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# Socio-Economical Municipalities' Status Estimation: Method, Software and Application in the High School Educational Process

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**Abstract:** Authors pay much attention to the problem of the socio-economical state of town and the problem of its estimation for the goals of municipal management. Author's methodology is based on an algorithm technique of a comprehensive estimation of socio-economical status in case of large cities. Classification of towns and cities is made by clustering procedure. This approach is realized in the computer information system "InfORMO". The paper gives guidance for the practical exercises using the computer information system "InfORMO", a detailed description of the algorithm and an implementation example of the author's methodology for assessing the socio-economic status of municipalities (towns, cities).

**Key words:** Classification of towns and cities · Indicator statistics system · Applied cluster analysis · Interactive learning technologies.

## INTRODUCTION

The process of complex socio-economical municipality development managing must not only synthesize the main provisions of the general methodology of economic systems management, but also be adapted to the specifics of a particular municipality, that is, it must contain an analysis of the current socio-economical status, monitoring and rapid assessment of its key indicators, definition of development goals and objectives. In the present conditions the problem of information management process services is acquired particular importance and urgency, to ensure successful implementation of analytical procedures and achieve the required quality control process. At the same time a problem of a correct socio-economical municipalities' status estimation goes primarily to the fore. This problem solving is a key challenge in identifying the current socio-economical situation contradictions, priorities determination while complex developing planning.

**Socio-Economical Indicator Statistics System:** During the analysis of the municipality as a complex socio-economical system a set of the most common areas that are required to describe and evaluate a complex municipal socio-economical status was formed: Demographic setting, employment, standard of life, education, health, law-abiding, industry, construction, transportation services, communication services, trade and services, investment policy [1-3]. In accordance with the list of directions comparative analysis of existing indicator systems at different evaluation techniques for municipal complex socio-economical status was carried out [2]. One of the variant of a good relationship between various aspects coverage and estimation scope is a system of indicators of the Russian Federal State Statistics Service for big cities with a population 100 thousand people and more [4-6]. Using 58 Rosstat indicators can be assessed 12 of 18 aspects of socio-economical status of 167 municipalities, urban settlements with a population more then 100 thousand people. However, this constraint can not be considered as

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disadvantage, since the parameter systems, accordingly, the socio-economical status integrated estimation methods should be specific to different types of municipalities. Moreover, as pointed out A.G. Granberg [7], while the allocation of the total municipalities' types it should be taken into account the size of municipality, first and foremost in terms of population. This indicator allows you to select a group of small towns (up to 50 thousand people), medium (50-100 thousand), large (100-500 thousand), large(from 500 thousand to 1 million) and the largest (more than 1 million people) of the city. Therefore, the sample should be further reduced. From 167 cities with population over 100 thousand people in the sample is left only a group of 137 large cities (large and major cities, virtually all centers of subjects and federal districts of Russia were excluded).

To ensure the greater homogeneity of the municipalities' initial sample it was introduced two constraints related to the basic characteristics of a municipalities' group: population and regions accessory with similar geographic, natural and raw materials, climatic, political, social and other conditions. In particular, municipalities belonging to the group of large cities with a population of 100-500 thousand people were selected for the study and the regions typology developed by the Independent Institute of Social Policy in the project "Social atlas of Russian regions" [8, 9] was used.

The reason for regions typology choice was the complexity of the used indicators system and composite indices, calculated according to statistics prior to 2003, inclusive. With a glance at restrictions 137 municipalities of big cities were included in the study sample, divided into five groups corresponding to different types of socio-economical areas in the project "Social atlas of Russian regions"

As a result of clustering [1-3, 10] within each region type there were identified four basic types of cities (Table 1).

In accordance with the general level of socio-economical development of one type cities relatively to other cities of this region there were given names of basic types: Type 1 - City leaders, Type 2 - middle "strong", Type 3 - middle "weak", type 4 - the city- outsiders. The total amount of cities types identified in the study was 20 (Table 1).

To identify the obtained cities' types it was invited to enter their designation as a code consisting of two parts separated by hyphens. The first part of the city stands belonging to one of five region types 1 (2), 3, 4, 5 or 6 (7), the second part - belonging to one of four basic types of cities. Table 2 for characteristics of the obtained cities' types shows the average "typical" values of the partial indicators.

The columns (Table 2) show the partial indicators average values of cities socio-economical status of corresponding types. The higher the value of an indicator, the higher position at the average these type cities occupy in the appropriate direction of socio-economical development. Consequently, the socio-economical condition of these type cities is better the more indicators have high values. These values ($\geq$ 50) in the table are in bold. Performed highlighting let clearly see the differences between basic types of cities and between types, taking account of regional variations.

