

Article

Cadastral Land Value Modelling Based on Zoning by Prestige: A Case Study of a Resort Town

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Received: 27 August 2020; Accepted: 21 September 2020; Published: 24 September 2020



Abstract: The article discusses cadastral land valuation in Russian resort towns, a procedure flawed by the fact that it does not take into account territorial prestige. Researchers in Russia and other countries state that it is essential to redistribute the land tax burden as the current situation creates tax injustice, which is reflected in the undervaluation of prestigious areas and the overvaluation of non-prestigious ones in resort towns. Competition for the most prestigious areas in such towns mainly stems from the opportunity for landowners to earn higher rental incomes during the high season. In view of this, the study aims to provide a method for cadastral land valuation in resort towns based on zoning by prestige. The application of the proposed method is demonstrated using the town of Anapa (a Russian resort town by the Black Sea) as a case study. The method is based on several research and analysis methods, including the following: the analytical method, which is used for a preliminary analysis of urban areas to identify the most attractive parts of resort towns; a modification of Saaty's methodology combined with Pareto analysis, which is used to identify criteria for assessing how prestigious and important a part of the town is; cluster analysis, which is used for ranking areas in resort towns; correlation and regression analysis, which is used for land valuation modelling. The article describes the key criteria for ranking areas in resort towns by prestige, gives a definition of prestige applied to resort town districts, and proposes an equation for calculating the integral indicator of prestige and a method for assessing prestige. The validity of the prestige map that was created for the town of Anapa was proved by analyzing the average market prices for land plots located within the identified zones. The cadastral land valuation models describing land plots in Anapa that are intended for private housing construction can be correctly interpreted and are of acceptable quality.

Keywords: territorial prestige; mass valuation; cadastral land valuation; modelling; cadastral value; zoning; resort towns; land plots; private housing

1. Introduction

Calculating the cadastral value of land is one of the topical issues in the current market system of Russia, as its results have an impact on the amount of land value tax collected and, consequently, on sustainable local development. According to the theory of taxation and the experience of developed countries, the main goal of a fair land tax is to ensure sustainable local development rather than simply to contribute to state revenue. However, this goal can only be achieved if several minimum conditions are met. Among them are the following: land tax rates should be calculated as a percentage of market

value; land valuation should be carried out by professionals who know the characteristics of the local market very well; land valuation methods that are used should be simple and readily verifiable by taxpayers; the characteristics of the property being evaluated should be logged in the Unified State Register of Real Estate; market prices for land plots should be declared and information on them should be freely available; land tax revenues should go to local governments and be used to improve public utilities and the quality of the environment [1]; the local community should be able to monitor how these funds are spent. Ideally, rather than evade taxes by any means, the population will indirectly invest money by paying land tax in increasing the market value of real estate through improving the territory as well as its environmental characteristics [2]. Thus, fair land taxation has a direct effect on sustainable local development. To achieve this effect, the right institutional environment needs to be created, which can be done, among other things, by improving the methodology of cadastral land valuation in Russia.

Currently, in many constituent entities of Russia, cadastral land valuation assessments that were produced by private valuation companies in the previous valuation period before the year 2017 are still valid, and Appendix A shows that the number of disputes in commissions and courts grew until that year. According to publications that appeared in mass media in 2016, interest in cadastral land valuation procedures and their results grew more than threefold compared to the previous period [3]. In addition, Vladimir Putin, President of Russia, noted in his annual call-in show that Russian people were interested in this issue. At the end-of-year board meeting of the Federal Service for State Registration, Cadastre and Cartography (Rosreestr), when summing up the results of 2015 and discussing the prospects for 2016, Igor Vasiliev, the head, noted that cadastral land valuation was increasing in social importance, and landowners were paying closer attention to the results of cadastral land valuation procedures. In 2016, against this background, a new plan [4] for land and property taxation began to be implemented, which implied the creation of publicly funded institutions for cadastral land valuation. One of the goals set for these institutions was to make land valuation assessments more objective, the effect of which can be seen in the graph (Appendix A) as a decrease in the number of valuation disputes from 2017 to 2019. It should be noted that, in general, 85% of appeals were filed concerning land plots, which makes the assessments of this particular type of real estate questionable. A significant portion of real estate tax revenues in many regions is accounted for by land tax. For example, in Krasnodar Krai, it accounts for 5.1% of budget revenue [5]. As can be seen from the statistics and the analysis performed, the issues related to cadastral land valuation are topical for a reason, making one of the tasks for the state and the scientific community to ensure that valuation procedures are accurate and correct.

What makes lands in populated areas special is the fact that their cost significantly exceeds that of other categories of land. This is due to a high level of urbanization and the amount of capital investment spent on construction, facilities, social infrastructure, etc. In the course of the study, about one hundred settlements were identified in Russia that can be classified as resort towns, among which are Sochi, Arkhyz, Kislovodsk, Gelendzhik, Zelenogorsk, Tuapse, Undory, Khadyzhensk, and others. An analysis of their features showed an increase in their appeal with tourists in recent years, and, accordingly, an increase in landowners' rental incomes. This means that there are several features characteristic of resort towns that influence the cadastral value of land plots and are not typical of other settlements. These include, for example, access to the sea coast in the municipal district, the distance from the land plot to the sea, the distance to the centre of Sochi, as well as the presence of and the distance to a ski resort. After analyzing cadastral land valuation reports covering Russian resort towns [6], several problems were revealed.

First, valuation procedures do not take into account some important factors that have an impact on the cadastral value of real estate and reflect the specific features of the land in resort towns and coastal towns (for example, such factors as the distance from entertainment venues, a unique climate, and hotel ratings).

Second, as the above factors are not taken into account, there is not enough information and legal background to ensure that the cadastral values of these particular territories are objective and reliable.

Third, due to technical and cadastral errors, incorrect information is entered into the Unified State Register of Real Estate, which leads to errors in calculating both the cadastral value of some land plots and land tax.

To prove that this is a topical issue and it is necessary to improve the cadastral land valuation methodology that is applied to resort towns, the cadastral values of land plots intended for private housing construction were compared with the market prices (using the town of Anapa as an example) (Appendix A). As a result, it was identified that major parts of such districts as Vysokiy Bereg and Gorgippia are undervalued by about 2.5 times, with the district of Novaya Alekseevka demonstrating the opposite situation.

This situation creates tax injustice, which is reflected in the undervaluation of prestigious areas, and the overvaluation of non-prestigious ones in resort towns. This means that the existing cadastral land valuation methodology is imperfect as it does not take into account the impact of profit from the value of land that is obtained by the residents of the towns located on the Black Sea coast, especially during the high season. This is why the study aims to develop a method for cadastral land valuation in resort towns based on zoning by prestige, which will make it possible to redistribute the land tax burden and ensure social justice.

The article is divided into sections. Section 2 discusses studies on mass land valuation and those on the influence of prestige on land prices. Section 3 describes the land valuation methodology proposed by the authors. Section 4 presents the results of testing this methodology on the Russian resort town of Anapa. Section 5 contains conclusions that were made based on the results of the research and also discusses the limitations of the proposed methodology and the areas where the results of the research can be applied.

2. An Overview of Works on Mass Land Valuation and the Influence of Prestige on Land Prices

Both Russian researchers and researchers from other countries have been discussing the issues of improving cadastral land valuation methods. Among the latest works, one should mention those by Lisi, G. [7]; Baumane, V. [8]; Balsera, M.C.M. and Martínez-Cuevas, S. [9]; Kovyazin, V.F. and Romanchikov, A.Y. [10]; Wang, D., Li, V.J., and Yu, H. [11]; Aydinoglu A.C. and Bovkir, R. [12]; Bencure, J.C. et al. [13]; Augustyniak, H. et al. [14]; Tajani, F. et al. [15], Calka, B. [16]; Morano P. et al. [17], and others. Quite a good review of literature on the mass valuation of real estate and its prospects is made in the article by Wang, D. and Li, V.J. [18].

A study by Demetriou, D. showed that both linear and nonlinear regression models are valuable tools that can be used to analyze the dependence of land prices on price factors [19]. Combining classical linear regression models with spatial regression models and using geostatistical methods were found to be adequate for developing a plan of values for rural properties of the North Fluminense Region (RJ, Brazil) [20]. Comparing linear regression results with geographically weighted regression (GWR) results obtained for Thessaloniki (Cyprus) showed that the GWR method has a much higher coefficient of determination, which means that the created model fits much better in the data [21]. Artificial neural networks (ANNs) can produce much better results, which is demonstrated by Lin, C.C. and Mohan, S.B. [22]. The problem with using ANNs is how this process works in practice. As the model does not have a definable structure, it becomes difficult to explain why an object has a particular value [23]. According to Doszyń, M., a combination of econometric, statistical, and expert opinion approaches, accompanied by using Kendall's coefficients in the process of land valuation, makes it possible to create a hybrid model with a high degree of flexibility. However, this methodology has some disadvantages. First, when calculating Kendall's coefficients, the measurement scale for real estate values is weakened by "transitioning" from the quotient to the ordinal scale. Second, the assumption that transitions between attribute categories are relatively constant is not always true [24].

