Building a monitoring system of migration flows based on the results of the survey, the theory of influence factors and the gravity model

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Abstract — **The study is devoted to the basis description of the monitoring system of separate regions population migration attitudes. The study was based on researches of official statistics sources, modernization of E. Lee's theory about factors influencing the decision to move, and making changes to the gravity model. The survey, allowed to identify key factors of influence and determine the structure of further data processing, was identified as main component of the proposed monitoring system during the study.**

Keywords — monitoring system, migration flows, gravity model, youth migration

I. INTRODUCTION

Every year the migration issue becomes more burning not only for the states, at the upper levels of which this issue is regulated in one way or another, but also for individual federal centers, regions and cities. The tasks of reducing the outflow from one place to another are puzzled by researchers from leading European countries and the United States of America, while in the Russian Federation these issues are just starting to be raised in meetings [1, 2, 3]. Under the command economic system, the problem of redistribution was regulated by top management: new employees were assigned to the existing positions, students were sent to plough virgin lands, and so on. In the transition to market relations, such a format has ceased to be relevant, and has not yet gained the necessary support for the organization of the process in an optimal way [4, 5].

In general, the current migration policy in our country covers only the main points, which are reflected in the reports of the current governance. This includes accounting for external migrants to Russia; tracking the number of Russian citizens receiving a new place of residence; and some accounting of population flows between the largest cities, regions or federal centers.

At the same time, often, the accounting system for all these flows at the city and even regional levels is entirely the responsibility of the regions themselves. Migration registration systems or monitoring systems include, at best, those indicators that are subsequently required in state-level reports. It is almost impossible to keep track of when a problem with outflow or, on the contrary, overpopulation is brewing in one region or another.

However, the settlement of this issue will help not only competently redistribute resources between cities, regions and federal centers, but also to evenly develop peripheral areas, pulling up their level closer to the one of the capital.

II. RESEARCH METHODOLOGY

During analyzing the foreign researchers' studies, we see that several models developed in the middle or in the end of the last century are most popular. The most commonly used is the gravity model, which serves as the basis for most modern studies [6]. The general idea of this model lies in the directly proportional dependence of the values of migration flows between specific settlements and the distance between them. The formula for calculation was derived in the sixties of the last century, but is relevant nowadays:

$$Mij = Pi*Pj/Dij^2*A \qquad (1)$$

where: Mij is the predicted number of migrants from region i to region j; Pi is the population of region i; Pj - population of the region j; Dij is the distance between regions i and j; A - the coefficient of compliance.

Subsequently, in the course of their research, scientists proposed to modernize this formula many times, and the most well-established proposal was to replace the indicator "distance between settlements" by "the cost of moving from point A to point B" [10]. However, even with this approach, the gravity model does not take into account many socially and economically significant factors that in one way or another can influence the decision of people to change their place of residence.

Another scientific system, which is devoted directly to the study of factors influencing the adoption of migration decisions, is the econometric theory E. Lee about groups of factors [18]. According to this, in each considered territory, be it a city, a region, a district, or a state, there is special group of factors influencing the population. These groups can be divided into three categories: pushing, holding and pulling. The author of the theory during the experiments identified some relationship between the influence and the status of the population of the territory in question. For example, the attracting factors of the territory of attraction, i.e. places where a person wants to move to, will have the greatest impact on people with a higher standard of living: they are highly educated, have a certain social status, have reached certain heights in the professional sphere. For such population groups, relocation is often a tool for raising earnings or moving up the career ladder.

In contrast, pushing factors in the donor area, i.e. the place from which people are going to leave will have the greatest

impact on people with lower socioeconomic status. Such pushing factors in this case are existing unemployment, low wages, high taxes. In this case, relocation is not so much a tool for raising the standard of living as a reason for finding the most favorable conditions for life, on the basis of which you can already rebuild your life.

Despite the attempt to unify the factors that influence decision-making about a change of residence, E. Lee's econometric theory basically has a statement about the uniqueness of a set of factors for each location. In addition to this, during our research, we concluded that a unique set of factors would not only be in consideration of certain areas, but also when focusing on a specific age group of the population, since the reasons for moving at the age of 20 and 40 will be absolutely different [15].

Thus, the synthesis of the two mentioned migration models formed the basis of the work done to develop the basis of the monitoring system of migration registration in Chelyabinsk region. Each of these systems was used taking into account the peculiarities of the chosen territory and only for the young population, i.e. people aged from 18 to 35 years. This category was chosen because young people are the engines of progress, engines of development. Just young people eventually shift responsibility for order in the city, living conditions and attractiveness of settlements.