So in general high level of four to six development lines is characteristic for leading cities, for the middle "strong" cities - two to three lines. In such cities, the average "poor" developed areas on the average one, two, but may be absent (type 5-3, see Table. 2). For cities, characterized by outsiders only one direction, often a state of law and order, but for type 1(2)-4 is also a state employment sphere.

Figure 1 shows the resulting algorithm, formed on the basis of the typology of integrated estimation methods of municipalities' socio-economical status.

Algorithm (Fig. 1) reflects the sequence of the major procedures performed in the implementation of the technique: on the basis of the main socio-economical indicators of the big cities, taken from the Statistical Abstract of the Russian Federation Federal State Statistics Service "Regions of Russia" (step 0 - preparatory), make an adjustment "negative" indicators (mortality, unemployment, crime), the calculation of normalized values of the array (step 1) and the values of individual indicators (step 2). From the values of individual indicators a composite index of city socio-economical condition was calculated and used to analyze the quality of clustering solutions in the large cities typology construction (steps 3.1 and 3.2). Formation of a comprehensive estimation of municipalities' socio-economical status is provided by combined using of the city type content characteristics and city comparative characteristics in the three-level indicators system (steps 4.1 and 4.2).

An even higher level of detail, down to the characteristics of socio-economical status of individual cities within the types, allows building graphical radar charts, named as the "profile of the city".

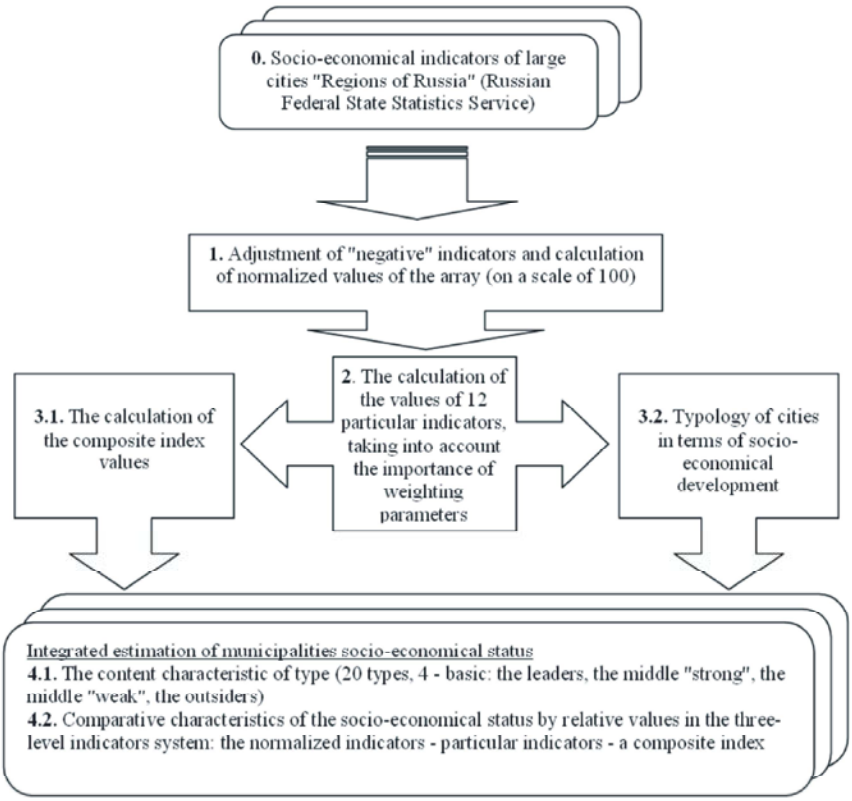


Fig. 1: Algorithm technique of a comprehensive estimation of municipalities socio-economical status in case of large cities

