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# THE IMPACT OF FACTORS ON RESIDENTIAL LAND PRICES: A CASE STUDY IN TU SON CITY, VIETNAM

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ABSTRACT

The study aims to determine the influencing factors and their impact levels on residential land prices. The research investigated 241 officials, real estate investors, appraisers, and real estate brokers on factors affecting residential land prices. Research results have shown 13 groups with 45 factors affecting the price of residential land. The impact rates of the factor groups range from 1.43% to 23.65%. The COVID-19 pandemic factor group has the strongest impact on land prices, followed by other factor groups, including upgrading administrative units; formulation and implementation of the planning; the real estate market; financial – economics; credit; real estate brokerage; infrastructure; location of the land parcel; particular factors; juridical factors; environment and social security. To harmonize the interests of the State, investors, and land users when valuing land, it is necessary to pay attention to the factors that strongly impact land prices first, and then the smaller ones.

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## 1. Introduction

In Vietnam, the land price is understood as the value of land use rights of an area unit at a specific time and in a specific location (National Assembly, 2013). The land price is one of the legal bases for calculating land use levy, land rent, taxes, fees, charges, and other financial obligations related to land such as purchase and sale of land use rights, and land lease, mortgage, capital contribution, compensation for land when the State recovers land, etc. (Bórawski et al., 2019; Han et al., 2020; Jahangir, 2018; Mera, 1992; Nam et al., 2019; Wang et al., 2019; Ping & Hui, 2010). To determine the above amounts correctly and adequately, we must first understand what factors affect land prices at various times and locations (Bórawski et al., 2019; Nam et al., 2021). Factors that affect land prices are those that increase or decrease the land price of specific parcels of land (Jiang et al., 2013; Kagel & Levin, 1986). Factors affecting land prices are classified into groups according to their characteristics. The traditional groups of factors that can affect the land price include a group of legal factors, a group of the location of land plots; a group of individual factors; a group of economic factors, a group of social–environmental factors, etc. (Dirgasová et al., 2017; Downing, 1973; Hultkrantz, 1991; Le, 2017; Nam et al., 2021; Ersoz et al., 2018).

The above researchers have only focused on assessing the influence of one or several factors on land prices based on inheriting the factors pointed out from previous studies or assuming the factors that may affect land prices by themselves on land prices and then performing hypothesis testing. Therefore, it is not possible to determine all the factors affecting

land prices. This is the research gap related to land prices. Therefore, our study aims to propose a method to identify factors affecting land prices, including inherited factors from previous studies (traditional factors) and new factors such as the COVID-19 pandemic, real estate brokerage activities, a policy of upgrading administrative units, planning, etc. Furthermore, the study also proposes some policy implications related to land prices for the State, real estate investors, valuation agencies, credit institutions, etc.

To test the proposed method to solve the problem that has been raised, the authors have studied the factors affecting the price of residential land in Tu Son city, Vietnam because, from 2017 to 2021, the price of residential land might also be affected by many factors, including both traditional and new factors, but so far there has been no research on this issue. Tu Son city is 15 km from the capital of Vietnam (Fig. 1). In addition to the introduction, the article has four main sections, including a literature review; data and methods; results and discussion; conclusion, and implications.