To make cadastral or mass valuation models verifiable, the methods through which the results are obtained must be clear and simple for taxpayers. Therefore, complex methods are often rejected by policymakers regardless of their statistical merits [25].

Territorial prestige is one of the factors influencing cadastral land valuation that has been least studied to date. Humanity has been classifying territories as prestigious or not since the first states emerged. The Soviet academician Yulian Bromley notes that it was due to the formation of specific groups and clans in those days that some territories were classified as prestigious, resulting in social stratification [26]. Currently, prestige plays an important role and has an impact on real estate prices, which is confirmed by the opinions expressed by professionals involved in the construction sector. They note that prestige is important but not critical and goes after such factors as transport accessibility, the availability of health care, education, and service facilities, and the availability of public amenities. According to an expert, prestige is an addition to the factors mentioned above and depends on public opinion [27].

Considering prestige as an attribute that is ascribed to objects or subjects by a society based on their significance and attractiveness, it can be concluded that when an object or subject is tagged as prestigious, it is viewed as having a permanent position (status) in this society. According to Henrich, J. and Gil-White, F.J., the common meaning of prestige means respect and reverence that are bestowed upon an individual by others without being influenced by violence, threat, or coercion [28]. The idea that material goods can serve as indicators of social status dates back to the theory of the leisure class proposed by Veblen, T. [29]. Within the functionalist theory of stratification, Davis, K. and Moore, W.E. define prestige as what we get for our accomplishments, stating that differences in prestige constitute a system of social inequality [30]. Prestigious goods are goods that are bought by the consumer to improve his or her social standing [29]. The supply for such goods is inevitably limited as a result of their shortage. As land has long been traded in the Russian real estate market, land plots can also be classified as prestigious goods, provided that they are advantageously located (for example, in good neighbourhoods or places popular with tourists). The main task in identifying prestigious territories is to give reliable assessments of their importance and influence, which will ensure investment flows. The very concept of prestige should be seen as an increase in the value of real estate located on a given territory by making it unique and, in the case of resort towns, ensuring that it will generate profit. The authors believe that the prestige of a land plot in a resort town depends on the opportunity for the landowner to make a profit through renting it to tourists; therefore, it can be assumed that an area where tourists want to comfortably stay for their holidays is considered to be prestigious. An important aspect is that holidaymakers differ in terms of their preferences concerning holiday and accommodation types.

If a territory is to be considered prestigious, it has to meet particular social, economic, and environmental requirements. As a rule, prestigious places in resort towns are attraction spots (such as local centres, the town centre, or the historic centre) with housing facilities and social infrastructure of a specific quality.

The issue of the need to take into account this factor has been raised by several Russian researchers, including Vandanimaeva, O.M. [31]; Romm, A.P. [32]; Nanazashvili, I.Kh. and Litovchenko, V.A. [33]; Portnoy, B.A. [34], as well as one of the authors of this article in one of her earlier works [35]. An analysis of the works by other Russian authors (Gerasimova, E.; Truschenko, O., etc.) leads to the conclusion that they mainly focus on patterns in the development of social segregation in urban areas and suggest that it should be evaluated depending on urban morphology (the location of objects), the city's social structure, and attendance at culture and entertainment facilities [36–41]. As for Western researchers, their works are mainly focused on measuring the phenomenon of social and spatial segregation in the city by using population census data, statistics, polls, as well as in-depth interviews with locals, the results of which are expressed in scores [42–46]. Multidimensional scaling methods were used by Logan, J.R. and Collver, O.A. [47]; and Semyonov, M., and Kraus, V. [48] to study the relationships between the objective characteristics of objects in prestigious areas and their category

memberships. An interesting and innovative approach to zoning geographic areas is the prestige density-based spatial clustering of applications with a noise algorithm (P-DBSCAN) proposed by Hao, F. [49]. At the same time, Hyötyläinen, M. and Haila, A. [50] claim that until recently, when Helsinki began to implement an entrepreneurial public real estate policy, there were no districts in Finland that wealthy citizens considered to be prestigious due to the state's monopoly on area planning. As a result of the new policy, private developers started implementing projects for the construction of luxury homes, thereby creating prestigious territories in the city. In Chile, the pattern of places where representatives of the upper class reside is changing as beautiful landscapes and hedonism are starting to outweigh prestige [51].

Despite the fact that there is already some theoretical background to the matter under consideration [52,53], the conceptual and methodological issues of territorial prestige assessment carried out as part of cadastral land valuation have not yet been properly addressed.

When studying the issue of cadastral land valuation, it was previously concluded that a significant factor influencing the specifics of land pricing in big cities is territorial prestige. Prestige discussed in an earlier article [52] is considered in reference to highly urbanized areas, where the emergence of prestigious districts is mainly associated with the processes of social and spatial segregation, or the isolation of social groups from each other, and with the development of the land market according to marketing and pricing laws. Also, the main criteria were identified for a district to be called prestigious, which include the average income, the quality of landscaping, proximity to water bodies, etc. It should be noted that the prestige factor is not applicable to all towns and cities. For example, provincial towns or so-called monotowns (factory towns) do not have prestigious districts. However, there is a separate group of settlements where some districts are starting to be considered prestigious based on processes and factors other than those previously discussed. Resort towns belong to this group.

In the context of this study, the prestige of an area that is located in a resort town and intended for private housing construction is understood as the result of a subjective attractiveness assessment that is given to this area by a group of people employed in the tourism industry by using rental income as the main assessment criterion. Some areas are considered to be more attractive and promising in terms of generating rental income due to the following reasons:

- interest on the part of potential buyers that is caused by such qualities of a land plot as being unique, luxurious, and of limited supply in the real estate market;
- complementarity, which means that the location possesses several attractive characteristics, such as proximity to the sea coast, being surrounded by entertainment venues that attract tourists, good ecology, and favourable microclimatic conditions;
- eagerness expressed by tourists and travellers to spend a long time in these areas.

As a rule, the city centre is considered to be the most prestigious district. In Russian resort towns, the centre is usually the district that is located closest to the sea coast and also considered to be the most prestigious and expensive.

The article [53] explains the choice of several criteria for assessing the prestige of districts in resort towns, which include: proximity to the sea coast with public beaches; availability of entertainment venues; environmental quality, including the sea coast and the sea itself [54,55]; microclimatic conditions [56,57]; the opportunity to install utility lines [58]; population density; hotel ratings. These criteria will make it possible, first, to state if there are any prerequisites for the emergence of prestigious districts in resort towns; second, to state where their boundaries are; third, to confirm or refute the hypothesis that pricing processes differ depending on how prestigious areas are; fourth, to find the cadastral value of a land plot taking into account the prestige of the area where it is located. The latter will make assessments more objective since it is in resort towns that the differentiation of rental income obtained by landowners depends on location. This causes competition for land plots located in the most prestigious areas. In addition, it will make it possible to achieve social justice by redistributing the tax base.

3. Materials and Methods

The proposed method of cadastral land valuation in resort towns based on zoning by prestige consists of a sequence of steps (Figure 1) that combine a modification of Saaty's methodology [59], Pareto analysis [60], cluster analysis, and also correlation and regression analysis.

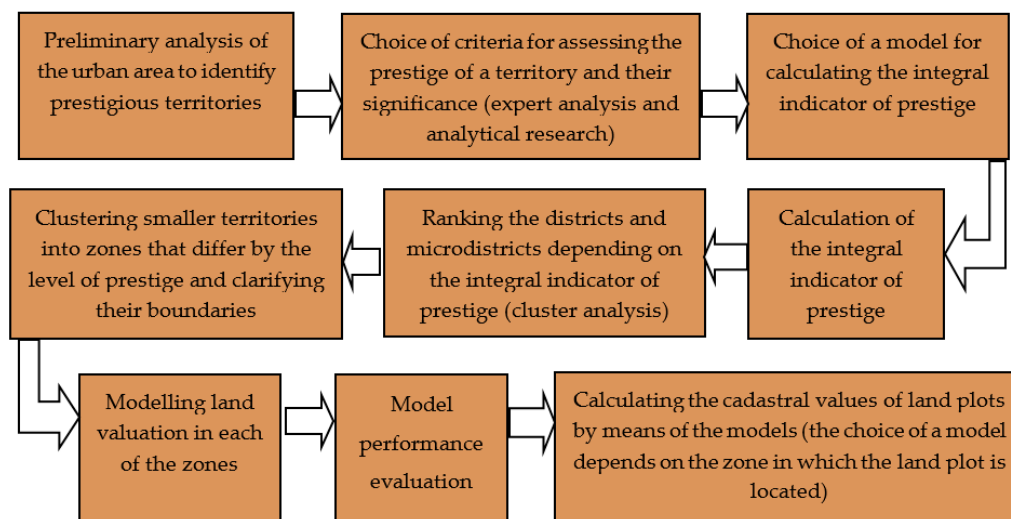


Figure 1. An algorithm for cadastral land valuation in resort towns based on zoning by prestige.