III. THE RESEARCH

As a tool for learning the migration situation in the region, an analysis of statistical data available in the public domain was tested. The territorial body of the Federal State Statistics Service for Chelyabinsk region provides some summary of information on migration flows. Using the data from the past sixteen years as an example, it turned out to see a negative trend in the migration coefficient movement.

TABLE I.   MIGRATION OF CHELYABINSK REGION 2002 - 2017

2002	2003	2004	2005	2006	2007	2008	2009
-1491	-854	-939	646	1601	2740	3914	1569
2010	2011	2012	2013	2014	2015	2016	2017
2511	9974	8786	9499	11002	3746	2704	-3840

On the basis of this table, it can be seen that in 2017, the rate of migration growth became negative for the first time during more than ten years. At the same time, the jump after the previous one, in 2016, is quite significant - 6.5 thousand people. At the same time, an important feature of official statistics is that it takes into account only those cases in which there is a registration confirmation of the fact of a decrease or increase. Thus, all the facts of relocation of students, small businessmen, employees for higher positions with paid rental housing fall out of the focus of research.

In addition to the overall migration rate, indicators of median age and increase (decrease) in fertility in Chelyabinsk region were considered.

The median age in most modern studies is an indicator characterizing the composition of the population of a particular territory.
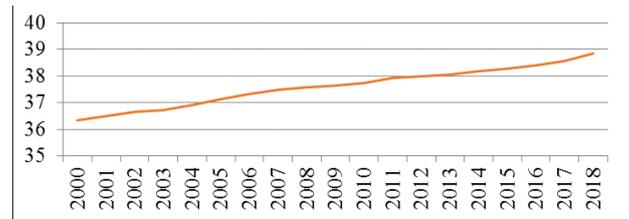

Fig. 1 The median age of the population of Chelyabinsk region

Thus, in this case, it is possible to note the obsolescence of the population, which may be associated with the departure from the region of families with minor children or just planning to create a family.

This hypothesis can be confirmed during the consideration of the index of the total fertility rate over the past seventeen years. It is noticeable on the graph that recently it has a negative tendency to decrease and reaches the figures of 2007-2008.
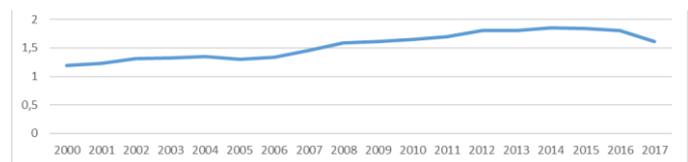

Fig. 2. Fertility rate in Chelyabinsk region

Also in the course of the study of official sources, such significant shortcomings were found as the delay in processing and providing data and inconsistency in collecting statistics in different regions. For example, when comparing the indicators of Chelyabinsk region and the neighboring large federal centers (Yekaterinburg, Kurgan, Perm, Tyumen) it is impossible to conduct a more detailed study than to analyze the rate of migration growth. The different data collection format, the delayed display of information over the past years, makes summary statistics non-unified, and the comparison process is almost impossible. In addition, the purpose of the study was a certain age category of the population, but not all areas carry out such detailed data collection.

As a result of the deficiencies found, it was decided to conduct their own research, the results of which could serve as the basis for the monitoring system, coupled with the existing official data and being suitable for applying them to a gravity model or theory of influence factors. At the same time, the study should be as unified as possible in order to be scaled to other areas if possible.

The most appropriate decision in this case was a survey of the population on the subject of migratory mood. The target audience of the research, namely the youth of the city of Chelyabinsk aged from 18 to 35 who have already received a higher education or are at the final stage of receiving it, participated in the survey. The survey list consisted of 10 questions about the nature of the education received or being received, dissatisfaction with specific areas of life in the current place of residence, the top priority reasons for a possible move.

IV. RESULTS OF THE RESEARCH

In total, about 1000 people took part in the study. The answers received were distributed according to E. Lee's theory of the factors that influence the decision to move. For example, the answers to questions about what exactly does not

suit the respondents in the current situation in the city and region and for what sake they are going to move, have become pushing factors. In turn, the holding factors were the answers to questions about the reasons for staying to live in the current place.

The study also determined that attracting factors are relevant only in cases where the probability of departure from one particular city to another is calculated. In other words, attracting factors characterize not so much the donor city as the city attracting the population.

The following factors were identified as factors restraining the change of residence among the youth of Chelyabinsk region:

1. The lack of financial opportunities to move in the near future was noted by 12% of all respondents. The economic indicator is also noted by all leading Russian and foreign studies, as it is a priority for the lower social stratum of the population and continues to be significant for people with an average and higher level of wealth.

