

Determining the market value of high-rise residential buildings based on evaluation of consumer properties

Svetlana Kolobova^{1*}

Moscow State University of Civil Engineering, 26 Yaroslavskoye shosse, 129337, Moscow, Russia

Abstract. As you know, high-rise construction is an indicator of the practical implementation of advanced innovative technologies in the construction industry of the country. High-rise building inevitably comes to the big cities, in connection with the shortage and value of land. The life cycle of any construction project, including high-rise buildings consists of chains: of engineering survey - design-construction-operation. In the process of operation of a tall building, decisions about major repairs or reconstruction of a building are made for decision-making on further use. This article describes methods of assessing the consumer quality of high-rise residential buildings and the establishment of prices based on consumer characteristics of a tall residential building. It is proposed to assess the premises under their quality characteristics. The study was conducted to establish the influence of individual, comprehensive and integral indicators of comparable quality for effective quality living spaces. Simultaneously, there was established a relationship of quality with the consumer cost of housing, ultimately with the potential needs of owners, tenants of the home, lessor dwelling, or buyers of residential properties and other participants in the residential real estate market. This relationship further creates consumer requirements to quality standard of premises at a certain stage of socio-economic development.

1 Introduction

In Russia the leaders of high-rise housing construction are the following Moscow construction companies: "Don-Stroy", Mirax Group, Mirax Park. High-rise residential buildings are already built in residential complexes of Moscow "Triumph - Palace", "Edelweiss", "Tricolor", "Continental", "Scarlet sails", "House on Mosfilmovskaya", "House in Sokolniki". Among the economy projects in construction there is a "Northern city", "Airbus", "Volga sails" and others. The demand for housing in high-rise buildings continues to evolve. Modern high-rise apartment buildings are constructed in such a way that you have a multi-level underground Parking. On the first two floors of multi-storey residential buildings there is a shopping centre. The hotel is located above the shopping centre . Apartments are located above the hotel. The top two floors are occupied by apartments and penthouses.

* Corresponding author: KolobovaSV@mgsu.ru

Repair and reconstruction of residential development in the future will solve the issue of increasing the of consumer quality of real estate : apartments, houses, neighborhoods. Consequently, this will increase their competitiveness on the market. After the repair, residential properties have a higher assessed value compared to residential facilities, which were not repaired. It is proposed to undertake an assessment of the premises according to their quality characteristics. The study was conducted with the aim of establishing the influence of individual characteristics and indicators of quality to determine the overall (effective) quality of living spaces. Thus was established the connection of quality with the consumer cost of housing, ultimately with the potential needs of the owners, lessees, tenants or home buyers and other participants in the residential real estate market. This relationship creates a consumer demand for quality space at a certain stage of socio-economic development.

2 Literature review

The influence of consumer characteristics on the cost of housing and subsequent sales is studied by scientists of different countries. Assessment of the quality of housing in various countries are described in several scientific publications. For example, in the article «Data quality challenges in the UK social housing sector» authors Caroline Duvierac, Daniel Neagub, Crina Oltean-Dumbravaa and Dave Dickenc explain that «The social housing sector has yet to realise the potential of high data quality» [1]. M. Norris is devoted his article to the study of the construction and management of the housing sector in the countries of Western Europe «Compared to the rest of the developed world, Western Europe is distinguished by relatively large social housing sectors».... However, institutional arrangements for the management, financing, and regulation of social housing have been commonly reformed since the 1970s. Object subsidies for the construction of new social housing have been cut and replaced by subject subsidies for tenants such as income-related housing allowances. As a result, new social housing construction has declined and the social profile of tenants has generally become more disadvantaged. In response, social landlords have devoted more attention to the social aspects of housing management and the regeneration of estates» [2]. A. Beer examines governance in the housing sector in developed economies : «Over recent decades, the management and delivery of housing assistance measures in many developed economies has become more complex as a wider range of actors have become involved in the sector» [3]. Emma R. continues the theme of the research management of the housing sector: «Through a case study of a small, affordable housing community in Sydney, Australia, it shows that housing governance can profoundly shape senses of home in aging, both contributing to and diminishing senses of home. Further, it points to a connection between housing governance and housing design with different housing typologies associated with different aging bodies and forms of management practice, with profound implications for residents' senses of home» [4].

