Evaluation of housing development balance in the Russian Federation regions

T Y Ovsiannikova, O V Rabtsevich and I V Yugova

1Department of real estate expertise and management, 1Federal State budgetary educational institution of higher education “Tomsk State University of Architecture and Building”, TSUAB, Solyanaya sq. 2, Tomsk, 634003, Russia

E-mail: saykova86@mail.ru

Abstract. The article is devoted to the analysis of the problem of balanced development of the housing sector in the regions of the Russian Federation. The relevance of the research is determined by heterogeneity of the socio-economic field of the Russian Federation and necessity to ensure a balanced development of the housing sector in the country’s regions as the most essential condition for leveling-off the living standard of the population. The article studies the current condition and development of the housing sector in the Russian regions through a system of indicators that characterize dynamics of the housing investment market and the population’s housing conditions. The authors of the article propose an approach to assessment of territorial differentiation of regions’ housing development levels based on the use of statistical analysis methods. The developed approach involves determining the integral index of the current condition and development of the housing sector in regions by aggregating the values of individual indicators that characterize dynamics of the regional housing investment market and housing conditions of the region’s population. The approach proposed by the authors allows us to analyze the housing sector as a complex system, characterize dynamics of its development and expose its results. The article tested the developed approach: it assessed the current condition and level of development of the housing sector in 80 regions of the Russian Federation and analyzed the balance of its development.

1. Introduction
One of the most significant issues in development of massive national economies is the socio-economic heterogeneity of territories and considerable territorial imbalances in their development. The causes of the socio-economic heterogeneity are both natural and climatic, and socio-political factors. The consequences of such heterogeneity are unbalanced territorial development of a country, degradation of individual territories, disproportions in the living standard of population, internal migration flows of labor resources, and unbalanced development of the economy as a whole. Therefore, the most important strategic direction of a state’s economic policy is to ensure balance in socio-economic development of its regions.

The housing sector as a subsystem of national economy is also affected by factors of economic heterogeneity. Territorial balance of housing development is one of the main conditions for leveling-off the standard of living of population in regions, increasing adequacy and accessibility of housing for a country’s population as a whole. Territorial balance of housing development is the most important criterion for efficiency of state’s housing policy. Thus, the analysis of functioning of regional housing
complexes in order to assess uniformity of the level of development of the housing sector in Russia is the most important objective of modern scientific research.

2. Literature Review
Since the problems of housing development in Russia and other countries are quite acute, works of many Russian and foreign scientists are devoted to the study of housing sector functioning problems. Housing as a field of research is an area comprising many issues, so works of scientists deal with studying various aspects of theory and practice, based on the use of different methodological tools.

At the same time, the literature review conducted by the authors shows that still a relatively insignificant number of studies are devoted to assessment of current condition and level of development of the housing sector in the regions of Russia. The analysis of territorial differentiation of the level of housing development is based on methods and tools of economic, statistical and mathematical analysis. In turn, these methods are based on the use of both quantitative (statistical) indicators and qualitative indicators, which are either the results of generalizations of population survey data, or expert assessments. It should also be noted that in most works there is no comprehensive approach to the study of the housing sector – there is either the analysis of the current condition and development of the housing market, or the housing conditions of the population.

Approaches to assessment of the current condition and level of development of the housing sector in regions proposed by researchers, can also be divided into two groups: approaches whose estimate is based on utilization of individual indicators [1, 2, 3, 4, 5, 6, 7]; approaches based on identification of integral characteristics that result from a comprehensive analysis of the values of individual indicators [8, 9, 10, 11, 12, 13]. Methods of assessment of the housing development level devised under the latter approach are usually based on the calculation of complex indicators by summarizing various statistical data and then applying statistical analysis tools to assess the territorial distribution of the obtained results.