The first step was to conduct a preliminary analysis of the urban area to see whether some prestigious areas could be identified. This step implied using analysis, synthesis, and comparison.

In the second step, a questionnaire (Appendix C) was developed and distributed among experts in the fields of land and property services, urban planning, architecture, ecology, and real estate valuation to create a combination of objective criteria for assessing prestige. Thirty-seven experts took part in the study, a number that meets the requirement specifying the minimum number of participants (thirty-three individuals) that was calculated according to [61]. To ensure that the results are reliable, an error value of 0.05 was accepted as permissible, with the optimal value being 0.1, as stated in [62]. The results of the expert opinion analysis were processed using the methodology presented in detail in [63], as well as in [59,64]. A Pareto chart, one of the quality control methods according to the Union of Japanese Scientists and Engineers, was used to find out which criteria were important. The Pareto principle states that 20% of the efforts bring 80% of the results while the other 80% of the efforts bring only 20% of the results. In Pareto charts, a horizontal line is usually drawn at 80% from the y-axis to intersect the curve. All the values to the left of the intersection show important factors, with all the rest showing other factors.

The choice of a model (additive, multiplicative, quasi-additive, etc.) showing the relationship between the integral indicator of territorial prestige (IITP) and the assessment criteria is made based on checking the criteria for multicollinearity as complying with the additivity rule. This was done by calculating the matrix determinant, whose elements are the correlation coefficients between the criteria. In finding the correlation coefficient, the following algorithm was used:

- (1) Formulating a regression equation $y = a \cdot x + b$, with a and b being found as follows:

$$b = \frac{\overline{x \cdot y} - \bar{x} \cdot \bar{y}}{\overline{x^2} - (\bar{x})^2}, \quad (1)$$

$$a = \bar{y} - b \cdot \bar{x}, \quad (2)$$

where x and y are the values of the criteria for which the correlation coefficient is calculated; $\bar{x}$, and $\bar{y}$ are the average values of the criteria; $\overline{x \cdot y}$ is the average of the product of the values.

- (2) Calculating variance for each criterion as follows:

$$\sigma_x^2 = \overline{x^2} - (\bar{x})^2, \quad (3)$$

$$\sigma_y^2 = \overline{y^2} - (\bar{y})^2, \quad (4)$$

- (3) Finding the correlation coefficient using the following equation:

$$r_{xy} = b \cdot \frac{\sigma_x}{\sigma_y}. \quad (5)$$

Territories were ranked in MapInfo, a GIS product that provides different data grouping options, for example, “equal number of records”, “equal range of values”, “groups formed naturally”, etc [65]. In this study, territories were ranked based on the integral indicator of territorial prestige (IITP) using cluster analysis, which enables researchers to classify the results of their observations and split data into homogeneous groups with great precision [66]. The number of zones that differ from each other by their levels of prestige was found with the help of the Euclidean distance according to the principle of “the nearest neighbour” [67]. The method was applied in the following sequence:

1. For each cluster, a new IITP value was found in order to normalize the results using the following equation:

$$IITP_N = \frac{IITP_i - IITP_{\min}}{IITP_{\max} - IITP_{\min}}, \quad (6)$$

where $IITP_N$ is the new IITP value; i is the criterion (cluster); $IITP_i$ denotes the values of the integral indicators of territorial prestige; $IITP_{\min}$ is the minimum IITP value; $IITP_{\max}$ is the maximum IITP value.

2. Using the new $IITP_N$ value, the Euclidean distance was calculated between the new values of the integral indicators of territorial prestige:

$$R_{i,(i+1)} = \sqrt{IITP_{Ni} - IITP_{N(i+1)}}, \quad (7)$$

where $IITP_{Ni}$ is the value of the new i -th integral indicator of territorial prestige; $IITP_{N(i+1)}$ is the value of the new $i+1$ integral indicator of territorial prestige; $R_{i,(i+1)}$ is the Euclidean distance between $IITP_{Ni}$ and $IITP_{N(i+1)}$ (the value of the new integral indicator of territorial prestige for various clusters).

3. The k-means clustering iterative algorithm was used to cluster the values according to the principle of the “nearest neighbour” until the Euclidean distance from the value of the integral indicator to its “nearest neighbour” did not exceed the threshold (maximum) value.

Cadastral land-value modelling should be carried out separately for each zone distinguished in a resort town by its level of prestige. To do this, the following algorithm is proposed:

1. Identifying the list of factors affecting cadastral values of land plots intended for private housing construction.
2. Obtaining initial data on the situation in the market, finding the values of the factors, and conducting an analysis.
3. Identifying the functional relationship between pricing factors and the price variable.
4. Developing a valuation model and calculating its parameter values.
5. Assessing the statistical significance of the model.

Initial data and base maps were taken from such official sources as the Unified State Register of Real Estate, the rules for land use and development in resort towns, the general plan of Anapa, and the

land use plan for Krasnodar Krai (the region where Anapa is located). Information on market prices for land plots was taken from real estate market databases compiled by the Federal Service for State Registration, Cadastre, and Cartography and from real estate websites such as Avito.ru, Domofond.ru, Gde.ru, Irr.ru, Rosrealt.ru, Realty.dmir.ru, Vestum.ru, Ubu.ru, Uberega.ru, Tourister.ru, and others. To find the values of numerical and distance factors (those associated with the distance of a land plot from an object that has a significant effect on its cadastral value), the MapInfo geographic information system was used.

To develop statistical models, the value factors that were selected based on the analysis of the real estate market were studied using correlation and regression analysis, which made it possible to reveal multicollinearity between them and their combined influence.

To determine the kind of functional relationship, value distribution can be analyzed. If the distribution graph is asymmetric and shifted to the left, and the distribution of the logarithms of this value is close to normal, preference is given to the multiplicative model. However, nonlinear models are difficult to apply, but nowadays they are often used to estimate the hedonic price function for private housing as they produce more accurate results [68]. Some Russian researchers believe that these models produce less accurate results than linear models [69,70]. This makes it preferable to use linear models and necessary to linearize nonlinear models, including multiplicative ones.

4. Results and Discussion

As an example, the proposed method of cadastral land valuation in resort towns based on zoning by prestige is applied here to the town of Anapa, a green settlement with flat topography, which has a unique environment and is comfortable for living. Anapa's real estate market is considered to be one of the most promising along with those of Sochi and Gelendzhik (other Russian resort towns by the Black Sea), which was the reason for selecting this particular settlement for the study.

Currently, new houses are being built and infrastructure is being improved in all districts and microdistricts of Anapa. The existing buildings can be divided into several groups: new high-rise and low-rise buildings of the upper class, blocks of flats that were built from the 1970s to the 1990s, private houses, and cottages. In Anapa, as in all resort towns, the so-called private sector is a widespread phenomenon. This is a form of real estate ownership in which there is a well-maintained territory with private houses and bungalows that are intended for renting during the high season. To analyze whether there are territories in Anapa that can be viewed as prestigious, its districts and microdistricts were considered separately (Appendix B). Based on the analysis, it can be concluded that there are all the prerequisites necessary for zoning the town map by prestige.

To develop a system of objective criteria for assessing territorial prestige, the eigenvalues of the experts' answer matrices were found, which are presented in Table 1. It can be seen that some values of λ_i exceed the permissible value (7.797). The answer matrices with such values were excluded from the analysis.

Table 1. The eigenvalues of the experts' answer matrices.

Expert Number	Matrix Eigenvalue (λ_i)	Consistency Index	Consistency Ratio, %
1	8.364	0.23	17
2	7.280	0.05	4
3	7.322	0.05	4
4	7.499	0.08	6
5	7.357	0.06	5
6	7.628	0.10	8
7	7.780	0.13	10
8	7.196	0.03	2
9	7.655	0.11	8
10	7.417	0.07	5

Table 1. Cont.

Expert Number	Matrix Eigenvalue (λ_i)	Consistency Index	Consistency Ratio, %
11	7.338	0.06	4
12	7.142	0.02	2
13	7.155	0.03	2
14	7.314	0.05	4
15	7.617	0.10	8
16	7.784	0.13	10
17	7.282	0.05	4
18	7.230	0.04	3
19	7.324	0.05	4
20	9.116	0.35	27
21	7.294	0.05	4
22	7.760	0.13	10
23	7.263	0.04	3
24	7.509	0.08	6
25	7.673	0.11	8
26	7.174	0.03	2
27	7.297	0.05	4
28	7.456	0.08	6
29	7.462	0.08	6
30	7.545	0.09	7
31	7.302	0.05	4
32	7.400	0.07	5
33	7.410	0.07	5
34	7.254	0.04	3
35	8.887	0.31	24
36	7.586	0.10	7
37	7.237	0.04	3
$\lambda_{\sigma\max}$	7.792	0.13	10

The weighting factors of the criteria for assessing territorial prestige in resort towns were calculated as the arithmetic mean of the experts' weights, whose answers were consistent and are presented in Table 2. The general level of expertise was 83%.