Table 1: Types of large Russian cities in terms of socio-economical development

| Region Type[1] | City Type[2] | Cities list |
|---|---|---|
| 1(2) | 1 | Nizhnevartovsk, Surgut |
| | 2 | Almetyevsk, Belgorod, Vologda, Dzerzhinsk, Nefteyugansk, Nizhnekamsk, Nizhny Tagil, Stary Oskol, Sterlitamak, Cherepovets |
| | 3 | Arzamas, Balashikha, Berezniki, Elec, Zeleznodorojny, Zhukovsky, Kamensk-Ural, Kolomna, Korolev, Mytishchi, Neftekamsk, Novokuibyshevsk, Noginsk, Odintsovo, Octyabr'skiy, Podolsk, Rybinsk, Salavat, Sergiev Posad, Syzran, Khimki, Tchaikovsky, Elektrostal |
| | 4 | Asbest, Zelenodolsk, Lyubertsy, Orekhovo-Zuevo, Pervouralsk, Serov, Serpukhov, Solikamsk Schelkovo |
| 3 | 1 | Tomsk |
| | 2 | Petrozavodsk, Syktyvkar, Yakutsk |
| | 3 | Komsomolsk-on-Amur, Norilsk, Ukhta |
| | 4 | Achinsk, Belovo, Vorkuta, Kansk, Kiselevsk, Leninsk-Kuznetsk, Mezhdurechensk, Prokopyevsk |
| 4 | 1 | Bryansk, Kaliningrad, Kirov, Kursk, Magnitogorsk, Murmansk, Sochi, Stavropol, Tver |
| | 2 | Veliky Novgorod, Vladikavkaz, Vladimir, Kaluga, Nalchik, Orel, Smolensk, Tambov |
| | 3 | Volgskiy, Kostroma, Novorossiysk, Orsk, Pskov, Taganrog |
| | 4 | Armavir, Balakovo, Bataysk, Velikie Luki, Volgodonsk, Glazov, Dimitrovgrad, Zlatoust, Kamyshin, Kislovodsk, Kovrov, Kopeysk, Miass, Murom, Nevinnomyssk, Novomoskovsk, Novotroitsk, Novocherkassk, Novoshakhtinsk, Obninsk, Pyatigorsk, Sarapul, Shakhty, Engels |
| 5 | 1 | Arkhangelsk, Ulan-Ude |
| | 2 | Abakan, Blagoveshchensk, Magadan, Petropavlovsk-Kamchatsky, Yuzhno-Sakhalinsk |
| | 3 | Angarsk, Biisk, Bratsk, Severodvinsk |
| | 4 | Artem, Nakhodka, Rubtsovsk Ussuriisk, Ust-Ilim |
| 6(7) | 1 | Ivanovo, Cheboksary |
| | 2 | Kurgan, Saransk, Chita |
| | 3 | Yoshkar-Ola, Maikop |
| | 4 | Derbent, Kyzyl, Cheboksary, Khasavyurt, Cherkessk, Elista |

1- Typology of regions in the project "Social Atlas" [8, 9].

2 - Basic types of cities: 1 - City leaders, 2 - medium "strong", 3 - average "weak", 4 - City-outsiders.

Table 2: The average "typical" values of the partial indicators for cities socio-economical status of corresponding types