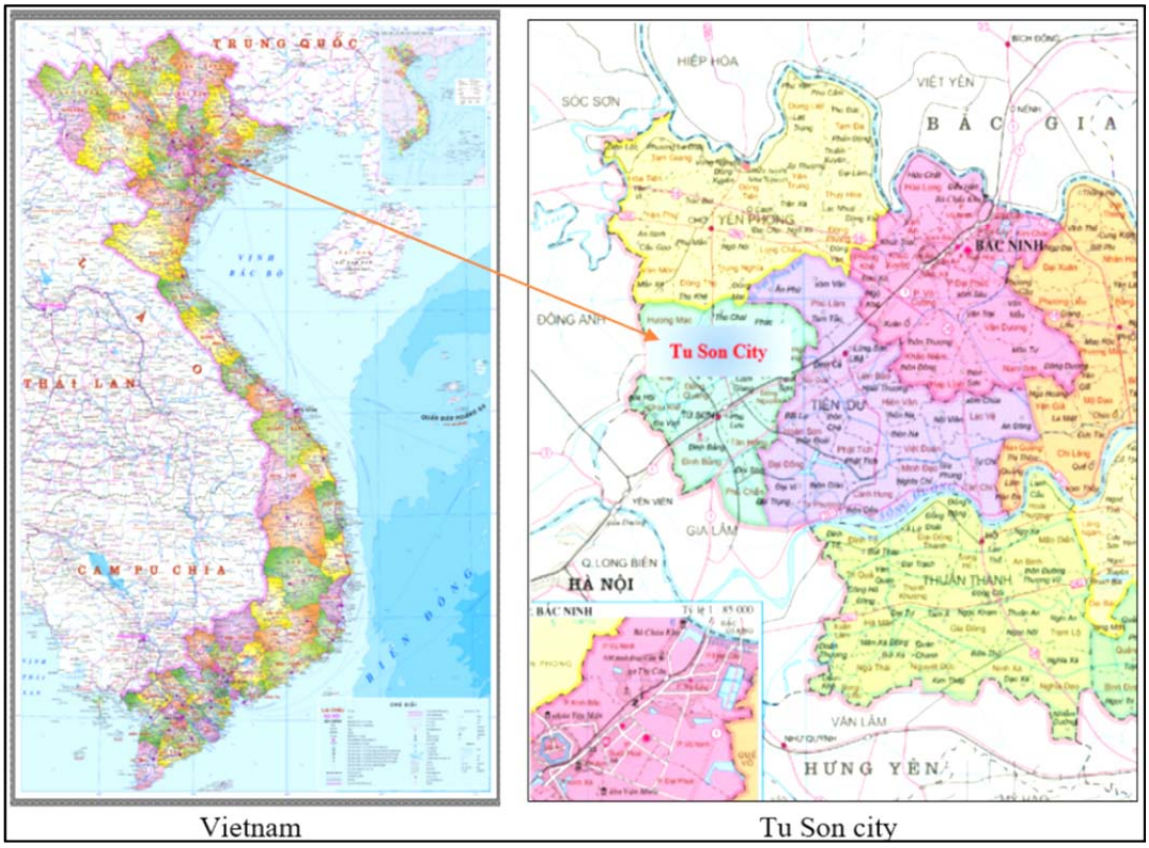


**Fig. 1.** Geographical location map of Tu Son city, Vietnam. *Sources*: own study.

## 2. Literature review

The factors affecting land prices determine whether the price of a particular parcel of land rises or falls in relation to the price of other parcels of land in that area and at a given time. In different areas, land prices may be affected by other factors and the level of their impact is also different. Even in a certain area, at different times, the land price is probably affected by different factors due to changing socio-economic and environmental conditions. The influencing factors, although having certain differences, can be classified into groups according to their common characteristics. The main groups affecting land prices include location factors, socio-economic factors, legal factors, infrastructure factors, individual factors, security factors, social order, environmental factors, credit factors, real estate market factors, etc.

The group of location factors includes factors such as distance to the center, to markets, to schools, to medical facilities, etc (Blatz, 1984; Downing, 1973; Lu & Wang, 2020). The group of economic-financial factors includes earning capacity of land plots, land finance, and people's income level (Jiang et al., 2013; Lu & Wang, 2020; Protopapas & Dimopoulos, 2019).


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The group of legal factors includes the legal status of the land plots, the restrictions on land use, the rights of land users, etc. (Dirgasová et al., 2017; Kheir & Portnov, 2016). The group of infrastructure elements includes a transportation system, energy supply system, water supply, drainage system, communication system, etc (Jiang et al., 2013). A particular group of factors is the area, shape, direction, and width of the land plots. The group of factors of security and social order includes factors such as: people's understanding and observance of the law, and management of social order (Jiang et al., 2013). The group of environmental factors includes factors such as air environment, water environment, noise, and waste collection and treatment (Dirgasová et al., 2017; Kheir & Portnov, 2016; Simangunsong et al., 2017). ). The group of credit factors includes the loan interest rate, total amount borrowed, and loan procedures (Hultkrantz, 1991; Kheir&Portnov, 2016). The group of real estate market factors includes the supply and demand for real estate and the forecast of future market movements (Fan et al., 2021). In addition to the groups of factors mentioned above, there are several other factors affecting land prices such as high-speed railway (Huang & Du, 2020), urbanization (Jahangir Alam, 2018; Jiang et al., 2013), or housing prices (Scott, 1983; Wen & Goodman, 2013), or land acquisition risk for socio-economic development (Blatz, 1984; Jiang et al., 2013). Factors affecting land prices are diverse and complex, vary in space and time, and are not fixed (Mitsuta et al., 2012; Scott, 1983).