The article discusses the influence of the quality of the workmanship and construction of new housing on sales prices and capital growth. To measure the quality of construction we use the unique situation in Singapore, where the newly completed residential projects are evaluated regardless of the quality of work in the framework of the quality evaluation system construction. «Empirical evidence suggests that apartments that are well constructed not only command a higher price for developers, but they also generate higher capital gains for homeowners and investors in the future» [5]. Other articles are devoted to the research to price discovery in the local housing market. The key question in scientific research is the quality of construction [6,7,8,9]. Russian scientists have also devoted their numerous scientific papers research housing. [10, 11, 12, 13, 14, 15].

3 Materials and methods

The author of this article found the concept of consumer quality and cost proposed method of determining this quality of housing.

To assess current market value we introduce the concept of integrated quality. Integral quality is determined by the set of all functional and economic indicators, it is through the relationship between consumer cost and the cost of a residential facility. Structure of consumer properties of objects of housing represented in Fig.1

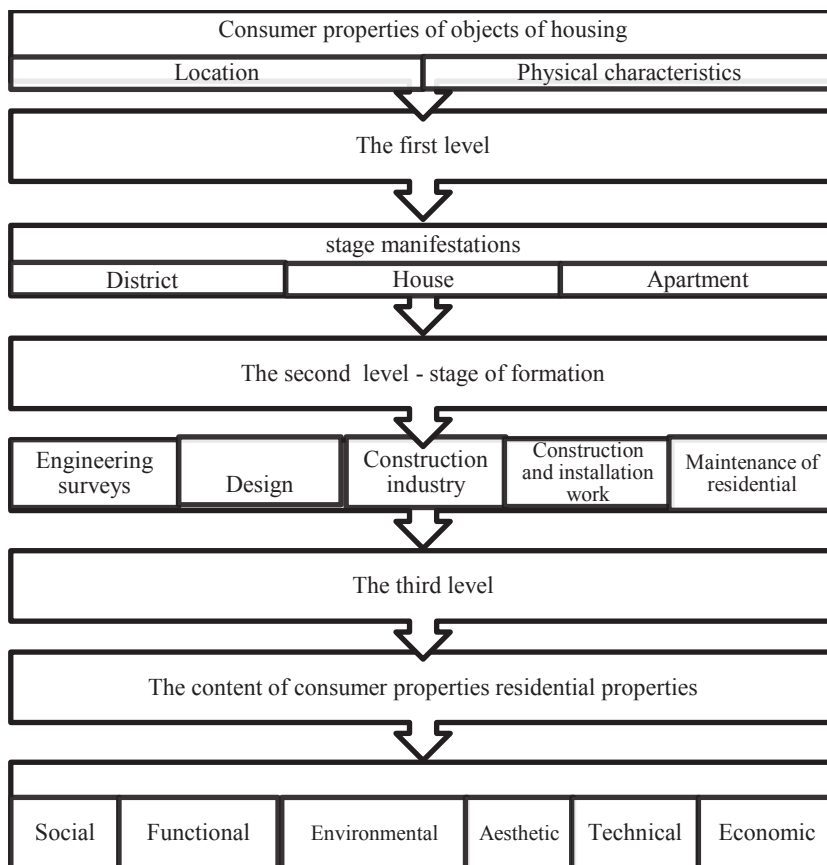


Fig.1. Structure of consumer properties of objects of housing

You must be able to measure consumer value of premises of different quality, that is, to set the level of quality. To measure the level of quality real estate by comparing it with a certain level of quality of the same object, taken as the base for comparison (the base quality). Based on this approach, the expression of quantitative relationships between the properties of a living object and the reflection of these properties in the process of operation of residential facility, namely, between the quality of construction and quality of maintenance and operation .