2. The presence of immovable or movable property, which was mentioned by 10% of the interviewees. If we compare the cost of housing to leading federal centers and periphery, we can see proportional dependence: the more attractive the place of residence, the higher the cost per square meter of residential premises.

3. Another factor that has a retaining effect was the presence of a specific proposal from the employer or working employment in the current place of residence. This was reported by 10% of respondents.

However, the most frequently mentioned influence factor was marked by a psychological factor, i.e. social attachment to the current city of residence, the presence of close people, family and friends in it. All interviewees, whether Chelyabinsk was their native city or not, noticed that they would be much more willing to move to another area if their loved ones had the opportunity to make the move with them. Thus, the widespread retention of the age population in its territory, i.e. providing them with an adequate standard of living, may entail more young people who decide to stay.

We also assumed that such a feature is characteristic of the age segment we are considering. Most young people, especially those who have not yet received higher education, are characterized by incomplete financial independence, which causes a strong dependence on the family and established social ties.

The following were attributed to the opposite category, the category of pushing factors:

1. 55% of respondents answered that they are not satisfied with the environmental conditions in the city. The critical situation in the city has been actively covered in the media over the past years, which provided a public response not only at the city level, but also at the state level.

2. 30% of interviewees noted the lack of opportunities for professional growth in Chelyabinsk. Remarkably, the number of people who noted this answer prevails over those who mentioned the presence of good job offers. It can be said that this is the most sharp question, which being unresolved makes young people look for a new haven.

3. Also, the cultural poverty of the area under consideration was noted as a pushing factor. It was reported by 24% of respondents.

4. The final mass pushing factor was discontent with the urban environment. This fact was noted by 16% of respondents. Here the road situations, and solutions to housing issues, and relationships with companies serving the city were described.

Thus, on the basis of the study, it was found that the main factor exerting a pushing effect on the youth of Chelyabinsk and the region was the social situation in the area.

V. RESULTS OF THE RESEARCH

One of the questions of the survey was the one of the most attractive areas for relocation. The study found that they became Central Russia, which was indicated by 42.7%, South Russia (27%) and Yekaterinburg, which was noted by 22.8% of respondents. Such results are quite predictable, so the study has just confirmed the hypothesis. Southern cities attract young people with a more pleasant climate and the presence of the sea in some cases, Central Russia and Yekaterinburg, as the nearest federal center, attract more opportunities and exposure to constant changes, technological innovations. It is Interesting, the southern regions were more often identified by younger interviewees, while more mature ones mentioned a similar lack of job opportunities for highly qualified specialists. Also, the older the respondent, the more often he highlights the economic factors of retention or attraction as the key ones: the high cost of moving, the presence of high-paying job offers, the cost of housing. Based on this, we can conclude that, despite the presence of higher education, financial factors remain prevailing over all others.

To adapt the factors obtained to the gravity model, the difference coefficient was decided to be renamed the criticality index. Due to the fact that attracting factors characterize cities of attraction, they will not be used in calculations. The total impact of the factors was taken as 1 to simplify and unify the monitoring system. In consequence of this, if we assume that the holding and pushing factors act with the same force, then the impact coefficients can be defined as 0.5. It follows that the most preferable situation for a city can be considered the one for which the criticality index value will be positive. In other words, retention factors will have the greatest impact, rather than repulsive. Such a situation can be observed in large federal centers or cities with a high standard of living. And in contrast, if the criticality index in a city is negative, then there is an increased likelihood of mass migration in the city or region under investigation.

The percentages of the respondents obtained during the study were reflected in the general formula with coefficients 0.5 and the corresponding signs: pushing factors were taken into account with a minus sign, holding - with a plus. Thus, the formula took the following form:

$$0,5 * (0,12 + 0,1 + 0,1) - 0,5 * (0,55 + 0,3 + 0,24 + 0,16) = 0,5 * 0,32 - 0,5 * 1,25 = 0,16 - 0,625 = -0,465 \qquad (2)$$

The criticality indicator has a negative sign and is significant enough. In other words, even with a small excerpt size, it can be concluded that the situation in Chelyabinsk is critical and requires close monitoring. Current migration statistics do not fully reflect this and are scattered in various sources.

To transfer all received factors to the monitoring system, it is necessary to select the appropriate equivalent, which can be monitored with statistical tools. For example, the lack of financial opportunities for relocation can be estimated by the cost of leaving the area: average transport fare to the nearest federal centers and the most attracting factors; the equivalent

of having movable or immovable property will be the average cost per square meter of housing; a critical situation in a city can be assessed using the well-being rating or the governor's rating of Russia.