Table 2. The weighting factors of the criteria for assessing territorial prestige given in order of importance.

Number	Criterion	Weighting Factor
1	Proximity to the sea coast with public beaches	0.26
2	Availability of entertainment venues	0.22
3	Environmental quality	0.17
4	Hotel ratings	0.13
5	Population density	0.11
6	Opportunity to install utility lines	0.07
7	Microclimatic conditions	0.04

As can be seen from Figure 2, the following criteria remained significant according to the Pareto chart: proximity to the sea coast with public beaches, availability of entertainment venues, environmental quality, and hotel ratings.

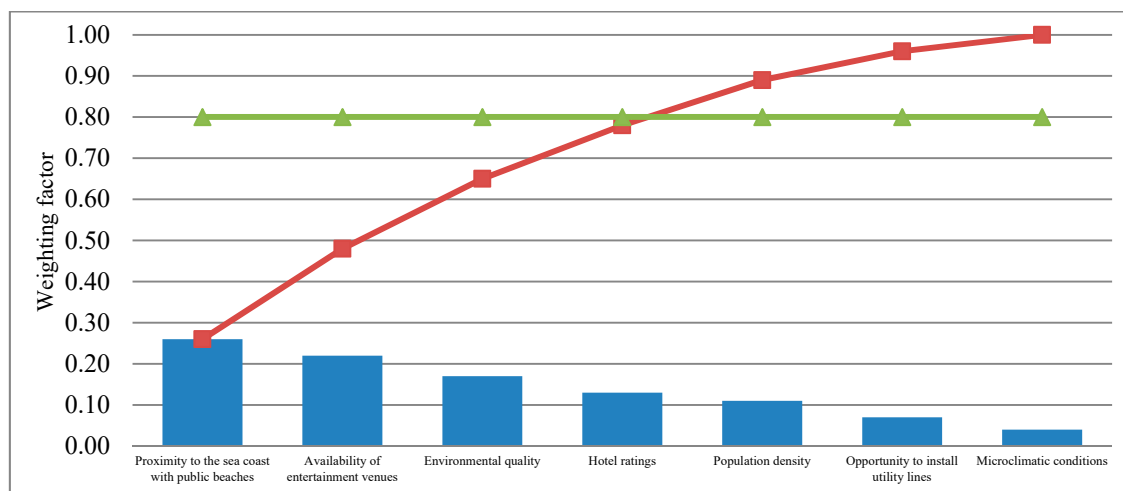


Figure 2. Identifying criteria that are significant for assessing territorial prestige in resort towns.

Correlation analysis in this case showed that the additive function is the most appropriate as it fulfils the condition that the criteria should be independent of each other (Table 3).

Table 3. Criteria for assessing territorial prestige: a multicollinearity check.

Prestige Assessment Criterion	Proximity to the Sea Coast with Public Beaches	Availability of Entertainment Venues	Environmental Quality	Hotel Rankings
Proximity to the sea coast with public beaches	1	0.32	0.43	0.12
Availability of entertainment venues	0.32	1	0.51	0.20
Environmental quality	0.43	0.51	1	0.21
Hotel rankings	0.12	0.20	0.21	1

The integral indicator that reflects the prestige of territories intended for private housing construction in resort towns will be calculated as the sum of pairwise products of the weights of the prestige assessment criteria and the values of the significant prestige assessment criteria:

$$IITP = \sum_{i=1}^n (p_i \cdot K_i), \quad (8)$$

where $IITP$ is the integral indicator of territorial prestige; p_i denotes the weights of the prestige assessment criteria, whose sum is equal to 1; K_i denotes the values of the significant prestige assessment criteria; n is the number of prestige assessment criteria.

K_i values are determined as follows:

- Proximity to the sea coast with public beaches is determined by measuring the distance from the sea coast to each land plot.
- The availability of entertainment venues is determined based on the density of the objects [71] located around the land plot that are attractive to tourists (within a distance of no more than 1 km). This makes it possible to identify areas where tourism infrastructure is highly developed (Figure 3a).
- Environmental quality [72] is determined based on beach quality rankings as the sum of normalized values for each beach (Table 4) located within walking distance (no more than 1 km) from the land plot (Figure 3b).
- Hotel ratings are analyzed regarding the number of objects (temporary accommodation facilities having a number of stars greater than three) per m^2 of the district or microdistrict.

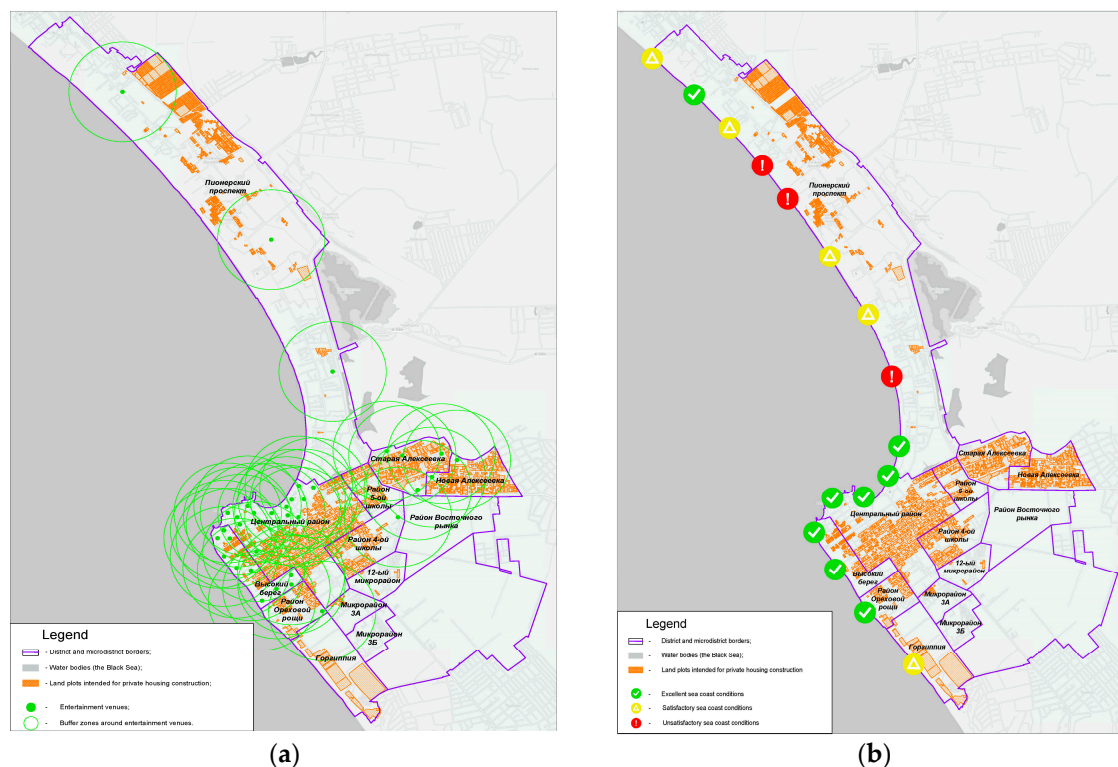


Figure 3. Spatial distribution of IITP criteria: (a) a map of buffer zones around entertainment venues in Anapa; (b) a map of beaches in Anapa.

Table 4. Beach quality and water-quality rankings in Anapa.

Rank	Beach	Normalized Criterion Value
1	Zolotaya Bukhta Hotel Beach	0.130
2	Malaya Bukhta Beach (Vysokiy Bereg Hotel)	0.120
3	Anapa Central Beach	0.110
4	Vysokiy Bereg Beach (near the lighthouse)	0.100
5	Odysseus Hotel Beach	0.095
6	A wild beach located in Malaya Bukhta	0.090
7	Chernomorets Beach	0.080
8	Malaya Bukhta Health Resort Beach	0.070
9	A wild beach located in Vysokiy Bereg behind the lighthouse	0.060
10	Beach of the 40th Anniversary of Victory	0.050
11	Lazurny Beach	0.040
12	A beach near Vityazevo	0.030
13	A beach near Dzhemete	0.020
14	Dobrodeya Beach	0.010

To calculate IITP values, K_i values must be normalized because otherwise the classification will be impacted by the criteria with the biggest ranges of values. IITP values are calculated for each land plot under consideration.

Using the hierarchical clustering method (the agglomerative approach) to analyze the sample of land plots based on their IITP values, 160 clusters were identified (Figure 4a). After finding the normalized $IITP_N$ values using Equation (6), the Euclidean distance was calculated (Figure 4b). According to the principle of “the nearest neighbour”, k-means clustering was performed using the iterative method until the Euclidean distance from the value of the integral indicator being considered to its “nearest neighbour” did not exceed the threshold value of 0.164, as this is the maximum value. In the end, the results formed three clusters.