Since the review proved that, on the one hand, there is little research in this area and, on the other hand, it does not allow a comprehensive assessment of the current condition and level of development of the housing sector in order to identify territorial imbalances, the authors of this article propose their approach to assessment of the current condition and level of development of the housing sector in the regions of Russia.

3. Methodology
Emerging trends in Russia’s socio-economic development determine significant price, reproduction, and structural imbalances in the housing investment market [14]. In Russia, the disproportions in the housing investment market have a pronounced territorial pattern due to significant heterogeneity of regional development. At the same time, for efficient functioning of the housing investment market in regions, it is necessary to improve mechanisms of state housing policy, which, in turn, requires analysis of the degree of territorial differentiation in the level of housing development in regions.

The authors of this article propose an approach based on a complex multidimensional grouping of data which involves calculation of an integral index of the current condition and development of the housing sector in regions (figure 1) to analyze the impact of territorial development imbalances on dynamics of the housing investment market. The method developed by the authors allows us to characterize the territorial balance of the development of a country’s housing sector as a complex system:

- firstly, formed by territorial subsystems that determine its dynamics;
- secondly, it unites separate local markets – primary housing market formed by housing construction; secondary housing market; housing services;
- thirdly, it is constantly changing: the dynamics of the system reflects development trends of the housing market, and the statics reflects the state of the housing services.

To assess regional differences in the level of development of the housing sector, a comprehensive system of indicators, which includes two groups of housing indicators, was formed:
indicators that reflect the dynamics of the housing investment market in a region;
– indicators that characterize housing conditions of a region’s population.

1. Justification of the theoretical approach to assessment of territorial balance of housing development

The theory of regional development, the theory of local markets, systems theory, theory of housing investment

2. Justification of methodological tools for assessing the balance of housing development

3. System analysis, logical analysis, statistical analysis methods (complex multidimensional grouping of data based on an integral indicator)

4. Formation of a system of housing indicators of the current condition and development of the housing sector in regions

Group 1. Indicators of development of the housing investment market in a region:
1.1. Amount of housing commissioning per capita in the region, thousand sq. m./person.
1.2. Index of availability in the primary housing market in the region, years.
1.3. Index of availability in the secondary housing market in the region, years.
1.4. Housing investment per capita in the region, thousand rubles/person.

Group 2. Indicators of housing conditions of region’s population:
2.1. Average supply of housing, sq. m./person.
2.2. Amount of area of housing equipped with all types of landscaping in the total area of the region’s housing stock, %
2.3. Amount of the area of renovated multi-family residential buildings in the total area of the housing stock, %
2.4. Amount of expenses for housing and utility services, as a percentage of the total amount of consumer spending of the population, %

5. Analysis of the degree of differentiation of housing indicator values (calculation of coefficients of variation based on regional data)

6. Development and calculation of integral indices of the condition and level of development of the housing sector in regions using a multidimensional average

Index of housing investment market development in the region

Index of housing conditions of the population in the region

7. Calculation of the integral index of the current condition and level of development of the housing sector in the regions

8. Complex multidimensional grouping of regions by the value of the integral index of the current condition and level of development of the housing sector

9. Assessment of the territorial balance of housing development and its impact on the functioning of the housing investment market

Figure 1. Stages of the approach to assessment of impact of territorial balance of housing development on functioning of the housing investment market.

Distinguishing of such groups of housing indicators, on the one hand, allows us to reflect the trends and directions of development of the housing sector through the analysis of market indicators, housing
investment, and, on the other hand, to characterize consequences of this development through assessment of indicators of living conditions of the population. Thus, indicators of the housing investment market are indicators of the ‘dynamics’ of the housing sector, and indicators of housing conditions are indicators of ‘statics’ describing its state.

