of R&D personnel per 10 000 people of the economically active population.

More often a typical region with arithmetical mean values of analyzed indicators is chosen as a benchmark. However, economic objects in the aggregate are characterized by predominantly asymmetrical distributions that are different from normal, so this method cannot be regarded as the best choice too. After the benchmark has been selected the Euclidean distance (generally accepted metrics for estimating the proximity of objects) is computed between the benchmark and each region. Prior to the computations, quantitative values of indicators should be normalized against benchmark values. By ordering distances, regions are ranked on a complex basis, with the top position assigned to the least remote region, etc. The introduced metrics can be used for clasterization of regions. Using the method in our particular case makes it impossible to take into account the difference in the impact of individual indicators on the integral rating value of a region.

4. Multidimensional scaling methods. In our opinion, this group of methods is the best suited for solution of the task posed. Firstly, interval scaling methods enable transition from quantitative values characterized by diversity of types and names to qualitative counterparts thereby making all indicators commensurable. The level intervals on which the order relationship is set – a limited range of numbers – correspond to a certain quality of every particular indicator characterizing the IHC of a region. Secondly, nominal scales obtained through the qualimetric approach (quantitative assessment of quality) can be used for identification of objects, particularly for classification of regions by the level of a regional IHC development. In other words, the scaling methods make it possible to evaluate the integral quality degree of the regional IHC and perform valid ranking of regions by a given indicator.

All regions subject to ranking are supposed to make up a uniform aggregate, i.e. belong to a system (cluster) of "family" objects. In our case this system (cluster) is understood as a group of regions of the same federal district characterized by a certain geographical location, territorial and economic unity, peculiar natural and economic environment and historically developed production specialization based on the territorial social division of labor as well as the same institutional environment.

It is obvious that prior to ranking the whole system of multidimensional objects – federal district regions – must be checked for consistency of all indicators using a multiple concordance coefficient that does not require mandatory normalcy of indicator values distribution.

The multiple concordance coefficient looks as follows (Vasiliev, 2003):

$$w = 1 - \frac{\sum_{i=1}^{m}\sum_{j=1}^{m}\sum_{k=1}^{n}\left|x_{ik} - x_{jk}\right|}{nm(m-1)(K-1)} \qquad (2)$$

where m is the number of rows in the matrix (the number of regions); n is the number of matrix columns (indicators); K is the number of quality levels selected; x is quality equivalent of a regional IHC indicator.

Based on experimental studies of real data it has been determined that the high object consistency begins with w>0.85. If w<0.65, it means the system has an abnormal object that should be excluded from the consideration.

An abnormal region being a multidimensional object can be spotted with the graphical analysis of indicator value distribution for all regions of the federal district. If of 22 constructed distributions any region has more than 7 spikes in graphs with respect to indicators in other regions, we have all the reasons to regard it as an abnormal item of the aggregate.

Assuming the system principle of emergency, the integral quality of a regional IHC (composite rating) should be greater than the simple sum of qualities of its constituent indicators. This property is characterized by the extent of entropy (disorder, dispersion) of indicators evaluating the regional IHC. The greater is the dispersion in qualitative assessments of a particular indicator, the higher is its entropy and hence significance. A region in which higher entropy indicators prevail has a higher IHC quality since the increasing entropy may lead to a qualitative change in the system (region). Viewed from this point, it is suggested that the integral quality of the regional IHC (composite rating) be calculated as a mean weighted arithmetic sum where weights are the entropy level of a particular indicator, rather than a sum of qualities (individual ratings):

$$Sr(HIC_i) = \frac{\sum_{j=1}^{n} P_{ij} H_j}{\sum_{j=1}^{n} H_j}, \quad i = 1..m \tag{3}$$

where $Sr(HIC_i)$ is the composite rating of an i-th region derived from all individual ratings (quality ranks) of IHC performance indicators; H_j is the j-th indicator entropy calculated by the Shannon's formula:

$$H_j = \sum_{i=1}^{m} p_{ij} \ln\left(\frac{1}{p_{ij}}\right) \tag{4}$$

where p_{ij} is a probability of appearance of the i-th value of the j-th indicator in the matrix (1), with the sum of all probabilities of i-th indicator values in the matrix columns equal to 1.