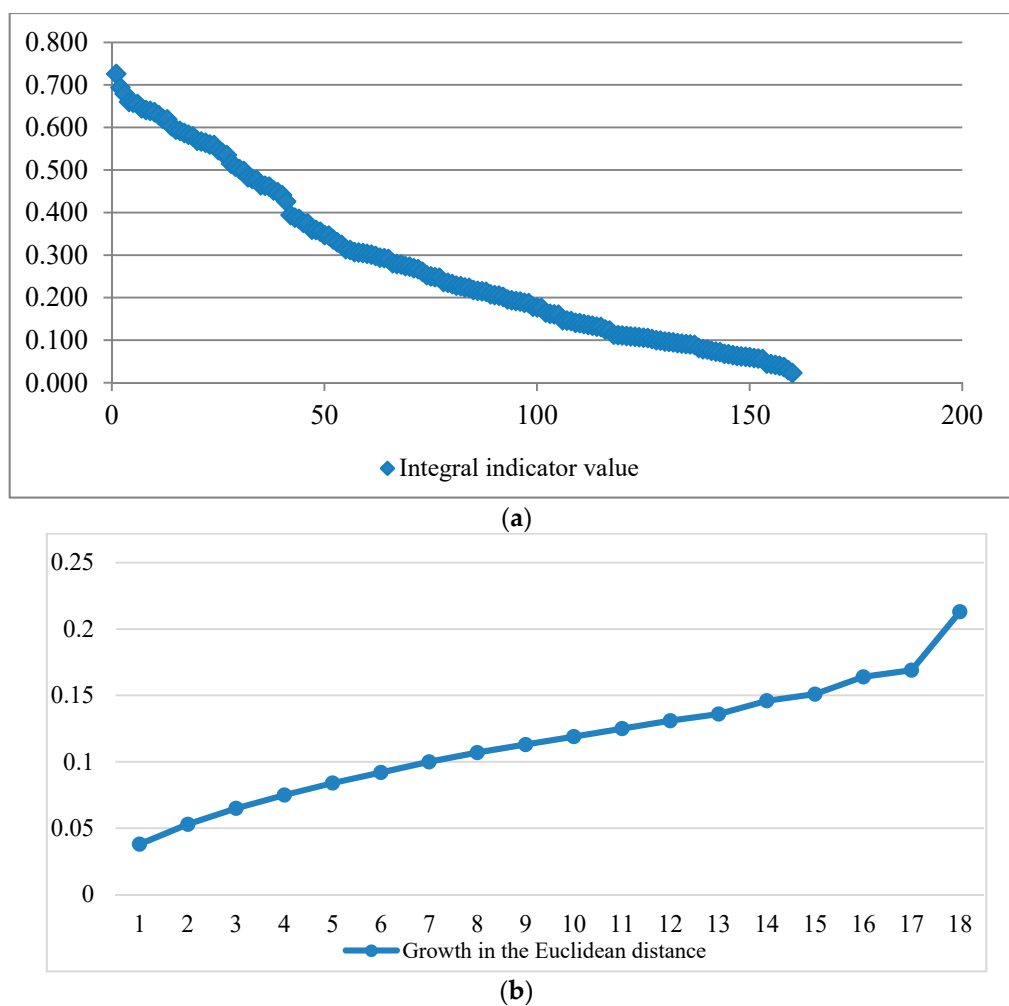


Figure 4. Graphs: (a) IITP value distribution; (b) growth in the Euclidean distance.

The map of Anapa was then divided into zones using the data on the clusters presented in Table 5.

Table 5. The results of k-means clustering applied to the integral indicator of territorial prestige.

Indicator	Cluster Number		
	1	2	3
Cluster boundaries	0.441–0.726	0.160–0.426	0.023–0.147
Cluster centre	0.583	0.293	0.085

The resulting cluster boundaries (denoting territories which differ by the level of prestige) are shown on the map of Anapa (Figure 5). The lines were drawn along natural or artificial boundaries (such as streets and roads, rivers, as well as district or microdistrict borders). In addition, only those districts and microdistricts of the town of Anapa were analyzed that have plots of land where private housing construction is permitted. As a result, three zones were identified: Zone 1—prestigious territories; Zone 2—standard territories; Zone 3—non-prestigious territories.

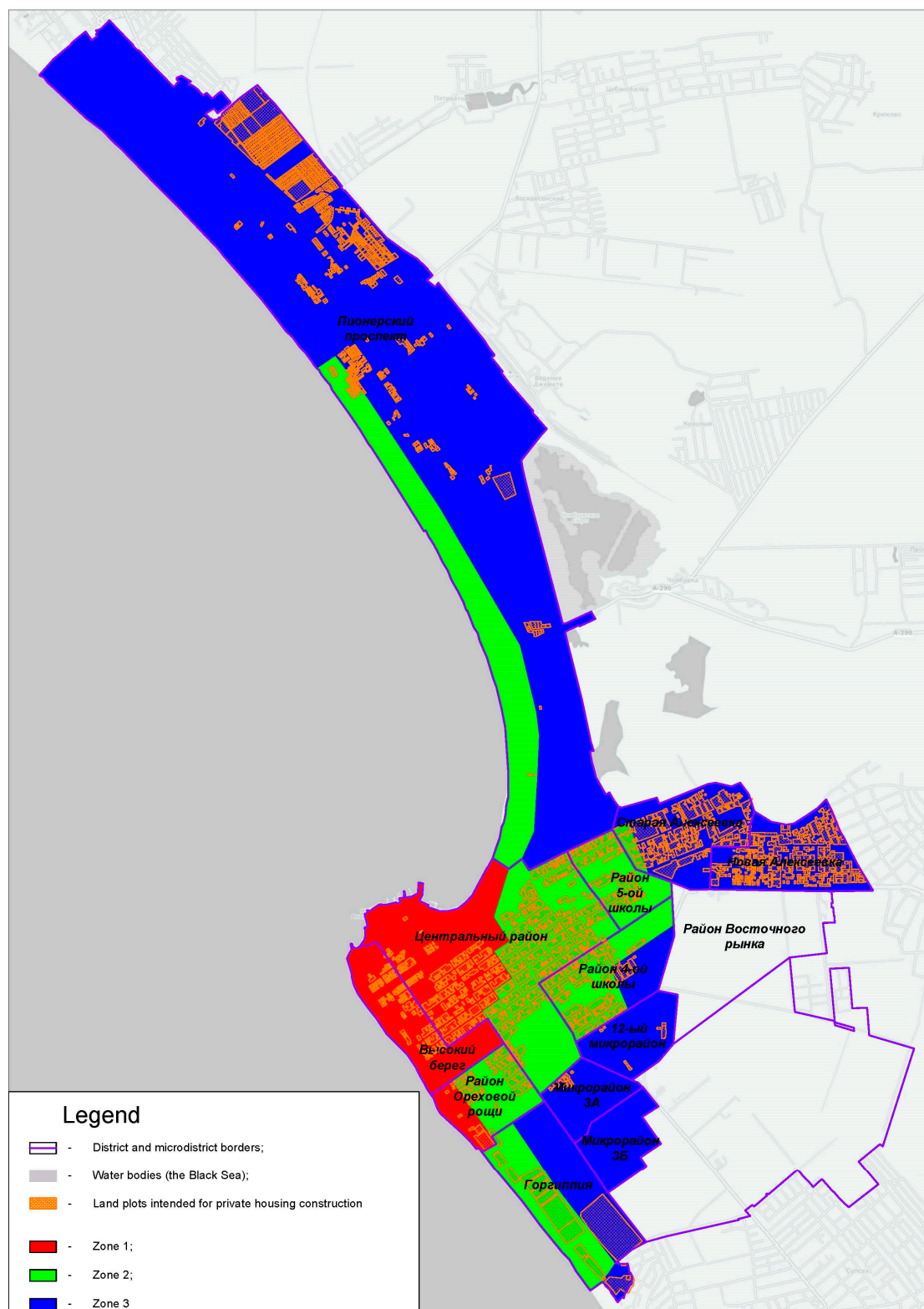


Figure 5. Anapa zoning by prestige.

The map shows that territories closest to the sea coast are prestigious. In addition, Central District has the biggest concentration of entertainment venues that attract tourists who prefer active recreation. Standard territories usually have access to good beaches, tourist accommodation facilities, and good customer service. On the contrary, non-prestigious territories are located at a great distance from the

Black Sea coast and entertainment venues. When comparing the results of Anapa zoning by prestige (Figure 5) and the map showing the distribution of market prices for land plots in Anapa (Appendix A), it was concluded that these maps are similar and commensurable. This confirms that the methodology for assessing territorial prestige in resort towns can be put into practice and used in land valuation. However, including territorial prestige assessed by the method considered above as a price factor in cadastral land valuation procedures is inappropriate, since it may result in the multicollinearity of the variables included in the regression equation and, as a consequence, in biased assessments and statistically insignificant models. For this reason, it is proposed that territorial prestige should be considered as a criterion for dividing the town into zones, with cadastral value modelling applied to each of them separately, i.e., it is necessary to formulate a hypothesis that pricing processes differ depending on the level of territorial prestige.