The number of indicators of the quality of any object, including living quarters, very large, and therefore requires the streamlining of these indicators, that is, their classification. As the basis of classification should be taken of the ability of indicators to Express the most characteristic groups of the object properties, the ability of quantitative and qualitative reflect

these properties. Their set needs to determine the quality of the object. Their body needs to determine the quality of the object. For the dwelling is inherent to a certain group of properties, component quality standard: a group of environmental, functional, aesthetic, economic, technical and social properties. The system and composition of individual indicators to obtain a comprehensive characterization of the quality of the object, based on the analysis of scientific publications. The individual indicators of the quality of a residential facility must allow its assessment at three levels: district, house, apartment. Level of quality dwelling is a relative characteristic based on the comparison of the actual values of individual quality indicators (hereinafter IQI) residential facility « P_j » with the respective preset values baseline « P_j^b ».

Since the properties through the relevant IQI, forming a quality residential properties, differently involved in the formation of this quality, that is, have different weight, it must be considered in determining comprehensive indicators of the quality of the estimated residential units on each of three levels of manifestation of these properties: urban district, houses, apartments. The quantitative values of the IQI of the object in each level are comparable using the weight of the IQI. The definition of weight, the IQI is produced using a introduced by the author three-point rating scale from 0 to 2 points. IQI, which have a significant effect on the formation of consumer quality of residential facility, is assigned the highest score 2, and IQI does not affect the consumer quality – 0.

Introduced coding of indicators, reflecting the level of their manifestation and the number summarizes their properties:

- consumer quality of apartments -100;
- consumer quality at house - 200;
- consumer quality of district - 300.

Since the properties through the relevant IQI, forming a quality residential facilities differ from one another by its weight, i.e., importance in the overall assessment of its level of quality, then there is a need for integrated indicators valuation for each of the three levels of manifestation of these properties : urban district, houses, apartments.

Obtaining a comprehensive measure of consumer qualities of premises associated with the approach of the calculated quantitative values of object on each level to the total index, taking into account comparability of the estimates IQI and the assigned weights of IQI.

To establish the relative weights IQI residential premises were involved 11 experts in the field of transactions with residential real estate, with practical experience in the real estate market from 6 to 15 years. The experts who participated in the determination of the functional weighting of the IQI, set out the assessment in accordance with the importance of quality. The most significant IQI was awarded a perfect score of "2", and IQI does not affect the quality of the residential object "0". In the processing of these data obtained the desired weight. Each expert was offered a questionnaire with tables. It was necessary to fill the table with given factors, "j" and IQI "Pj" to a residential facility.

An example of a questionnaire table for assessment factors given in table 1

Table 1. Evaluation of residential property.

Questionnaire N Mr (s) expert! I ask You to consider tables with the factors inherent in residential facilities: apartment, house , district level . Please top score of "2" to the factor having the most impact and "0" -factor that does not influence consumer qualities of the specified objects		
Sequence number	Factors «j»	Rating
<i>At the level of the apartment</i>		

1	The location of the apartment in the house	
2	Space-planning solution of the apartment	
3	The presence of the glassed balcony(s)	
4	Combined bathroom (bathroom with toilet)	
5	Improved furnish of premises under the "European standard"	
6	Sanitary state	
<i>At the level of the house</i>		
1	Space-planning decision of the house	
2	The level of technical furnishing	
3	House territory improvement	
4	The proximity to public transport	
5	The building belongs to the monuments of history, culture and architecture	
6	Shopping, office space on the first floor of the house	
<i>At the district level</i>		
1	The location of the location of the house relative to the center of the city	
2	The environment	
3	The improvement district	
4	The individuality of the area	

After filling in the experts table, is the processing of the obtained results. Initially it was determined the weight of characteristics at each of three levels of the house and area:

$$m_j = \frac{\sum_1^J V_{js}}{\sum_1^J \sum_1^S V_{js}} \quad , \text{ in this case } \sum_1^J m_j = 1 \quad (1)$$

Where: m_j – the weight characteristics «j»;

V_{js} – the assessment, exhibited j-th characteristic of the s-th expert;

j= 1, J – ordinal characteristics;

s= 1, S – serial number expert.