Having ranked all the regions by the composite rating value, we obtain, accordingly, their distribution by the IHC development level. This distribution makes it possible to assess the efficiency of controlling the regional IHC as the key factor of the whole regional innovation system.

The IHC assessment of a region relies on a previously built system of indicators covering the main spheres of activities that largely influence the innovative development of a region: the intellectual core, the R&D, innovation-entrepreneurship and culture-and-education activities. Examples of such indicators are given in Tables 1 - 4.

Table 1. Indicators for evaluation of the intellectual core of a regional IHC

Line #	Content of Indicator	Calculation formula	Comments
1	Assessment of intellectual resource of regional businesses	$P_{11} = \frac{G_{IP} + G_{IE} + G_{R\&D}}{3}$	Characterizes available intellectual property of regional business organizations (G_{IP}– average annual intellectual property growth rate; G_{IE} – average annual growth rate of innovative enterprises; $G_{R\&D}$ – average annual growth rate of R&D expenditures)
2	Assessment of regional strategic resource	$P_{12} = \frac{\sum_{m=1}^{6} C_m(+)}{m_C}$	Characterizes availability and quality of the regional strategic resource (C_m: mission, goal, environmental analysis, strategic plan, implementation tools, region development scenario)
3	Assessment of regional administrative resource	$P_{13} = \frac{\sum_{m=1}^{6} A_m(+)}{m_A}$	Characterizes availability and quality of the administrative resource of a region (A_m: e-government, public officer's code, HR reserve and vacancies, qualification and re-qualification of public officers, knowledge control system, quality management systems)

Notes: Here and in the tables below data for indicator calculations are taken from sites of regional authorities and official Rosstat sources.

Table 2. Indicators for evaluation of the regional IHC in the innovation-entrepreneurship sphere

Item #	Content of Indicator	Calculation formula	Comments
1	Investments in fixed capital per capita (IpC_{FA}), adjusted for the share of investment in the fixed assets development (I_D): construction of new facilities (except housing), acquisition or modernization of machinery, equipment, transport, communications development, etc.	$P_{21} = IpC_{FA} \cdot I_D$	Characterizes provision of the regional population with the infrastructure development potential (including the innovative infrastructure)
2	Proportion of innovative goods, work, services (Q_I) in the total amount of shipped goods, performed work and services (Q)	$P_{22} = \frac{Q_I}{Q} \cdot 100$	Characterizes efficiency of innovation activity of intellectual subjects
3	The number of individual entrepreneurs (S_{IE}) per 1000 people of economically active population (S_{EAP})	$P_{23} = \frac{S_{IE}}{S_{EAP}} \cdot 1000$	Characterizes intensity of labor resource involvement in small businesses
4	The number of advanced process technologies used (APT_U) per 1,000 of economically active population	$P_{24} = \frac{APTu}{S_{EAP}} \cdot 1000$	Characterizes intellectual activity of labor, ability to perceive new
5	Proportion of organizations using special software (SSW) for research, designing and CAM/CAE management in the total number of organizations studied (O)	$P_{25} = \frac{O_{SSW}}{O} \cdot 100$	Characterizes provision of intellectual subjects with computer information technologies
6	Proportion of organizations using global information networks (GIN) in the total number of organizations studied	$P_{26} = \frac{O_{GIN}}{O} \cdot 100$	Characterizes provision of intellectual subjects with modern communications capabilities

Table 3. Indicators for evaluation of the regional IHC in the R&D sphere.