Housing indicators are mainly either statistical data from Rosstat (Federal State Statistics Service), or indicators determined based on their values (coefficients of housing affordability in primary and secondary markets, housing investment per capita), which makes it easy to perform calculations. The exception is the indicator “the amount of the area of renovated multi-apartment residential buildings in the total area of the housing stock, %”, calculated from the data from the Fund of assistance to reforming housing and communal services. The values of housing indicators were prepared for 80 regions of the Russian Federation (Sevastopol and the Chukotka Autonomous Okrug were excluded from the study due to the lack of necessary statistical information) as of 2018, which allowed for comparability of statistical data (many statistical indicators of housing conditions of the population – for example, the average housing availability by region – are published with a one-year lag).

4. Data Analysis and Results
In order to justify the necessity for further analysis and identify the degree of territorial differentiation of the level of development of the housing sector, the authors of the article initially assessed the degree of variation in the values of housing indicators in the regions of Russia (table 1).

**Table 1.** Assessment of the degree of variation in the values of housing indicators by Russian regions as of 2018.

| Housing indicator | Description (method of calculation) | Degree of differentiation (Authors’ calculation) |
|-------------------|-------------------------------------|-----------------------------------------------|
| **1. Indicators of development of the housing investment market in the region** |
| 1.1. Amount of housing commissioning per capita in a region, thousand sq. m./person. | Calculated by the authors as the ratio of housing commissioning per year in a region to the average annual population in a region according to [15] | Coefficient of variation – 49.0 % Average value for regions – 0.46 sq. m./person. Percentage of regions with above-average values – 42.5 %, below-average – 57.5 %. |
| 1.2. Index of availability in the primary housing market in a region, years. | Calculated by the authors as the ratio of the cost of a standard apartment (the cost of an apartment is determined based on the size of the household and the social norm of housing security of 18 sq. m. / person) in the primary and secondary markets, respectively, to the average income of a household of three people in a region according to [15] | Coefficient of variation – 18.8 % Average value for regions – 2.7 years. Percentage of regions with above-average values – 67.5 %, below-average – 32.5 %. |
| 1.3. Index of availability in the secondary housing market in a region, years. | | |
| 1.4. Housing investment per capita in a region, thousand rubles/person. | Calculated by the authors as the product of housing input in the region and the price of one square meter of housing area in the primary market according to the data [15] | Coefficient of variation – 70.6 % Average value for regions – 22.6 thousand rubles/person. Percentage of regions with above-average values – 32.5 %, below-average – 67.5 %. |
| **2. Indicators of housing conditions of the region’s population** |
| 2.1. Average housing availability in a region, sq. m./person. | The ratio of the total area of housing stock in a region at the end of the year to the population in a region at the end of the year [15] | Coefficient of variation – 14.3 % Average value for regions – 26.0 sq. m./person. Percentage of regions with above-average values – 53.8 %, below-average – 46.3 %. |
| 2.2. Amount of the area of housing equipped with all types of landscaping in the total | The ratio of the area that is simultaneously equipped with types of improvement that are statistically monitored (sewage, water supply, central heating and hot water | Coefficient of variation – 24.3 % Average value for the regions – 61.1 % Percentage of regions with above-average values – 50.0 %, below-average – 50.0 %. |
As can be seen from Table 1, most housing indicators have an average or significant degree of variation in values by region – the value of coefficient of variation is about 20% [18], which indicates a significant territorial differentiation of housing development in the Russian regions.

Indeed, the key indicator of development of the housing investment market is the introduction of housing per capita. Coefficient of variation of this indicator’s values for the Russian regions was almost 50% – in 2018 in 57.5% of the Russian regions introduction of housing per capita did not exceed the national average, which indicates significant territorial imbalances in distribution of housing investment. The same fact is confirmed by a very high variation in the values of the indicator “amount of the area of renovated multi-family residential buildings in the total area of the region’s housing stock, %”, reflecting the amount of investment directed to the renovation of housing stock in the regions. The heterogeneity of the territorial development of regional housing investment markets does not allow for an increase in the volume of housing commissioning in the country as a whole, and, consequently, an improvement in the housing conditions of the Russian population.