| | City type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Indicator | 1(2)-1 | 1(2)-2 | 1(2)-3 | 1(2)-4 | 3-1 | 3-2 | 3-3 | 3-4 | 4-1 | 4-2 |
| Demographic setting | 66,64 | 41,81 | 20,97 | 16,84 | 61,36 | 46,63 | 40,85 | 19,98 | 43,45 | 36,49 |
| Employment | 70,95 | 61,09 | 54,47 | 52,90 | 60,73 | 63,35 | 40,99 | 40,61 | 63,33 | 57,44 |
| Standart of life | 63,71 | 34,26 | 28,84 | 27,02 | 37,20 | 40,08 | 55,33 | 29,65 | 37,21 | 31,86 |
| Education | 46,19 | 46,38 | 17,58 | 13,08 | 75,83 | 47,99 | 34,90 | 17,65 | 69,75 | 48,84 |
| Health | 29,12 | 34,37 | 22,59 | 22,40 | 76,32 | 58,89 | 32,12 | 24,80 | 55,27 | 58,00 |
| Law-abiding | 24,21 | 61,24 | 74,19 | 51,05 | 47,37 | 39,83 | 51,06 | 52,72 | 64,31 | 72,95 |
| Industry | 39,49 | 23,19 | 11,86 | 10,54 | 30,36 | 19,82 | 24,40 | 13,08 | 30,38 | 24,31 |
| Construction | 49,36 | 23,82 | 12,08 | 6,26 | 53,15 | 26,38 | 12,89 | 4,70 | 27,08 | 22,10 |
| Transportation services | 16,67 | 22,88 | 10,57 | 5,04 | 38,51 | 12,89 | 17,61 | 8,60 | 39,19 | 28,39 |
| Communication services | 54,75 | 38,34 | 17,70 | 13,76 | 87,87 | 36,33 | 32,28 | 11,44 | 67,34 | 49,83 |
| Trade and services | 59,44 | 27,13 | 17,39 | 10,98 | 60,71 | 55,17 | 39,28 | 18,58 | 50,10 | 32,62 |
| Investment policy | 56,37 | 20,24 | 10,91 | 6,55 | 47,52 | 35,82 | 35,77 | 8,49 | 32,20 | 19,71 |
| | City type | | | | | | | | | |
| Indicator | 4-3 | 4-4 | 5-1 | 5-2 | 5-3 | 5-4 | 6(7)-1 | 6(7)-2 | 6(7)-3 | 6(7)-4 |
| Demographic setting | 31,47 | 21,86 | 47,59 | 37,52 | 34,55 | 26,05 | 47,47 | 43,24 | 33,68 | 47,57 |
| Employment | 65,02 | 51,63 | 66,39 | 55,25 | 43,54 | 50,02 | 60,01 | 57,31 | 45,76 | 47,49 |
| Standart of life | 28,43 | 23,13 | 37,84 | 41,49 | 35,65 | 26,21 | 31,82 | 30,14 | 28,16 | 12,10 |
| Education | 39,15 | 18,25 | 63,56 | 26,12 | 38,83 | 16,28 | 84,66 | 57,26 | 28,73 | 14,23 |
| Health | 34,96 | 25,28 | 62,82 | 50,50 | 31,04 | 23,52 | 68,20 | 57,51 | 44,87 | 30,28 |
| Law-abiding | 67,23 | 70,10 | 56,76 | 53,21 | 47,99 | 39,16 | 60,47 | 40,53 | 73,92 | 75,54 |
| Industry | 19,90 | 12,83 | 26,46 | 19,67 | 18,83 | 13,60 | 23,37 | 16,44 | 19,36 | 12,86 |
| Construction | 14,73 | 5,50 | 12,81 | 13,95 | 6,29 | 3,15 | 26,91 | 16,19 | 12,65 | 6,03 |
| Transportation services | 20,90 | 8,75 | 17,52 | 10,93 | 13,73 | 5,37 | 36,43 | 27,56 | 19,12 | 6,33 |
| Communication services | 39,32 | 16,91 | 48,73 | 28,67 | 32,27 | 16,22 | 72,53 | 46,13 | 31,70 | 10,30 |
| Trade and services | 22,68 | 16,55 | 42,27 | 41,10 | 23,58 | 18,84 | 34,60 | 35,06 | 23,37 | 14,34 |
| Investment policy | 23,38 | 9,17 | 28,87 | 18,98 | 11,65 | 7,13 | 20,42 | 34,89 | 22,09 | 21,85 |

The developed radar charts can be used for comparing the socio-economical condition of the same type cities and for this state estimation relative to the "typical" values average.

Thus, as a result of the analysis, "Profile of the City" Taganrog we can conclude that in the near future as the priority areas of socio-economical development of Taganrog can be chosen field of construction (for example, share housing, improving the mechanisms mortgage construction), the further development transport infrastructure, improvement of investment policy and a source of best practices can serve the investment strategy of Novorossiysk.

A similar analysis can be performed for each of the sample. To allow an arbitrary sampling of cities for comparison, to facilitate access to statistical data and build the operational diagrams a computer information system (IS) InfORMO (Information Support of municipalities' development) was developed.

**Information System Based on Integrated Estimation Methodology:** An information system InfORMO 1.0 (Certificate of state registration *No* 2006612814 from 09.08.06) was created to provide a better practical use of integrated estimation methodology of municipalities' socio-economical status.

IS structural components are database, graphical reports forming module and software module that implements the algorithm of the integrated methodology for estimating the municipalities' socio-economical status (Fig. 1).

**The Information System Database Contains:**

- General overview of each city in the sample, all subjects and federal districts of Russia;
- Name, guidance and primary statistical data on 58 indicators of the Russian Federal State Statistics Service in 137 cities of sampling;
- Names and values of 12 private indicators and composite index of municipalities' socio-economical development;
- Analytical information on each of 20 identified types of large Russian cities.

With the help of information system InfORMO 1.0 the following problems may be solved:

- Input (export) and editing of primary statistical data;
- Automatic calculation of 12 private indicators values and composite index of socio-economical development;
- Upgrade, if necessary, an indicator system of cities' socio-economical development by the addition of new indicators and their groups, or, using the developed design-master of indicators, through the formation of arbitrary particular indicators by mathematical processing of existing indicators;
- Formation of queries and selection of general and statistical information about cities in several ways:

- Hierarchical - a list of cities is displayed in the submission of relevant subjects and Federal districts;
- Typological - cities are displayed in order of affiliation to relevant types of regions and types of cities;
- Alphabetic - the entire sample of cities is arranged in alphabetical order of their names

- Creation and printing or sending to an external file reports with a help of master-report-builder.