The survey should be wider, distributed everywhere, automatically counted and constantly updated. With a constant watching of views on the current situation even once a quarter, the situation in the city and region can be monitored not only after the fact, when the population decreases, but to a warning.

Similar questioning should be extended to other age groups: schools should have questionnaires for pupils, as educational migration is also a significant indicator for the development of the city, and large enterprises should interview their employees, because with such a channel, the greatest coverage is possible.

If the interviewed population is evenly divided into random groups, it is possible to achieve a permanent stream of relevant information that will highlight the problem of migration attitudes at the level of different population groups. For example, students from different high schools of the same direction can be interviewed during periods of different sections or divided into subgroups to clarify the results.

VI. RESULTS OF THE RESEARCH

As a result of the study, the general structure of the monitoring system was determined:

1. The collection of statistical information should be continued in at least the same format that is currently available. However, all indicators should be presented in one place and clearly increased during the time. Perhaps, at the initial stage, the monitoring system will be one Internet page with graphs changing here and now.

Data can be pulled from the following sources:

a. Registration services;

b. Medical institutions;

c. Educational institutions;

d. Personnel records of urban enterprises.

2. Questioning can and should be one of the tools for assessing migration attitudes of the population in the "here and now" mode because of its mobility. Questioning should be carried out at different levels in order to determine the most complete picture and to review all areas that require close attention and study. It can be conducted at the following levels:

a. Generalized level on shared resources;

b. Young people by polling in educational institutions;

c. School pupils on the subject of academic migration;

d. Employees of organizations as the most able-bodied stratum of the population;

e. Government structures or specific areas of employment to identify more special problems;

f. Many others.

Thus, the summation of only two ways to assess the criticality of the migration situation will allow to identify problem areas more correctly and allocate available resources

more accurately. At the same time, the described monitoring system can be scaled both to small settlements and to larger federal centers. Each territory will have its own factors and its own characteristics, but the generalization of information gathering will provide an additional opportunity to compare living conditions for raising it in lagging regions.

References

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[8] Mkrtchyan, NV (Mkrtchyan, N., V) ; Florinskaya, YF (Florinskaya, Yu F.), 2018, "Labor Migration in Russia: International and Internal Aspects"

[9] Beine, M (Beine, Michel), Coulombe, S (Coulombe, Serge), 2018, "Immigration and internal mobility in Canada"

[10] Venhorst, VA (Venhorst, Viktor A.), 2013, "Graduate migration and regional familiarity"

[11] O. Busch, B. Weigert, "Where have all the graduates gone? Internal cross-state migration of graduates in Germany in 1984 - 2004", Annals of regional science, 2010, vol. 44, issue 3, pp. 559-572

[12] J. van Geel, V. Mazzucato, "Conceptualising youth mobility trajectories: thinking beyond conventional categories", Journal of ethnic and migration studies, 2018, vol. 44, issue 13, pp. 2144-2162

[13] A. Bernard, M. Bell, "Educational selectivity of internal migrants: global assessment", Demographic research, 2018, vol. 39, art. 29

[14] Biagi B. (Biagi, Bianca), Faggian A. (Faggian, Alessandra); McCann P. (McCann, Philip), 2011, " Long and Short Distance Migration in Italy: The Role of Economic, Social and Environmental Characteristics"

[15] Busch O. (Busch, Oliver), Weigert B. (Weigert, Benjamin), 2010, "Where have all the graduates gone? Internal cross-state migration of graduates in Germany 1984-2004"

[16] JE Anderson, "Theoretical foundation for the gravity equation", American Economic Review, 1979, vol. 69, issue 1, pp. 106-116

[17] A.Arpaia, A. Kiss, B. Palvolgyi, A. Turrini, "The effects of European integration and the business on migration flows: a gravity analysis", Review of World Economics, 2018, vol. 154, issue 4, pp. 815-834

[18] Huttunen K. (Huttunen, Kristiina), Moen J. (Moen, Jarle), Salvanes K.G. (Salvanes, Kjell G.), 2018, "Job Loss and Regional Mobility"

[19] Tarasyev A.A. (Tarasyev, Alexandr A.), Agarkov G.A. (Agarkov, Gavriil A.), Hosseini S.I. (Hosseini, Seyed Iman), 2017, "Machine Learning in Labor Migration Prediction"

[20] Rafiq, S (Rafiq, Shuddhasattwa); Nielsen, I (Nielsen, Ingrid); Smyth, R (Smyth, Russell), 2013, The Encyclopedia of Global Human Migration Published, "Effect of internal migration on the environment in China"