The reason for the lack of investment activity in the housing investment market is also the low effective demand of the population, which is the main investor in housing construction. Rather low values of housing affordability indices – 2.7 years in the primary market and 2.5 years in the secondary market – do not exceed the value of the target indicator (3 years) set by the state [19], and it would seem that they indicate a high level of housing affordability for households. However, the actual level of housing affordability for the population of Russia is considerably lower, firstly, because the simple housing affordability index does not take into account population’s expenditures on consumption; secondly, because assessment of the affordability index is usually based on the use of a artificially low index of housing per capita (18 sq. m./person), which does not allow speaking about sufficient level of housing adequacy; thirdly, the simple affordability index calculated based on the average per capita income of the population does not allow us to assess investment opportunities of households with different income levels in the housing market. Indeed, assessment of availability of housing in the primary market, taking into account distribution of the population by income level, shows that in 2018 for 60% of the Russian population with incomes up to $ 431.8 per person / month (income in rubles is converted to US dollars at the annual exchange rate of the dollar for 2018 according to [20]) it would take more than 3 years to accumulate funds for the purchase of new housing, provided that consumption was completely abandoned, and for 25.6% of the least prosperous group of population, whose income does not exceed $ 215.9, the affordability index is at least 7 years,
which in fact, makes it impossible to improve housing conditions [21]. In order to simplify the calculation of complex indicators, the authors used the simple housing affordability index [22].

The results of the development of the housing investment market directly affect the condition of the housing sector and determine the level of housing adequacy. The most important indicator of housing adequacy, which characterizes the size of a dwelling unit, is the average availability of housing. The level of housing security of the Russian population is also geographically heterogeneous – in 2018, the average area of housing per resident ranged from 14.1 sq. m. per person in the Republic of Tyva to 32.7 sq. m. in the Moscow region. Despite the fact that more than half of the regions (53.8 %) have an average housing security index higher than the national average (more than 26 sq. m. per person), the housing security of the Russian population is extremely low in comparison with indicators of other countries of the world [14].

One of the most important parameters of housing adequacy is also the level of improvement of residential premises. In Russia, statistical monitoring is carried out for such housing stock that has the following types of improvement: sewerage (drainage), water supply, central heating and hot water supply. In this regard, when calculating the integral index of housing conditions of the population, the authors used the “amount of the area of housing equipped with all types of improvements in the total area of the housing stock, %” indicator. The level of improvement of the housing stock also has a pronounced territorial differentiation: in 2018, in 20 regions less than 50% of the housing stock was fully landscaped, in 42 regions the level of improvement did not exceed 70%, and only in 8 regions the amount of the area of the housing stock equipped with all types of improvements was more than 80% (calculated by the authors according to [15]). The analysis shows that the quality of housing stock in Russia does not fully correspond to the concept of adequate housing: in 40 regions (50% of the total number of regions), the amount of the housing stock equipped with basic types of improvements was lower than the national average – less than 61.1 %.

Since the quality of dwelling is determined by the intensity of housing renewal, the calculation of comprehensive indicators also contains such an indicator as “amount of the area of housing equipped with all types of improvement in the total area of the housing stock” characterizing the dynamics of the processes of renovation of the existing housing stock. This parameter was calculated by the authors using the data on the area of renovated multi-apartment buildings, starting from the period of implementation of regional capital repair programs (the period of 2017-2018), according to Rosstat Federal State Statistics Service) [15] and the Fund of assistance to reforming housing and communal services [17]. The processes of housing stock renovation are characterized by territorial heterogeneity: in 2018, in 16 regions of Russia (20% of the number of regions), the share of capital renovated housing was less than 3% of the total area of the housing stock, in 45 regions (56.3% of regions), this indicator was in the range from 3 to 10%, and only in 7 regions (8.8% of regions), its value was equal to more than 15%.