There have also been several studies that have evaluated the impact of each factor on land prices, for example, land tax, legal regulations on land use, changing political institutions, urbanization, or the time required to create land banks (Bórawski et al., 2019; Han et al., 2020; Jahangir, 2018; Mera, 1992; Wang et al., 2019; Ping & Hui, 2010; Trung & Quan, 2019 ). According to Wang et al. (2019), land prices are strongly influenced by land speculation. When the level of speculation increases, the land prices also increase proportionally. However, at a certain point, land prices will fall because the supply of land is greater than the quantity demanded. In Dhaka, Bangladesh, real estate speculation also increased land prices Jahangir Alam (2018). According to research by Ping & Hui (2010), the factors affecting land prices are urban infrastructure, available land area, and urban transport capacity. Besides, the expressway system has a strong influence on land prices (Huang & Du, 2020). In Tokyo, land tax has an impact on land prices (Mera, 1992). According to Wen & Goodman (2013), land prices increase due to rising housing prices. Similarly, according to Scott (1983), land prices are affected by different factors in different periods in the same area, including housing prices. Besides, land price is also affected by legal, socioeconomic, and location factors (Protopapas & Dimopoulos, 2019) or loan interest rate (Hultkrantz, 1991). The price of industrial land in China is affected by the level of economic development, population density, and location factors (Lu & Wang, 2020). Besides, real estate supply and demand factors also affect land prices (Kheir & Portnov, 2016). According to Huang & Du ( 2020), in urban areas, high-speed railway increases land prices in suburban areas of the city due to convenient transportation, so the demand for land in the suburbs increases, causing land prices to increase. Besides, economic, financial, environmental, and demographic factors also affect residential land prices (Kheir & Portnov, 2016; Mitsuta et al., 2012; Scott, 1983).

In Vietnam, according to Hai & Huong (2017), groups of factors affecting land prices include a group of individual factors, a group of legal factors, a group of infrastructure factors, a group of socio-economic factors, a group of location factors, a group of neighboring factors, a group of real estate supply and demand factors. According to Hai & Huong (2017), there are 4 main groups of factors affecting land prices, including: urbanization, infrastructure, environment, and land supply and demand. Research by Phan & et al. (2017) also pointed out four groups of factors affecting land prices, namely regional, individual, economic, and social factors. Tran & Nguyen (2021) noted that 28 factors belonging to 9 groups of factors that had an impact. The price of residential land was most affected by the group of factors of supply and demand for land use rights, the group of factors such as the location of the land plot, the group of factors of urbanization, and 6 other groups of factors. Group of social factors affecting the price of residential land. Research by Nam et al. (2021) pointed out 10 factors affecting the price of residential land, in which the location factor had the strongest impact on the land price; land plots on major roads, favorable for business, are priced significantly higher than the prices of land plots in other locations. According to Pham & Phan (2021), legal factors had the most influence on land prices. Ho et al. (2020) identified 6 groups of factors, including: infrastructure,

particular, economic, location, social, and legal, that have an impact on residential land prices. In contrast, according to research by Trung and Quan (2019), the group of factors of supply and demand for land use rights has the greatest impact on residential land prices. According to research by Hai & Huong (2017), location factors have the strongest impact on land prices. Nam et al. (2021) assessing factors affecting public land fund management also pointed out the factor that had the strongest influence on specific land prices when determining public land rent for the area and location of the land plot. In addition, when studying the factors affecting the land price of winning land auctions, Nam et al. (2019) identified 6 groups of factors, of which the group of residential land use rights market factors (supply and demand and forecast of the land use right market) had the strongest impact on the auction winning land price.

In addition to the above factors, there are some other factors, such as the COVID-19 pandemic, the policy of upgrading administrative units, and real estate brokerage activities that may also affect land prices, but there has been no research to assess the extent of their influence compared to the factors that are indicated previously. Therefore, this is an issue that needs to be addressed in this article.