For example, the weight factor « j_1 » «The location of the apartment in the house» - m_{j_1} is as follows:

$$m_{j_1} = \frac{\sum_1^1 V_{j_1s}}{\sum_1^6 \sum_1^{11} V_{j_1s}} = \frac{12}{66} = 0.182 \quad (2)$$

Similarly, the calculation of the weights for other factors. Example and definition of weights for groups of factors for objects on the level are shown in table 2.

Table 2. Sample weights for groups of factors for objects on the level.

Factor j	At the level of the apartment					
Expert , S	The location of the apartment in the house	Space-planning solution of the apartment	The presence of the glassed balcony (s)	Combined bathroom (bathroom with toilet)	Improve d furnish of premises under the "Euro-standard"	Sanitary state
1	1	2	1	0	0	2
2	1	2	1	1	0	0
3	2	1	1	1	0	2
4	0	2	1	1	1	1
5	2	1	2	0	0	0
6	1	1	2	2	1	0

7	2	1	1	0	1	1
8	1	2	0	1	0	2
9	0	2	1	1	0	2
10	1	1	2	1	2	0
11	1	0	1	1	0	2
$\sum_1^{11} V_{jS}$	12	15	13	9	5	12
m_j	0.182	0.227	0.197	0.136	0.076	0.182
$\sum_1^6 m_j = 0.182 + 0.227 + 0.197 + 0.136 + 0.182 + 0.076 = 1$						

Similarly one computes the values of weights at the house and the area. Then in the same way the weight IQI - « P_j » in each group of characteristics:

$$m_{P_j} = \frac{\sum_1^P V_{P_jS}}{\sum_1^P \sum_1^S V_{P_jS}}, \text{ in this case } \sum_1^P m_{P_j} = 1 \quad (3)$$

Where m_{P_j} -- weight IQI « P_j »; V_{P_jS} -- the mark awarded P_j -th IQI s -th expert.

Weight m_{P_j} is calculated by multiplying the weight m_{P_jS} on the weight characteristic « j » weight m_j . For example, $m_{P_1} = 0.182 \cdot 0.182 = 0.033$

$$m_{P_2} = 0.227 \cdot 0.182 = 0.041$$

$$m_{P_3} = 0.197 \cdot 0.182 = 0.036$$

$$m_{P_4} = 0.212 \cdot 0.182 = 0.039$$

$$m_{P_5} = 0.182 \cdot 0.182 = 0.033$$

4 Results

Example the definition of weights m_{P_j} and the average marks q_{P_j} at the level of the apartment the factors "the location of the apartment in the house" and "Space-planning solution of the apartment" are shown in table 3.

Table 3. Example the definition of weights m_{P_j} and the average marks q_{P_j} at the level of the apartment the factors "the location of the apartment in the house" and "Space-planning solution of the apartment".

Expert , S	The location of the apartment in the house					Space-planning solution of the apartment					
	Feature rooms	Floors	Material of walls, floors	The proximity to the Elevator shaft	Orientation rooms	The kitchen area of over 10 sq m	The hall area of over 10 sq m	Ceiling height	Area of residential and outbuildings	The device built-in wardrobes	Adjoining rooms in the apartment
1	1	2	1	1	2	1	2	1	0	2	0