To assess the territorial balance of housing development in the regions and identify imbalances in functioning of the housing investment market, the authors propose an integral index of the current condition and development of the housing sector in the region, formed by two complex indicators – the index of development of the housing investment market in the region and the index of housing conditions of the population in the region.

The housing investment market development index reflects the ‘dynamics’ of the housing sector – it characterizes trends in the primary and secondary housing markets. The index of the living conditions of the population describes ‘statics’ of the housing sector – it allows getting an idea of the condition of the housing stock and characterizes the quantity and quality of dwelling, consumption of housing and housing maintenance services. The housing investment market development index characterizes the dynamics of housing construction, which determines production of housing, and availability of housing for the population. The index of housing conditions of the population allows us to assess sufficiency and quality of housing, which are indicators of the efficiency of the housing sector and reflect the level of housing adequacy. Thus, the integral index of the current condition and
development of the housing sector in the region is a comprehensive characteristic of the housing sector as a complex changing system formed by individual local markets.

The integral index of development of the housing sector is calculated as an arithmetic mean of values of the index of housing investment market development and the index of housing conditions of the population (table 2) and serves the basis for multidimensional grouping of regions. The housing investment market development index and the housing conditions index, in their turn, are complex indicators as well – they are determined by aggregating several private housing indicators using the multidimensional average formula, which serves as a tool for complex multidimensional grouping of regions by the value of the integrated housing development index.

Table 2. Sequence of calculation of the integral index of the current condition and development of the housing sector in a region.

| Calculation stage | Calculation index                          | Calculation formula                                                                 | Conventional symbols in formulae |
|-------------------|-------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------|
| 1                 | Index of housing investment market development in region, $I_{HI}$ | $I_{HI} = \frac{1}{n} \sum_{j=1}^{n} \frac{x_{ji}}{\bar{x}_j}$ | $x_{ji}$ – value of $j$-typed the housing market indicator of housing investment for $i$-typed region; $\bar{x}_j$ – average value of $j$-typed the housing market indicator of housing investment in regions; \( j \)- serial number of the housing indicator, \( j = 1, n \), where \( n \) – number of all housing indicators of the housing investment market, in the formula \( n = 3 \); \( i \)- serial number of the region, \( i = 1, m \), where \( m \) – number of all regions, in the formula \( m = 80 \). |
| 2                 | Index of housing conditions of population in region, $I_{HC}$       | $I_{HC} = \frac{1}{k} \sum_{j=1}^{k} \frac{x_{ji}}{\bar{x}_j}$ | $x_{ji}$ – value of $j$-typed housing indicator of housing conditions of the population for $i$-typed region; $\bar{x}_j$ – average value of $j$-typed housing indicator of housing conditions of the population by region; \( j \)- serial number of the housing indicator, \( j = 1, k \), where \( k \) – the number of all housing indicators of the housing investment market, in the formula \( k = 4 \). |
| 3                 | Index of the state and development of the housing sector in the region, $I_{i}$ | $I_{i} = \frac{I_{HI} + I_{HC}}{2}$ | $I_{HI}$ – index of housing investment market development in region; $I_{HC}$ – index of housing conditions of population in region. |
Calculation of indices of development of housing investment and housing conditions of population according to the formula of multivariate L1-mean helps to ensure comparability of the obtained results – values of the indices are comparable with their average value for all regions (equal to one) – that is, the region with index value equal to one, will show the average result, the region in which the value of the index is less than one, will show the result below the average level in the country, and the region with an index value bigger than one, will show the result above the national average.