Item #	Content of Indicator	Calculation formula	Comments
1	The number of R&D personnel ($S_{R\&D}$) per 10,000 people of economically active population	$P_{31} = \frac{S_{R\&D}}{S_{EAP}} \cdot 10000$	Characterizes provision of a region with R&D personnel
2	Proportion of researchers having scientific degrees (S_{Deg}) in the total number of researchers (S_T)	$P_{32} = \frac{S_{Deg}}{S_T} \cdot 100$	Characterizes provision of R&D sphere with personnel having scientific degrees
3	Proportion of internal R&D expenditures ($E_{R\&D}$) in the total turnover of organizations	$P_{33} = \frac{E_{R\&D}}{Q} \cdot 100$	Characterizes financial ability of organizations to carry out R&D activities
4	Proportion of patent applications filed (PA_F) per 1,000 researchers (Res)	$P_{34} = \frac{PA_F}{S_{Res}} \cdot 1000$	Characterizes the intellectual activity of researchers

Table 4. Indicators for evaluation of the regional IHC in the culture-and-education sphere

Item #	Content of indicator	Calculation formula	Comments
1	Proportion of employment in education ($e_{E\&C}$) and rendering cultural services in the total quantity of the employed	$P_{41} = \frac{Se_{E\&C}}{Se} \cdot 100$	Characterizes provision with personnel involved in the cultural and educational activities
2	Proportion of the employed having higher vocational education (Se_{HVE})	$P_{42} = \frac{Se_{HVE}}{Se} \cdot 100$	Characterizes the educational level of the labor resource
3	Proportion of household spendings on education (HS_{ED}) and entertainment (HS_{ENT}) in the total household budget	$P_{43} = HS_{ED} + HS_{ENT}$	Characterizes self-development capabilities of the labor
4	Proportion of budget spendings on social-and-cultural activities (BS_{SCA}) in the total budget spendings (BS)	$P_{44} = \frac{BS_{SCA}}{BS} \cdot 100$	Characterizes efforts of regional administration to promote social and cultural development of the labor resource

Notes: Budget social and cultural spendings include spendings on education, medical aid, physical culture and sport, social policy.

To sum up, we have 17 indicators to evaluate the integral quality and dynamics of the IHC development of a region.

The second method. Comparing the current status of the regional IHC with its previous status and building a consolidated dynamics index. This assessment option helps define the status change direction, i.e. fix positive or negative dynamics of development but does not allow us to determine the quality level of the IHC status.

Building the consolidated dynamics index requires justification of the choice of the mean value. Since relative values are a preferable criterion for the indicator system formation, it is reasonable to use the geometric mean for the analysis of their cumulative change because this form of the average is common to ratios and products (just like the arithmetic mean is common to sums, differences and other linear functions). The geometric mean may be simple or weighted. In the latter case weights are defined based on the indicator significance for achieving the evaluation goal. The advantage of this evaluation method is that initial indicators may be expressed by absolutely different values and be incommensurable.

The cumulative change of the IHC status will be defined by changes of grouped and individual indicators expressed by group (I) or individual (i) indices:

1. The IHC indices in a particular sphere must reflect changes in individual indicators expressed by simple individual indices:

$$i_P = \frac{P_1}{P_0}; \qquad (5)$$

The individual indices are supposed to be equipotent, hence index weights are equal to 1. As a result we obtain the following formula of a group index reflecting the IHC change in a particular sphere:

$$I_P = \sqrt[n_j]{i_{P1} \cdot i_{P1} \cdot \ldots \cdot i_{Pn_j}} \qquad (6)$$

where n_j is the number of indicators in the j-th group.

To evaluate the contribution of each individual indicator into the group index change their changes may be ranked by the $|i_P\text{-}1|$ value. The greater the changer value, the greater is the effect of a given indicator on the change dynamics of the regional IHC. The following rank classification is suggested:

Group 1 – factors that have a significant impact on the change of the regional IHC or its performance results (indicators ranked 1 to 5);

Group 2 – factors that have a noticeable impact (indicators ranked 6 to 11);

Group 3 – factors that have a minor impact (indicators ranked 12 to 17).

Based on this ranking the administration of a region should first of all pay attention to the first group of indicators and take measure to ensure the growth of respective indicators. In this case some indicators may be adjusted promptly, e.g. the proportion of organizations using the global information networks while a positive change in others is possible only in the long-term perspective by pursuing a target-oriented economic policy (the proportion of household spendings on education, recreation and entertainment.

The results of the regional IHC change ranking by all the four spheres $|(I_P)\text{-}1|$ makes it possible to determine which of them has a substantial influence on the IHC development dynamics of the whole region.