2	1	2	1	2	0	1	2	1	1	0	0
3	2	1	1	0	2	2	1	1	1	2	0
4	0	2	1	1	1	0	2	1	1	1	1
5	2	1	2	2	0	2	1	2	0	0	0
6	1	1	2	1	0	1	1	2	2	0	1
7	2	1	1	1	1	2	1	1	0	1	1
8	1	2	0	2	2	1	2	0	1	2	0
9	0	2	1	1	2	0	2	1	1	2	0
10	1	1	2	2	0	1	1	2	1	0	2
11	1	0	1	1	2	1	0	1	1	2	0
$\sum_{j=1}^{11} V_{js}$	12	15	13	14	12	12	15	13	9	12	5
m_{P_j}	0.182	0.227	0.197	0.212	0.182	0.182	0.227	0.197	0.136	0.182	0.076
$\sum_{j=1}^5 m_{P_{js}} = 0.182 + 0.227 + 0.197 + 0.212 + 0.182 = 1$						$\sum_{j=1}^6 m_{P_{js}} = 0.182 + 0.227 + 0.197 + 0.136 + 0.182 + 0.076 = 1$					
$q_{P_j} = \frac{\sum_{j=1}^{11} V_{js}}{\sum_{j=1}^{11} 1}$	$12/11=1.091$	$15/11=1.364$	$13/11=1.182$	$14/11=1.273$	$12/11=1.091$	$12/11=1.091$	$15/11=1.364$	$13/11=1.182$	$9/11=0.818$	$12/11=1.091$	$5/11=0.455$

Table 4. An example of defining an integrated index of consumer qualities of the i-th apartment on the basis of estimates of IQI and weights

Code prop erties	Individual quality indicators (IQI) - (Pj)		Average score	Weight	Final score
			q_{P_j}	m_{P_j}	$q_{P_j} \cdot m_{P_j}$
100	Evaluation of consumer qualities of premises				
110	The location of the apartment in the house				
	P1	Feature rooms	1.091	0.033	0.036
	P2	Floors	1.364	0.041	0.056
	P3	Material of walls, floors	1.182	0.036	0.043
	P4	The proximity to the Elevator shaft	0.273	0.039	0.011
	P5	Orientation rooms	1.091	0.033	0.036
		Σ		0.182	0.182
120	Space-planning solution of the apartment				
	P6	The kitchen area of over 10 sq m	1.091	0.041	0.045
	P7	The hall area of over 10 sq m	1.364	0.052	0.071
	P8	Ceiling height	1.182	0.045	0.053
	P9	Area of residential and outbuildings	0.818	0.031	0.025
	P10	The device built-in wardrobes	1.091	0.041	0.045
	P11	Adjoining rooms in the apartment	0.455	0.017	0.008
		Σ		0.227	0.247
130	The presence of the glassed balcony(s) loggia (s)				
	P12	Area balcony(s) loggia (s)	0.716	0.081	0.058

	P13	Type of glazing installation, double glazing	0.534	0.081	0.043
		Σ		0.197	0.101
140	Bathroom				
	P14	The presence of combined bathroom	0.678	0.042	0.028
	P15	Square bathroom	0.513	0.036	0.018
	P16	Sanitary arrangements	0.505	0.035	0.018
		Σ		0.136	0.064
150	Improved furnish of premises under the "European standard"				
	P17	The need for improved finish	0.320	0.025	0.008
	P18	The equipment with modern technical devices	0.534	0.024	0.013
		Σ		0.076	0.021
160	Sanitary state				
	P19	The microclimate in the apartment	1.182	0.023	0.027
	P20	Conditions of insolation and artificial illumination	1.091	0.021	0.023
	P21	The conditions of artificial lighting	1.364	0.024	0.033
	P22	Organization of space for the installation of air conditioning	0.818	0.018	0.015
	P23	The view from the window (window)	0.818	0.025	0.020
	P24	The noise level in the apartment	0.455	0.022	0.010
	P25	The need for repair	1.091	0.030	0.033
		Σ		0.182	0.161
	TOTAL:			1.000	0.776
<p>Comprehensive index of consumer qualities of the apartment:</p> $C_{iP_j}^a = \sum_1^{25} q_{P_j} \cdot m_{P_j} = 0.776$					

Table 5. An example of defining an integrated index of consumer qualities of the i-th house on the basis of estimates of IQI and weights.