The list of factors that have a significant impact on the cadastral value of land plots in the resort town of Anapa was compiled based on the list of pricing factors that is present in the current cadastral land valuation report and the results of analyzing the real estate market. It is presented in Table 6.

Table 6. Pricing factors.

Code.	Factor
F1	Availability of a shopping facility
F2	Availability of recreational facilities
F3	Availability of a medical facility
F4	Availability of a cultural facility
F5	Connection to a gas supply system
F6	Connection to a water supply system
F7	Connection to a heating system
F8	Connection to a power supply system
F9	Connection to a sewer system
F10	Distance to the nearest bus stop
F11	Distance to the nearest railway platforms and stations
F12	Distance to the nearest bus terminal
F13	Distance to the airport
F14	Distance to the nearest port
F15	Distance to sea coast
F16	Distance to the town centre
F17	Number of hotels
F18	Quality of the sea coast
F19	Availability of entertainment venues

The number of land plots used in modelling was 225. As developing a model requires analyzing at least five or six land plots per each factor under study [73] and there are nineteen factors to be considered, it is necessary to analyze from 95 to 114 land plots. It should be noted that this is more of a guideline rather than a requirement since the number of objects will be sufficient only if it is possible to create a statistically significant model based on the data that was collected.

First of all, it should be noted that such factors as F1, F3, F6, F7, F8, and F9 have the same values for all objects within the three zones and are therefore excluded from the analysis (Table 8). For the same reason, factors F5 and F18 are also excluded from the analysis of the zone of prestigious territories.

A multicollinearity check showed multicollinearity between factors in all three zones. As an example, Table 7 presents a matrix of partial correlation coefficients for Zone 2 (the zone of standard territories), where multicollinear factors are shown in bold. Of the two multicollinear factors, the factor with the lower t-statistic was excluded from further modelling.

Table 7. Checking pricing factors in Zone 2 (the zone of standard territories) for multicollinearity: a matrix of partial correlation coefficients.

	F2	F4	F5	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
F2	1												
F4	0.47	1											
F5	0.18	0.23	1										
F10	0.16	0.27	0.16	1									
F11	0.28	0.56	0.33	0.72	1								
F12	0.27	0.54	0.31	0.76	0.99	1							
F13	0.29	0.58	0.36	0.64	0.99	0.97	1						
F14	0.08	−0.37	−0.38	−0.19	−0.38	−0.37	−0.41	1					
F15	−0.20	0.19	0.30	0.09	0.23	0.21	0.26	−0.96	1				
F16	0.45	0.44	0.23	0.16	0.26	0.25	0.27	−0.11	−0.02	1			
F17	0.46	0.35	0.16	0.21	0.30	0.30	0.29	−0.08	−0.00	0.27	1		
F18	0.11	0.32	0.14	0.17	0.25	0.25	0.26	−0.02	−0.04	0.23	0.01	1	
F19	0.48	0.66	0.42	0.23	0.48	0.46	0.51	−0.32	0.13	0.69	0.32	0.14	1

Multicollinear factors are shown in bold.

Table 8 shows the results of selecting the factors that will serve as a foundation for developing models for each of the three zones. Factors with values lower than 0.2–0.3 are marked with * [74], along with multicollinear factors are marked with **, both are excluded from modelling.

Table 8. Significance values of the pricing factors in the three zones of Anapa.

Factor	Prestigious Territories	Standard Territories	Non-Prestigious Territories
Availability of a shopping facility (F1)	-	-	-
Availability of recreational facilities (F2)	0.75	1	0.25 *
Availability of a medical facility (F3)	-	-	-
Availability of a cultural facility (F4)	−0.68 **	0.64	−0.20
Connection to a gas supply system (F5)	-	0.24	−0.60
Connection to a water supply system (F6)	-	-	-
Connection to a heating system (F7)	-	-	-
Connection to a power supply system (F8)	-	-	-
Connection to a sewer system (F9)	-	-	-
Distance to the nearest bus stop (F10)	−0.07 *	0.20 **	−0.03 *
Distance to the nearest railway platforms and stations (F11)	0.24	0.37 **	−0.01 *
Distance to the nearest bus terminal (F12)	0.04 *	0.35 **	−0.52 **
Distance to the airport (F13)	0.04 *	0.37	0.84 **
Distance to the nearest port (F14)	−0.29	0.06 *	−0.73 **
Distance to sea coast (F15)	0.02 *	−0.20 **	−0.19 *
Distance to the town centre (F16)	0.21 *	0.50	1
Number of hotels (F17)	1	0.55	−0.20
Quality of the sea coast (F18)	-	0.25	0.01 *
Availability of entertainment venues (F19)	0.56	0.57	0.27

*: Factors with values lower than 0.2–0.3. **: Multicollinear factors.

Table 8 clearly shows the differences in pricing factors and their influence on the market value in each of the three zones, which confirms that pricing processes differ depending on the level of territorial prestige.

In modelling the process of cadastral land valuation applied to land plots intended for private housing construction, the price in roubles per square metre was used as a dependent variable, with its values calculated for each land plot located in one of the three zones.

When there is no multicollinearity, a linear regression model is used to find the cadastral value of an object, which is sufficient to prove that pricing factors differ for the three identified zones. The models that were developed in order to find the price per square metre (Y) for land plots intended for private housing construction in the town of Anapa are as follows:

The zone of prestigious territories:

$$Y = 9472.14 + 12179.84 \cdot X_{F2} - 724.07 \cdot X_{F11} - 678.89 \cdot X_{F14} + 155058.72 \cdot X_{F17} + 5051.68 \cdot X_{F19} \quad (9)$$

The zone of standard territories:

$$Y = 12779.67 + 12136.5 \cdot X_{F2} + 11044.31 \cdot X_{F4} + 327.55 \cdot X_{F5} - 11014.6 \cdot X_{F13} - 762.02 \cdot X_{F16} + 1048.76 \cdot X_{F17} + 2106.5 \cdot X_{F18} + 589.65 \cdot X_{F19} \quad (10)$$

The zone of non-prestigious territories:

$$Y = 5648.28 + 11.6 \cdot X_{F4} + 1080.92 \cdot X_{F5} - 4337.3 \cdot X_{F16} + 3132.01 \cdot X_{F17} + 608.53 \cdot X_{F19} \quad (11)$$

Each of the models was assessed in terms of its quality and statistical significance. The results are presented in Table 9.

Table 9. Model quality parameters.

Parameter	Prestigious Territories	Standard Territories	Non-prestigious Territories
Coefficient of multiple correlation (R)	0.76	0.92	0.84
Coefficient of determination (R ²)	0.58	0.85	0.72
Adjusted R ²	0.53	0.83	0.70
Standard error	1710.07	1212.19	838.68
F-test (cut-off value)	2.45	1.86	2.07
F-test (calculated value)	11.63	64.68	36.46
Significance (F)	4.34×10^{-7}	3.20×10^{-34}	2.55×10^{-18}
Darbin–Watson test	1.70	1.76	1.61
Darbin–Watson critical values	1.34–1.77	1.506–1.85	1.51–1.77

As a result of the study, a method was developed for cadastral land valuation in resort towns based on zoning by prestige. Within this method, a way of assessing territorial prestige was also developed.

For resort towns in general, a list of significant criteria was formulated for assessing territorial prestige based on the method of expert analysis and the Pareto chart. The criteria were ranked by significance and included proximity to the sea coast with public beaches (with a criterion weight of 26%), availability of entertainment venues (22%), environmental quality (17%), and hotel ratings (13%). This combination confirms theoretical assumptions and the results of analytical studies devoted to the emergence of territories in resort towns that are considered to be prestigious due to generating higher rental incomes.

By applying the proposed method to the town of Anapa, the following results were obtained:

First, when zoning the map of Anapa by prestige, three zones were identified, whose values of the integral indicator of prestige range from 0.023 to 0.147 for the zone of non-prestigious territories, from 0.160 to 0.426 for the zone of standard territories, and from 0.726 to 0.441 for the zone of prestigious territories. K-means clustering was used to obtain these values. The boundaries of the zones were drawn on the map along the closest natural or artificial boundaries.

Second, by comparing the results of zoning by prestige (Figure 5) and the map indicating market prices (Appendix A) for land plots intended for private housing construction, it was revealed that prices were higher within the zone of prestigious territories (the central part of the town spreading along the sea coast with excellent public beaches and a large number of entertainment venues) and lower for land plots located at a distance from the Black Sea coast and entertainment venues. This proves that the results of zoning the map of Anapa by prestige are objective.