A sphere with a large number of indicators has the advantage – here it is the innovation-entrepreneurship sphere (IE). Its index should have the largest weight. The intellectual core (IC) is characterized by multi-aspect indicators, while the R&D sphere plays a significant part in promotion of the innovative development of a region, therefore, their weights are equipotent and have to be ranked second by their value.

The final index formula looks as follows:

$$I_{IHC} = \sqrt[4]{(I_{IE})^{3/2} \cdot (I_{IC})^{1} \cdot (I_{R\&D})^{1} \cdot (I_{CE})^{1/2}} \qquad (7)$$

This methodology was tested in the Penza Region with the purpose to identify factors that had a negative effect on the implementation of the regional innovative development programs. Given below are the changes in the IHC performance indicators in 2012 as compared to 2011 (Table 5).

Table 5. Ranking the factors by their impact on the formation and development of the regional IHC

Item #	IHC performance sphere	$\|(I_P)^{1/2}\text{-}1\|$	*Rank, R*
1	Intellectual core (IC) of a region	0. 088	3
2	Innovation-entrepreneurship (IE) sphere	0.147	1
3	R&D sphere	0.115	2
4	Culture-and-education (CE) sphere	0.069	4

Viewed from the above, the largest contribution to the IHC performance dynamics of the Penza Region was made by the innovation-entrepreneurship sphere. This trend has become a typical for most Russian regions (Filimonova, 2013; Fedosova, 2013). The regional government should continue with improvement of the innovation development policy in the territory and pay careful attention to the development of the culture-and-education sphere.

4. Conclusions

Based on the research findings the following conclusions have been made:

1. The intellectual human capital is the key factor of boosting the innovation development of a region, therefore, evaluation of the IHC performance is essential for the region management practice.

2. The domestic and foreign literature dedicated to the human capital of a region lack specific methodologies for evaluation of its intellectual component that has substantial significance for the innovative development of territories.

3. It is suggested that the human intellectual capital be evaluated through a system of indicators characterizing its intellectual core and performance in the innovation-entrepreneurship, R&D and culture-and-education spheres.

4. The IHC evaluation methodology has the following specific features:

– relies on the structural-integrated approach that views the object of research as a multidimensional integral value but takes into account changes of its individual constituents;

– makes it possible to assess not only the current IHC status but also the dynamics of its changing with time;

– uses methods of rating assessment, index analysis, quality statistics and information theory to improve the validity and reliability of the results obtained.

5. The proposed methodology of the IHC evaluation is oriented at intensification of the innovative development of a region because it allows for:

– formation and development of innovation activity competences in the region to promote improvement of the innovative culture of the population (Barysheva, 2012);

– improvement of the IHC quality control mechanism by monitoring the IHC status and development dynamics;

– making interregional comparisons based on ranking the regions by the IHC quality and adjust, accordingly, the objectives of the regional innovation-driven policy;

– ensuring the competitiveness of a region in high-tech industries based on the quality improvement and payoffs from the use and development of the intellectual human capital.

Acknowledgement

The research was carried out within the scope of the R&D project "Assessment of the Intellectual Potential of a Region In Terms of Innovation Development" in accordance with the Government's Assignment to the Financial University for 2014 and the planned period of 2015-2016 (approved by the Deputy Chairman of the Russian Federation Government as of Feb.14, 2014, No. 795p-P17).

Correspondence to:
Raisa Fedosova
Financial University under the Government of the Russian Federation
Leningradski prospect, 49, 125993, Moscow-city, Russia
Telephone: +7-915-796-61-00
Email: frn-professor@yandex.ru

Reference

1. Barysheva A.V. Modernization of Russia from the Standpoint of a New Paradigm of Scientific Knowledge. Moscow: "Maska Publishing Center" LLC 2012: 340.
2. Bobylev S.N. Indicators of Sustainable Development for Russia. Vestnik MGGU: SET (Bulletin of the Moscow State University for Humanities: Socio-Ecological Technologies) 2012; 1: 8-18.
3. Bozbura F.T., Beskese A., Kahraman C. Prioritization of human capital measurement indicators using fuzzy AHP. Expert Systems with Applications 2007; 32(4): 1100-1112.
4. Cinquini L., Passetti E., Tenucci A., Frey M. Analyzing intellectual capital information in sustainability reports: Some empirical evidence. Journal of Intellectual Capital 2012; 13(4): 531-561.
5. Dmitrieva T.Ye. Rating Assessment in Interregional and Intraregional Comparisons (Methodological Aspect). URL: http://do.gendocs.ru/docs/index-169583.html (accessed date: 12.11.2010).
6. Fatkhutdinov R.A. Management Decisions: Manual. Moscow: INFRA-M 2003: 314.
7. Fedosova R., Kheifitz B. The defense complex of