Code properties	Individual quality indicators (IQI) - (Pj)		Average score	Weight	Final score
			q_{P_j}	m_{P_j}	$q_{P_j} \cdot m_{P_j}$
200	Evaluation of the quality of consumer home				
210	Space-planning decision of the house				
	P26	The device ramps for wheelchairs and people with limited mobility	1.091	0.053	0.058
	P27	Room for bicycles, scooters, wheelchairs	1.364	0.042	0.057
	P28	The presence of a spacious hall in the hallways	1.182	0.022	0.026
	P29	The possibility of placing concierge doorman in the entrance	0.818	0.035	0.029
	P30	The presence of underground garage	0.455	0.038	0.017
	P31	Exterior facades of the house	1.091	0.046	0.050
	P32	Floors	1.091	0.046	0.050
		Σ		0.282	0.287
220	The level of technical furnishing				
	P33	The availability of modern elevators	1.000	0.063	0.063
	P34	Device intercom	0.818	0.052	0.043

	P35	Device video intercom and video camera	1.343	0.032	0.043
	P36	Device automatic sprinkler	1.182	0.045	0.053
	P37	The device of systems of ventilation and conditioning	1.102	0.039	0.043
		Σ		0.231	0.245
230	House territory improvement				
	P38	The possibility of using the adjacent territory	0.678	0.042	0.028
	P39	The availability of Parking machines	0.513	0.036	0.018
	P40	The playgrounds and sports facilities	0.505	0.035	0.018
	P41	The presence of fencing the local area	0.320	0.025	0.008
	P42	Gardening and landscaping	0.534	0.024	0.013
		Σ		0.162	0.085
240	The proximity to public transport				
	P43	The proximity to public transport	0.678	0.042	0.028
	P44	The proximity to the metro	0.513	0.036	0.018
	P45	The proximity to the Railways stations	0.505	0.035	0.018
		Σ		0.113	0.064
250	The building belongs to the monuments of history, culture and architecture				
	P46	Belonging to the monuments of history	0.320	0.026	0.008
	P47	The building belongs to the monuments of culture	0.534	0.024	0.013
	P48	The building belongs to the monuments	0.320	0.025	0.008
	P49	Finding a home in the historical buffer zone	0.534	0.024	0.013
		Σ		0.099	0.042
260	The placement of household service enterprises on the ground floor				
	P50	Educational facilities	0.678	0.042	0.028
	P51	Allocation of the storage areas	0.513	0.036	0.018
	P52	The location of the office space	0.505	0.035	0.018
		Σ		0.113	0.064
		TOTAL:		1.000	0.787
<p>Comprehensive consumer house quality:</p> $C_{iP_j}^h = \sum_{26}^{52} q_{P_j} \cdot m_{P_j} = 0.787$					

Table 6. An example of defining an integrated index of consumer qualities of the i-th district on the basis of estimates of IQI and weights.

Code properties	Individual quality indicators (IQI) - (Pj)		Average score	Weight	Final score
			q_{P_j}	m_{P_j}	$q_{P_j} \cdot m_{P_j}$
300	Evaluation of consumer qualities of the area				
310	The location of the location of the house relative to the center of the city				
	P53	The location of the area in the city	0.678	0.042	0.028
	P54	The time spent on the road	0.513	0.036	0.018
	P55	The number of available modes of transport	0.505	0.035	0.018
		Σ		0.113	0.064
320	The environment				