## 3. Data and Methods

### 3.1. Research steps

The study was carried out in 7 main steps (Fig. 2) to determine the influencing factors, their impact rates, and impact levels of each factor group on land prices. Step 1 was to study the authors' research results on factors affecting land prices to synthesize groups of influencing factors. Step 2 collected secondary data on natural and socio-economic conditions of Tu Son city related to land prices. Step 3 was to survey and collect data on factors that may affect the price of residential land using printed questionnaires. Step 4 processed the collected data and builds a research model assuming the factors affecting land prices. Step 5 investigated for the second time to determine the impact of each hypothetical factor on land prices according to the 5-level Likert scale. Step 6 verified the collected data using SPSS20.0 software to remove the factors that did not satisfy the test conditions. Step 7 determined the level of impact of the groups of factors and conducted discussion and proposed policy implications related to land prices.

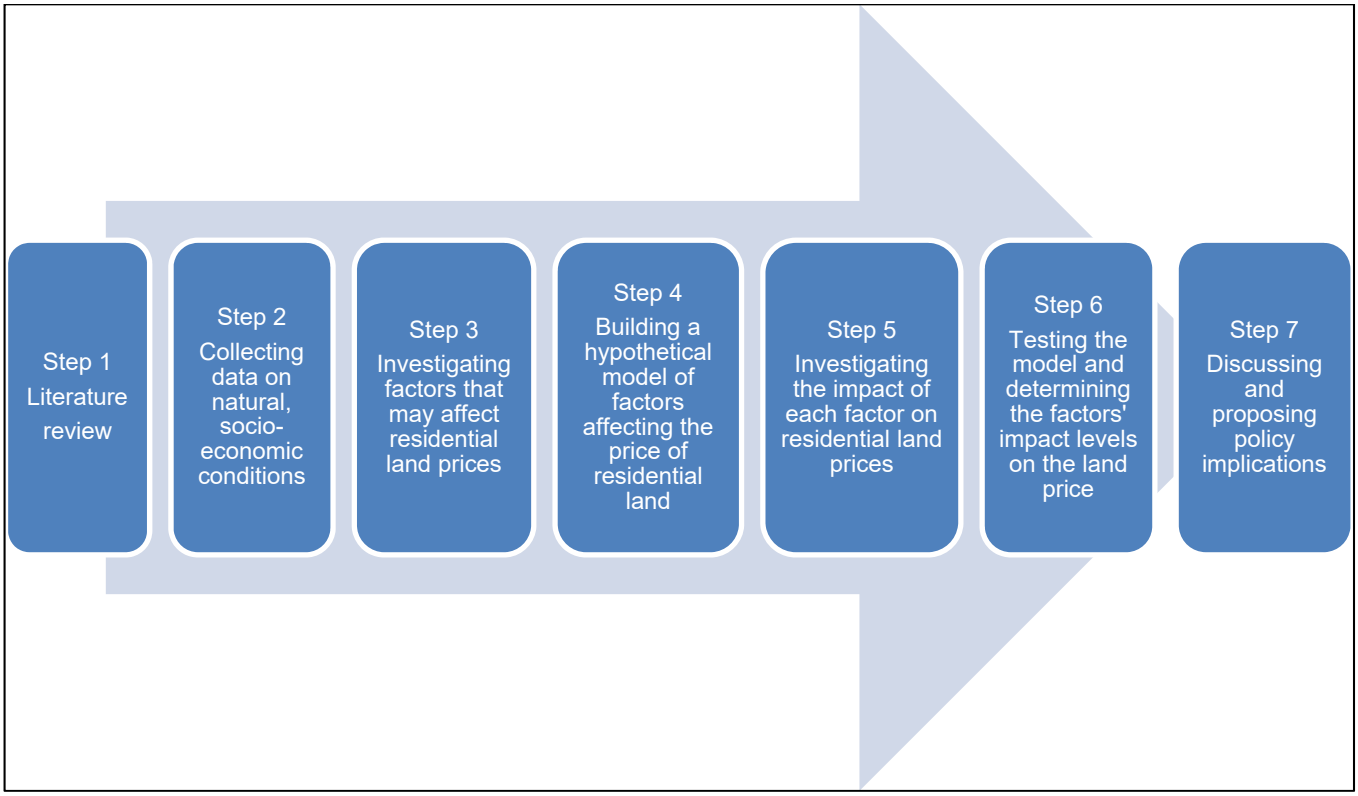


**Fig. 2.** Steps to research factors affecting land prices. *Sources*: own study.

### 3.2 Data collection and hypothetical research model

Secondary data on natural, socio-economic conditions in the 2017-2021 period were collected at state agencies in Tu Son city. Primary data on factors affecting residential land prices were collected in July 2022. First, the study carried out a survey using questionnaires of 241 people to grasp the factors affecting the price of residential land in Tu Son city, including officials directly related to residential land prices, real estate investors, land appraisers, and real estate agents. The questionnaire contains basic information about survey respondents and 42 hypothetical factors affecting residential land prices inherited from previous studies, including groups of infrastructure, legal, and personal factors; distinctive, environmental, socio-economic factors, etc. Each factor had 2 corresponding options (affecting and not affecting the price of residential land) for respondents to choose one of the two. In addition, respondents were also asked to add other factors that might affect the price of residential land according to their assessment. The results of data processing using SPSS20.0 software showed that 56 factors probably affected land prices, of which 14 factors were added (distance to administrative centers, supermarkets, workplaces, etc.) to the 42 elements already available.