Russia: problems and basic innovations. Actual problems of economics 2013; 10 (148): 524-530.
8. Fedosova R.N. Development of the Human Potential in the Innovation Economy. Vestnik Akademii (Bulletin of the Academy) 2012; 4: 97-100.
9. Fedotova M.A. The Rating of Investment Attractiveness of the Russian Federation Regions. Information Bulletin of IAEFL «Formation of Friendly Investment Climate in Russia" 2012; 17: 271.
10. Filimonova N.M., Polzunova N.N., Malkerov M.U. Hi-tech entrepreneurial structure upgrade project. Investment Management and Financial Innovations 2013; 10(4): 166-170.
11. Filippova N.A. The role of Human Capital in the Development of Regional Economy: Synopsis of PhD (Economics) Thesis: 08.00.01. Ulyanovsk 2007: 22.
12. Gusev A.B. Ratings of Innovative Development of Russian Regions. URL: http://www.kapital-rus.ru/index.php/articles/article/2574 (accessed date: 12.12.2013).
13. Hormiga E., Batista-Canino R.M., Sánchez-Medina A. The role of intellectual capital in the success of new ventures. International Entrepreneurship and Management Journal 2011; 7(1): 71-92.
14. Kalenskaya N.V. Infrastructural Support of Innovation Activity. Rossiiskoye Predprinimatelstvo (Russian Entrepreneurship) 2007; 7(2): 55-58.
15. Kamaltdinova R.M. The Impact of Motivation on the Reproduction of Human Capital under Modern Conditions. Kreativnaya Ekonomika (Creative Economy) 2009; 9: 42-46.
16. Leskina O.N. The Intellectual Capital of the Middle Class as a Prerequisite for Sustainable and Innovative Development of Russia. Journal of scientific publications of post-graduate and doctoral students 2013; 6(84): 48-49.
17. Loseva O.V. The Human Intellectual Capital as a Factor of Innovative Development of the Regional Economy. V Mire Nauchnykh Otkrytiy (In the World of Scientific Discoveries). Series "Economics and Innovative Education" 2011; 3(15): 205-213.
18. Meadows D., Randers J. Limits to Growth. The 30 Year Update. Translated from English. Moscow: Akademkniga Publishers, 2007: 342.
19. Onopriyenko Yu.I. Human Capital as a Factor of Regional Development: Synopsis of PhD (Economics) Thesis: 08.00.05. Moscow 2004: 21.
20. Phusavat K., Comepa N., Sitko-Lutek A., Ooi K.-B. Interrelationships between intellectual capital and performance: Empirical examination. Industrial Management and Data Systems 2011; 111(6): 810-829.
21. Sagdeyeva L.S. Human Capital Quality Management in Terms of Innovative Development of a Region. Online Scientific Journal of the All-Russian Attestation Commission 2012; 3(39): 11.
22. Sherkunov S.A. The Human Component of the Iinnovative Regional Economic Development. Vestnik of INZHEKON (Bulletin of ENGECON University). Series "Economy" 2010; 3(38): 281-285.
23. Subramaniam, M., Youndt, M. The influence of intellectual capital on the types of innovative capabilities. Academy of Management Journal 2005; 48(3): 450-463.
24. Vasiliev A.L. Russia in the XXI Century. Quality of Life and Standardization. - M.: RIA “Standarty i Kachestvo" ("Standards and Quality") 2003: 440.
25. Vasilyev V.I., Krasil'nikov V.V., Plaksiy S.I., Tyagunova T.N. Statistical Analysis of Multidimensional Objects of an Arbitrary Nature. Moscow: ICAR Publishing House 2004: 382.

7/27/2014