When calculating the index of development of the housing investment market in the regions, instead of the housing indicator “housing affordability index”, the indicator “housing affordability coefficient” was used, which is a reverse indicator in relation to the accessibility index [22]. Also, when determining the housing conditions index the housing indicator “amount of expenses on payment of housing and communal services, in percent of the total amount of consumer expenses of the population of the region, %” has been replaced by the reverse indicator “amount of consumer expenditure remaining after payment of housing and communal services, %”. Utilization of such indicators during calculation of complex indices is due to the fact that the methodology of multivariate L1-mean calculation involves a positive change in value (increase in value) of the integral index with increasing values of partial indicators. The housing affordability coefficient reflects positive changes in the investment opportunities of the population – it characterizes the amount of housing space available for purchase by the household, and “amount of household consumer spending remaining after payment of housing and communal services, %” reflects availability of housing and communal services for the population. It should also be noted that the average housing affordability coefficient was used when calculating the housing investment market development index i.e. the arithmetic mean of the normalized values of affordability coefficients in the primary and secondary housing markets.

Practical validation of the approach developed by the authors is indicative of imbalances in the housing sphere development, manifestations of which are:

– structural imbalances: emerging market dynamics of housing investment is not sufficient for a qualitative improvement of living conditions of the population: the maximum value of the index of market development of housing investment is 2.63, while the index of housing conditions of population – 1.70 (figure 2); ‘dynamics’ of the system cannot improve its condition;

– territorial imbalances: in 2018, the integral index of the condition and development of the housing sector in 61.3% of regions (49 regions) was below the national average (less than one), in 38.8% of regions its value exceeded one, and in 15% of regions the index value was less than 0.8 (table 3).

The calculations also indicate that imbalances in the development of the housing sector also reveal unfavorable situation in both production and consumption of housing in most regions of Russia. In most regions, the values of the housing investment market development index and the housing conditions index are less than one – below the national average (figure 2). The lack of effective functioning of the housing sector and the systemic nature of problems in its development is also indicated by the practical equality of the number of regions with unfavorable dynamics of the housing investment market to the number of regions with a low level of housing adequacy: the index of development of the housing investment market is less than one in 55 regions, the index of housing conditions of the population – in 50 regions.

Assessment of the balance of housing development based on the approach proposed by the authors of the article indicates the presence of territorial inequality in providing population of the Russian regions with affordable and adequate housing.
Figure 2. Distribution of Russian regions by values of the housing investment market development index, the housing conditions of the population index, and the integrated housing development index in 2018 (the area of the circle corresponds to the value of the integrated housing development index).

Table 3. Grouping of Russian regions by the value of the integral index of the condition and development of the housing sector and the average size of housing investment per capita in the group in 2018 (calculated by the authors based on the data [15, 16, 17]).

| Interval of grouping by the value of the integral index | Number of regions in the group | Share of regions in the group, % | Average amount of housing investment per capita in the group, thousand rubles/person |
|--------------------------------------------------------|-------------------------------|---------------------------------|----------------------------------------------------------------------------------|
| less than 0.8                                          | 12                            | 15.0                            | 11.09                                                                            |

Regions in the group:
Altai Republic, Amur region, Jewish Autonomous region, Karachay-Cherkess Republic, Kemerovo region, Republic of Buryatia, Republic of Dagestan, Republic of Kalmykia, Republic of Tuva, Stavropol territory, Volgograd region, Zabaikalsky Krai
### 5. Conclusion

The approach to assess the current condition and development of housing in the regions of Russia based on a complex multidimensional grouping of data proposed by the authors allows us to study territorial differences in the level of accessibility and adequacy of housing. As the practical validation of the developed approach shows obtained values of the condition and development index of the housing complex in the Russian regions give evidence of existence of territorial imbalances in the development of the housing sector – in most regions (in 61.3% of the total number of regions) the level of development of the housing complex is below the national average. This indicates both the unfavorable situation in the regional housing investment markets and low level of housing affordability, as well as low quality of the housing stock. In more than 50% of the regions, housing production cannot improve living conditions of the population, which makes it impossible to increase intensity of housing reproduction processes on a national scale as well. The unbalanced territorial development of the housing sector in Russia hinders provision of affordable and adequate housing for the population.

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