Master-report-builder can operate in two modes: step-by-step and single-window. In the step-by-step mode, the user fills out a series of forms, each of which specifies one of the query parameters:

- The Federal district selection - from the list with the district names you can select one or several options, an option "all districts" is also available;
- The region type selection - according to the "Social atlas of Russian regions" typology, a list of types' names is showed, from which you can select several or all types;
- The choice of the subject - the displayed names' list includes only those subjects of Russia, which belong to the selected in step 1 federal district, or in step 2 – regions' type. If steps 1 and 2 are not limiting, that is selected "all regions" or "all types", flipping list of subjects includes an alphabetical list of all subjects. From the list you can select several or all subjects;
- The city type selection - from a list of basic cities' types, you can select one or more options;
- The city selection - a list of cities as well as in the third step, is formed in the light of these limitations. In addition to real cities the list may contain "Phantom City", presented with average indicators for each of 20 cities' types. Each town has a phantom name corresponding to the type code, for example, "Typical city 4-3". The use of "typical" urban key points helps interpreting the comparisons results of cities socio-economical status - the graphs can clearly show that some areas of the city is developed worse than the average for the type;
- The time period choice - you can specify options beginning 2000;
- The selection of socio-economical indicators - the names of parameters are displayed in a hierarchical list from which you can select individual indicators, the whole group or particular indicators are displayed;
- Choice of ways for data representing - it can be a table or bar chart, if up to four indicators are chosen to compare, table, or radar chart (city profile), when compared 5 to 12 indicators, only the table, if you have selected more than 12 indicators, or data for several years;
- Looking through and editing of the report - the appearance of a generated report (histogram, radar chart or table) can be adjusted: changes in scale, color, font, line thickness and other parameters;
- The report publishing way selection - the results can be printed, or transferred to an external file in RTF or XLS, where data handling can be extended by means of MS Office. Any part of the report may also be directly copied to the clipboard.

Single window mode of master-report-builder allows you to accelerate the process of generating reports for more experienced users, since most of the steps (1 to 8) can be performed on a single screen.

**The Order of Practical Training Execution (Work-Shop):** The use of based on the described methodic information system InfORMO 1.0, implemented into the studying process shows good results and gives an opportunity to develop a participative approach of teaching in high school. This pedagogical approach emphasizes learning through individual experience [11]. Students, while studying such courses as "Regional Economics", "Municipal Management", "Socio-economical Development and Management", can have such individual experience with analysis of socio-economical state of cities and towns performed in InfORMO 1.0. The suggested order of practical training is given below in a form of consequent steps chain. This order has a recommended, not strict character.

- Getting acquainted with the information support methodology of the integrated municipalities socio-economical development process and manual IS InfORMO 1.0.
- Checking with the teacher the municipality name for the analysis of the socio-economical status.
- With an alphabetical list of cities from a database of IS InfORMO requesting a detailed description of the municipality, including a description of the city and region types, radar chart "profile of the city," the 12 key areas of the histogram of socio-economical development. Obtained using IS InfORMO materials should be printed, or exported to a document MS Word.
- Analyzing the collected data to identify and justify the choice of the main directions of the priority development of the socio-economic condition of the municipality (in the diagram of the profile).
- Developing a set of priority actions within the selected areas of priority development of the municipality socio-economical condition. Taking into account likely limited resource availability briefly describe the implemented activities and expected results, which consists, for example, in the increasing of the indicators absolute values of municipality socio-economical condition.
- Entering into the database IS InfORMO the new values of socio-economical condition of the municipality and re-build and print "City profile".
- Making a description and analyzing the dynamics of individual indicators on the obtained charts (before and after implementation of the proposed action). Making notes whether there was an improvement in the socio-economical condition of the municipality.
- If necessary, repeating steps 5-7, observing and analyzing the indicators' dynamics.
- Preparing a resume about the effectiveness and feasibility of the proposed measures of the municipality socio-economical development.

Thus, on the basis of implemented algorithm the use of IS InfORMO allows performing a detailed comparative analysis of socio-economical condition of the municipality, providing a high level of clarity and information content through a system-generated charts, comparison tables. Integrated use of available analytical data of the information system in municipal governing will detect the key points: what areas of municipal life require priority development, how to build the necessary management system, which management techniques to apply, how to respond adequately to the changing external and internal conditions, etc.

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