	P56	The condition of the air environment	1.000	0.063	0.063
	P57	Background radiation	0.818	0.052	0.043
	P58	The presence of industries and businesses	1.343	0.032	0.043
	P59	Proximity to transport routes	1.182	0.045	0.053
	P60	Gardens	1.102	0.039	0.043
		Σ		0.231	0.245
330	The improvement of the district				
	P61	Walking distance to the objects of trade, consumer services	1.182	0.022	0.026
	P62	Walking distance to objects of education, culture, sports, leisure	0.818	0.035	0.029
	P63	The improvement district, road surface, landscaping, lighting,	0.455	0.038	0.017
	P64	The presence of the Park, square, pond	1.091	0.046	0.050
	P65	Parking machines	1.091	0.046	0.050
		Σ		0.282	0.287
340	The individuality of the district				
	P66	Historical value of residential development	1.182	0.072	0.085
	P67	Ethnic and landscape value of the territory	0.818	0.077	0.063
	P68	The presence of zones of protection of historical, cultural and architectural monuments	0.455	0.078	0.035
	P69	Density	1.091	0.063	0.069
	P70	Storeys building	1.091	0.084	0.092
		Σ		0.374	0.344
		TOTAL:		1.000	0.940
Comprehensive index of consumer qualities of the district: $C_{iP_j}^d = \sum_{53}^{70} q_{P_j} \cdot m_{P_j} = 0.940$					

Consistency of expert opinion was verified with the value of standard deviation [16,17]. Comprehensive quality indicators "C_i" characterizing the level of consumer quality of the premises of the i-th residential facility on three levels – apartments, houses, district:

Apartment	House	District	(4)
$C_i^a = \sum_1^J q_{P_j} \cdot m_{P_j}$	$C_i^h = \sum_1^J q_{P_j} \cdot m_{P_j}$	$C_i^d = \sum_1^J q_{P_j} \cdot m_{P_j}$	
$0 \leq q_{P_j} \leq 2$	$0 \leq q_{P_j} \leq 2$	$0 \leq q_{P_j} \leq 2$	
$0 \leq m_{P_j} \leq 1$	$0 \leq m_{P_j} \leq 1$	$0 \leq m_{P_j} \leq 1$	
$0 \leq m_j \leq 1$	$0 \leq m_j \leq 1$	$0 \leq m_j \leq 1$	

Где: C_i^a, C_i^h, C_i^d – comprehensive consumer quality of apartments, houses, area of the i-th residential facility;

q- average rating exposed the experts P_j –th IQI the i-th residential facility;

i = 1, n –the objects of evaluation;

j= 1, J – characteristics included in the IQI;

P_j = {1 ÷ P} – the individual indicators of the quality of the IQI assessment objects.

5 Conclusions

To calculate the magnitude of the current market value of a residential facility can be used the integral index of quality of a residential facility. Methodological basis of the calculation remains unchanged, and the accuracy of calculations is high enough. For this we use relative values complex indices of consumer quality residential properties C_i^{oa} , C_i^{oh} , C_i^{od} - r_i^{oa} , r_i^{oh} , r_i^{od} , having them as the quotient of the absolute values of the complex indices on the value of the maximum of the rating scale used ($q^{max} = 2$ points):

$$r_i^{oa} = \frac{C_i^{oa}}{q^{max}}; r_i^{oh} = \frac{C_i^{oh}}{q^{max}}; r_i^{od} = \frac{C_i^{od}}{q^{max}} \tag{5}$$

Obtained three values "r" for each underlying and the estimated object at the three levels comparable because they are derived using the same methodology. The importance of these indicators in the formation of an integrated indicator of quality should be taken into account by the introduction of their weights is "y". This weight should be determined depending on the conditions that determine supply and demand for this type of residential property and the importance for the participant of the real estate market, for example, for the buyer and the seller, each of these conditions. These weights can be obtained from the analysis of the information about the cost of rent and sales of residential properties in the city or area when changed external conditions: the location, highways infrastructure and other factors.