Third, cadastral land valuation models were developed that describe land plots intended for private housing construction in Anapa and can be interpreted as follows:

- The zone of prestigious territories: the coefficients of X_{F2} , X_{F17} , X_{F19} show an average increase of 12,179.84 roubles, 155,058.72 roubles, and 5051.68 roubles in the price for 1 m² of land with an increase in the number of recreational facilities within a 2-km radius, hotels within a 2-km radius, and entertainment venues within a 1-km radius, respectively, and the coefficients of X_{F11} , X_{F14} show a decrease of 724.07 roubles and 678.89 roubles in the average price for 1 m² of land with an increase in the distance to the nearest railway platforms and stations and an increase in the distance to the nearest port, respectively.
- The zone of standard territories: the coefficients of X_{F2} , X_{F4} , X_{F5} , X_{F17} , X_{F18} , X_{F19} show an average increase of 12,136.5 roubles, 11,044.31 roubles, 327.55 roubles, 1048.76 roubles, 2106.5 roubles, and 589.65 roubles in the price for 1 m² of land with an increase in the number of recreational facilities within a 2-km radius, an increase in the number of cultural facilities within a 1-km radius, a connection to a gas supply system, an increase in the number of hotels within a 2-km radius, a better quality of the sea coast, and an increase in the number of entertainment venues within a 1-km radius, respectively, and the coefficients of X_{F13} , X_{F16} show a decrease of 1516.18 roubles and 743.74 roubles in the average price for 1 m² of land with an increase in the distance to the airport and the town centre, respectively.
- The zone of non-prestigious territories: the coefficients of X_{F4} , X_{F5} , X_{F17} , X_{F19} show an average increase of 11.6 roubles, 1080.92 roubles, 3132.01 roubles, and 608.53 roubles in the price for 1 m² of land with an increase in the number of cultural facilities within a 1-km radius, a connection to a gas supply system, an increase in the number of hotels, and an increase in the number of entertainment venues within a 1-km radius, respectively, and the coefficient of X_{F16} shows an average decrease of 4337.3 roubles in the price for 1 m² of land with an increase in the distance to the town centre.

Fourth, model adequacy checking showed that the regression models are adequate, which is proved by:

- the coefficients of determination (0.58, 0.85, 0.72), whose values exceed 0.5, which shows that the models are of acceptable quality;
- F-test values that, at a significance level of 0.05, are much higher than the reference values, which suggests that the factors included in the model quite fully explain the market price indicator as a dependent variable (i.e., the models are significant);
- the analysis of the residuals, which showed that Durbin–Watson test values lie within the critical values, i.e., there is no autocorrelation of the residuals (i.e., the model is of good quality).

5. Conclusions

Amendments to the Tax Code of the Russian Federation that came into force in 2015 defined the cadastral value as a tax base, which resulted in its growth. This spurred research into cadastral land valuation practices based on the principle of justice. This principle underlies the proposed cadastral land valuation method based on zoning by prestige.

Summing up the results of the study, several conclusions can be made:

First, a comparative analysis of the cadastral values used for calculating land tax and the real market prices in the resort town of Anapa showed that plots of land intended for private housing construction were not evaluated objectively. Currently, there is an inequity in the distribution of the cadastral values of land plots, as some of those located in prestigious territories are undervalued, while some land plots located in standard territories or non-prestigious territories are overvalued.

Second, the concept of territorial prestige in resort towns should be introduced into legislation and land valuation procedures that are connected with land plots intended for private housing construction. This concept can be described as the result of a subjective attractiveness assessment that is given to an area by a group of people employed in the tourism industry by using rental income as the main assessment criterion.

Third, in the course of studying how and why prestigious territories emerge in resort towns, it was identified that territorial prestige develops historically and is based on a number of assessment criteria that can be objectively measured, change over time, and characterize the quality of the environment in an area or district rather than the quality of a land plot itself.

Fourth, an equation is proposed for calculating the integral indicator of territorial prestige in resort towns that has the form of an additive function, which is confirmed by the absence of multicollinearity between the criteria of territorial prestige.

Fifth, a method is proposed for assessing territorial prestige in resort towns, which is based on zoning the urban area depending on the value of the integral indicator of territorial prestige. The method was tested on land plots intended for private housing construction in Anapa, as a result of which significant criteria for assessing prestige and three different zones were identified (the zone of prestigious territories, the zone of standard territories, and the zone of non-prestigious territories).

Sixth, it was proved that the boundaries of the three zones were correct by comparing the average market prices for land plots located within them. It was identified that the three zones differ in terms of the average prices. Within the zones, prices vary depending on the individual characteristics of objects. This proved the hypothesis that pricing processes differ depending on the level of territorial prestige. Taking this into consideration, cadastral land value modelling should be carried out separately for each land plot intended for private housing construction.

Seventh, the cadastral land value models that were developed for land plots intended for private housing construction in the town of Anapa can be correctly interpreted and are of acceptable quality.

By applying the results of this study to cadastral land valuation in resort towns, it will become possible to redistribute the tax burden between land proprietors, which will eventually ensure sustainable local development through fair land taxation. However, it should be noted that the proposed method is limited in its application as it can be used only for cadastral land valuation in resort towns where prestigious zones have started to emerge. A promising direction for future research in this area is to develop more accurate cadastral land valuation models based on nonlinear methods, such as GWR and other promising ones.

The results of the study can be used by public cadastral agencies for cadastral land valuation in resort towns, financial experts who analyze the consequences of using cadastral land value assessments that were carried out by public cadastral agencies, and tax professionals who use land value assessments in taxation. Moreover, the data on the three zones that were identified can be used in individual land valuation procedures aimed at assessing how attractive a land plot is in terms of investment, as well as in different land planning practices.

Author Contributions: Conceptualization, E.B.; methodology, E.B.; software, E.B., M.H. and J.S.; validation, E.B., M.H. and J.S.; formal analysis, E.B., M.H. and J.S.; investigation, E.B., M.H.; resources, E.B.; data curation, E.B., M.H. and J.S.; writing—original draft preparation, E.B.; writing—review and editing, E.B., M.H. and J.S.; visualization, E.B., M.H. and J.S.; supervision, E.B.; project administration, E.B., M.H. and J.S.; funding acquisition, B.E. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: We are grateful to the Department of Engineering Geodesy and the Department of Foreign Languages at Saint Petersburg Mining University for inspiration, encouragement and administrative support.

Conflicts of Interest: The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

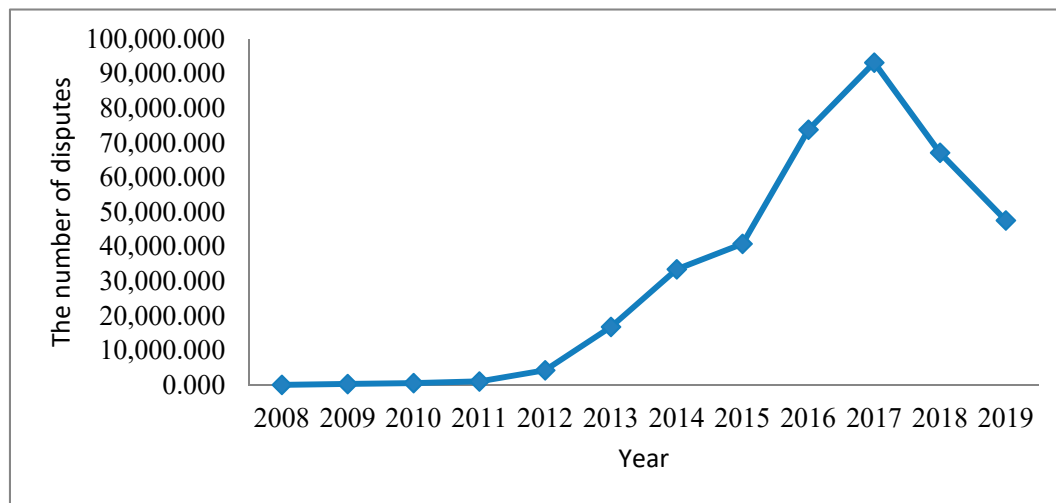


Figure A1. Changes in the number of disputes concerning the cadastral valuation of real estate for the period from 2008 to 2019.