Integral indicator of comparable quality, including estimated residential facility can be determined by the formula:

$$C_i^{int} = r_i^{oa} \cdot y^{oa} + r_i^{oh} \cdot y^{oh} + r_i^{od} \cdot y^{od} \tag{6}$$

By the proposed technique provides for the calculation C_i^{int} for a number of objects, which had previously conducted evaluation of the transaction of purchase and sale and there is information about selling price (S). These indicators will be used for the valuation of the object. Similarly being an integral indicator of the quality of a residential facility. Of the total number of objects for which received and processed information, selected object, which $S_i^{int} \approx S_0^{int}$. The presence of equality can be considered if the coefficients differ in the magnitude of the accuracy of the calculations by almost 5-7 %. If such an object is, and the price is inserted to the market of the object may be adopted same as that of the analogue.

If this is not unique, then the total number of objects selected two:

one with $S_1^{int} \leq S$, another with $S_2^{int} \geq S_0^{int}$.

The cost is calculated based on the assumption that it changes linearly with the values S^{int} between S_1^{int}, S_2^{int} .

Then the estimated value of residential property can be determined by the formula:

$$S_0 = S_1 + \frac{(C_0^{int} - C_1^{int}) \cdot (S_2 - S_1)}{C_2^{int} - C_1^{int}} \tag{7}$$

Investors, potential buyers, tenants and other entities can calculate according to this method the market value based on an integral quality indicators, characterizing consumer properties, decides on the subsequent use of these objects: purchase, sales, rent, mortgage, etc. In the case that the objects in question do not satisfy the demand in the real estate market, the owner of a residential facility, takes the decision to repair, rebuild or overhaul to improve its consumer properties.

This technique allows to estimate the current market value of a residential facility based on the level of its consumer qualities before making a decision about capital repairs, reconstruction, and renovation of the facility.

References

1. C. Duvierac, D. Neagub, C. Oltean-Dumbravaa, D. Dickencs. ,*International Journal of Information Management* **38**, Issue 1, 196-200 (2018)
2. M. Norris. *Social Housing Landlords: Europe International Encyclopedia of Housing and Home*, 438–443 (2012)
3. A. Beer. *Housing Governance, International Encyclopedia of Housing and Home*, 497–501 (2012)
4. E. R. *Housing Journal of Housing for the Elderly* **31**, Issue 3 (2017)
5. Joseph T.L., Ooi Thao T.T., Le Nai-JiaLee. *Journal of Housing Economics* **26** 126-138 (2014)
6. Joseph T.L., Ooi1Thao, T.T. Le. *Regional Science and Urban Economics* **43**, Issue 6, 850-861, (November 2013)
7. V. Zahirovich-Herberta, K. M.Giblerb. *Journal of Housing Economics* **26**, 1-18 (2014)
8. E. Nezhnikova, R. Obukhov 08025 MATEC Web Conf. Volume **106** (2017)
9. V. Földváry, G. Bekö, S. Langer, K. Arrhenius, D. Petráš. *Building and Environment*, Volume **122**, 363-372 (2017)
10. 10 N. Safronova, E. Nezhnikova, A. Kolhidov MATEC Web Conf. Volume **106**, (2017)
11. E. A. Antipov, E. B. Pokryshevskaya. Mass appraisal of residential apartments: An application of Random forest for valuation and a CART-based approach for model diagnostics. **39**, Issue 2, 1, 1772-1778 (2012)
12. D.N. Silka, I.G. Lukmanova, A.A. Afanasev, M.A. Kasyanov, *International Journal of Economics and Financial Issues*. 5(3s) 121-124 (2015)
13. Kamenetsky M.I. *Forecasting problems*, **3**, 76-91 (2013)
14. A.A. Kokoshin, B.I. Bartenev *Studies on Russian Economic Development* **6**, pp. 6-18 (2016)
15. I. Lukmanova, N. Yaskova , *Procedia Engineering* Volume **165** , Pages 1293-1299 (2016)
16. T. Drerupa , B. Enkeb, H-M. Gaudeckerc *Journal of Econometrics* Volume **200**, Issue 2, Pages 378-389 (2017)
17. A. N. Koshev, V. V.Kuzina . *Procedia Engineering*. Volume **161**, Pages 1874-1878 (2016)