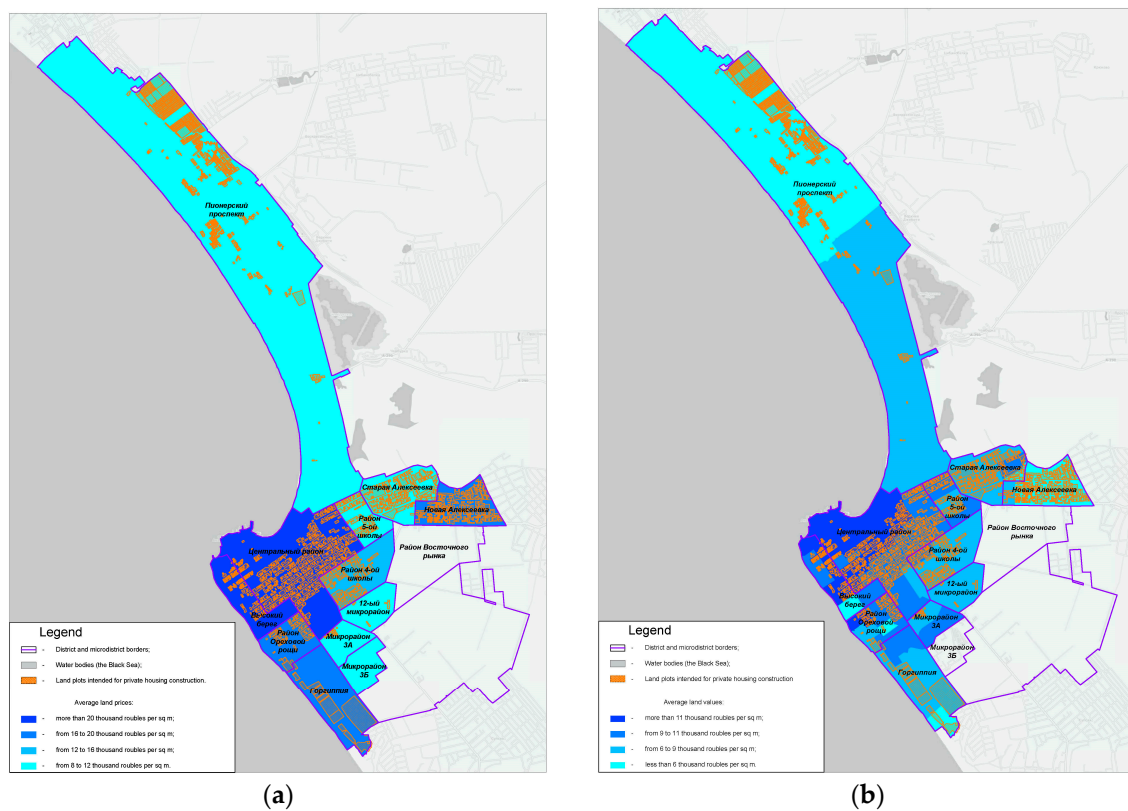


Figure A2. Comparison of land plots for private housing construction in terms of their market prices and cadastral values: (a) zoning by market prices; (b) zoning by cadastral values.

Appendix B

Table A1. Characteristics of Anapa's districts and microdistricts.

District	Proximity to the Sea Coast	Availability of Entertainment Venues	Environmental Quality	Building Types	Population Density	Situation in the Market
Central District	Close to the sea coast and beaches	Shops, markets, shopping centres, beaches, sights, nightclubs, an amusement park, a water park, concert venues, a venue for celebrations and festivals (Theatre Square), a 3D cinema, museums	High air pollution levels; at the same time, it is one of the greenest areas in the city	Temporary accommodation, private houses, administrative buildings, facilities for health care, education, culture, services, and sports	The most densely populated part of the town, an influx of tourists in the summer	Housing is considered the most expensive and prestigious, few free territories
Vysokiy Bereg District (Malaya Bukhta)	Located on the sea coast, close to beaches	Many hotels of different kinds	Beautiful landscapes, the best environmental indicators in the town	A variety of multi-storey buildings, good infrastructure	Overcrowded, a noticeable influx of people in the high season	One of the most prestigious territories
Microdistrict 12	More than 2 km from the beach	Places that attract tourists during the high season are not located within walking distance, but there is Red Square Shopping Centre	Good quality of air, no environmental problems	Five-storey and nine-storey buildings that appeared in the 1970s and 1980s; new buildings with shopping facilities are being built; there is some infrastructure	Dormitory town, not overcrowded even in the high season	The biggest supply on the real estate market, prices are lower than the average level in the town
Orekhovaya Roshcha District	Located on the sea coast, close to beaches	No attractions for tourists; there is a beach and a rocky coastline	No environmental problems	Blocks of flats that were built in the 1980s; the private sector prevails; the number of prestigious new buildings is growing	Not overcrowded	Considered one of the most comfortable for living
Microdistricts 3A and 3B	Far from the sea coast	No attractions for tourists	No environmental problems; strong winds from the sea	The private sector prevails; multi-storey buildings located close to each other; Microdistrict 3A is very green and cosy, has good infrastructure; infrastructure in Microdistrict 3B is worse than in other parts of the town	Most flats in new buildings were bought to be used only during the high season	Real estate prices are lower than in other districts and microdistricts

Table A1. Cont.

District	Proximity to the Sea Coast	Availability of Entertainment Venues	Environmental Quality	Building Types	Population Density	Situation in the Market
Pionersky Prospekt District	Runs along the sea coast	A highly developed and comfortable recreational area	No environmental problems	The main street runs along the sea from the town centre to the village of Vityazevo (a distance of more than 12 km), a lot of different types of accommodation for tourists, including camps	Not overpopulated, a noticeable influx of people in the high season	Prices are not higher than average
South Market District and East Market District	South Market District is closer to the sea coast	Food markets	No environmental problems	There are mainly private houses, small hotels, and guest houses	Not overcrowded even in the high season	Prices are not higher than average
Staraya and Novaya Alekseevka	Far from the sea coast	Hypermarkets and entertainment venues	Hilly terrain, view on the mountains, good environmental indicators	Cottages prevail; new high-rise buildings are being constructed; good infrastructure	Not overcrowded	Prestigious territory; residents with upper-middle incomes live here, which results in the fact that real estate is significantly overvalued
Gorgippia	Located on the sea coast near beaches	The main tourist attractions are within easy reach	No environmental problems	Large territories have been allocated for private housing construction	Not overcrowded, a noticeable influx of people in the high season	Prices are higher than average

Appendix C

EXPERT QUESTIONNAIRE

FOR IDENTIFYING CRITERIA APPLICABLE TO ASSESSING TERRITORIAL PRESTIGE IN RESORT TOWNS

Expert (full name): ____ Age: ____ Employer: ____ Position and specialization: ____

Work experience: _____

You are invited to take part in the preparation of expert materials on the impact of various criteria on territorial prestige. As part of this work, you will need to act as an independent expert and give your assessments.

The purpose of the expert questionnaire is to identify the main criteria for assessing the prestige of territories intended for private housing construction in the resort towns of Russia, namely in Anapa, Gelendzhik, Sochi, and Taman.

The task to be performed is to do a pairwise comparison using the criteria proposed for assessing territorial prestige. Relative importance rankings should be used in the assessment process (Table A2).

Table A2. Relative importance rankings.

Points		Explanation
Equal importance	1	Equal contribution to reach the goal
Transitional assertion	2	
Moderate advantage	3	Experience and assertion give a slight advantage to one factor over the other
Transitional assertion	4	
Considerable advantage	5	Experience and assertion give a strong advantage to one factor over the other
Transitional assertion	6	
Significant advantage	7	A significant advantage is observed in practice
Transitional assertion	8	
Very strong advantage	9	A strong advantage of one factor over the other is observed in practice

According to the scale, the result of comparing a pair of indicators is a natural number from 1 to 9 or a proper fraction from 1/1 to 1/9, which should be put into the table (see Table A3 below).

Table A3. An example of filling in the expert table.

Criteria	1	2	3
1	1	5	3
2	1/5	1	1/2
3	1/3	2	1

For example, if an expert believes that the first factor has a considerable advantage over the second one, then they put 5 in the cell located at the intersection of Row 1 and Column 2 (see the relative importance rankings in Table A2) and 1/5 at the intersection of Row 2 and Column 1. When there is doubt in the assessment (for example, it is not clear whether the second and the third factors are equivalent, or whether the third factor has a moderate advantage over the second factor), they put 1/2 in the cell located at the intersection of Row 2 and Column 3 and they also put 2 at the intersection of Row 3 and Column 2, and so on. The result of the assessment is a square matrix where all diagonal entries are 1.

The expert is asked to fill in only one table, which also has additional lines in case the expert decides to mention some other criteria for assessing territorial prestige in resort towns that were

not taken into account by the author of the questionnaire. The table compares the impact of the following criteria:

1. Proximity to the sea coast with public beaches
2. Availability of entertainment venues
3. The opportunity to install utility lines
4. Hotel ratings
5. Environmental quality
6. Population density
7. Microclimatic conditions

Table A4. A comparison of criteria for assessing territorial prestige in Russian resort towns.

Criteria for Assessing Territorial Prestige	1	2	3	4	5	6	7	8	9	10
1	1									
2	-	1								
3	-	-	1							
4	-	-	-	1						
5	-	-	-	-	1					
6	-	-	-	-	-	1				
7	-	-	-	-	-	-	1			
8	-	-	-	-	-	-	-	1		
9	-	-	-	-	-	-	-	-	1	
10	-	-	-	-	-	-	-	-	-	1

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