To increase the accuracy of the collected data and reduce the number of questionnaires in Step 2, as well as reduce the cost of the investigation and the number of times to test the model, the study selected 47 factors with a ratio of rating greater than 50% (majority) of the total number of respondents. The remaining 9 factors (land buyers' tastes, distance to historic sites, land taxes, traffic density, etc.) with a rate of less than 50% (minority) were excluded. The selected elements were classified according to their properties into 13 groups. Each group was considered a latent variable or an independent variable and had 3 to 6 factors. The factors belonging to the groups were called observed variables (Table 1). Some additional factors that might impact residential land prices included the magnitude of the impact of the COVID-19 pandemic, its prevention, and control measures, its repetition cycle; factors related to real estate brokerage, administrative unit upgrading, land use planning, etc. (Table 1). The model that assumed factors affecting residential land price was shown in (Fig. 3).

**Table 1**

Groups of factors affecting residential land prices

| **Factorgroups** | **Factorgroups** |
|---|---|
| H1. Group of COVID-19 pandemic factors (CO) | Distance to entertainmentfacilities |
| Impact of the pandemic | Distance to fitness and sports centers |
| Measures to prevent and combat the pandemic | H7. Group of security and social order factors (SO) |
| The cycle of the pandemic repeats | People's knowledge of the law |
| H2. Group of administrative unit upgrade factors (AD) | Obey the laws of the people |
| Urban upgrading policy | Security and social order management |
| Urban upgrading plan | H8. Group of environmental factors (EN) |
| Carrying out urbanupgrading | Smog |
| H3. Group of making and implementing planning factors (PL) | Noise |
| Socio-economic development planning | Waste collection and treatment |
| Land useplanning | H9. Group of legal factors (LE) |
| Construction planning | Legal status of the land plot |
| H4. Group of infrastructure factors (IN) | Restrictions on constructionplanning |
| Transportation system | Restrictions on land use rights |
| Energy powersupply system | H10. Group of economic and financial factors (EC) |
| Water supply and drainage system | Income-generating ability of the land plot |
| Communicationsystems | Land finance |
| System of education and health facilities | Land buyer's income level |
| System of cultural, physical training and sports facilities | H11. Group of credit factors (CR) |
| H5. Group of particular factors (PA) | Loan interest rate |
| Area of the land plot | Loan procedure |
| The shape of the land plot | Amount borrowed |


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| | |
|---|---|
| Facade width | H12. Group of real estate brokerage factors (BR) |
| The length of the parcel of land | Real estate brokerage form |
| The direction of the land plot | Professional qualifications of brokers |
| H6. Group of factors of land plot location (LO) | The broker's sense of compliance with the law |
| Distance to the city center | H13. Group of real estate market factors (RE) |
| Distance to markets and supermarkets | Real estate supply |
| Distance to schools | Real estate demand |
| Distance to medical facilities | Forecast of real estate supply and demand |

*Sources*: own study.

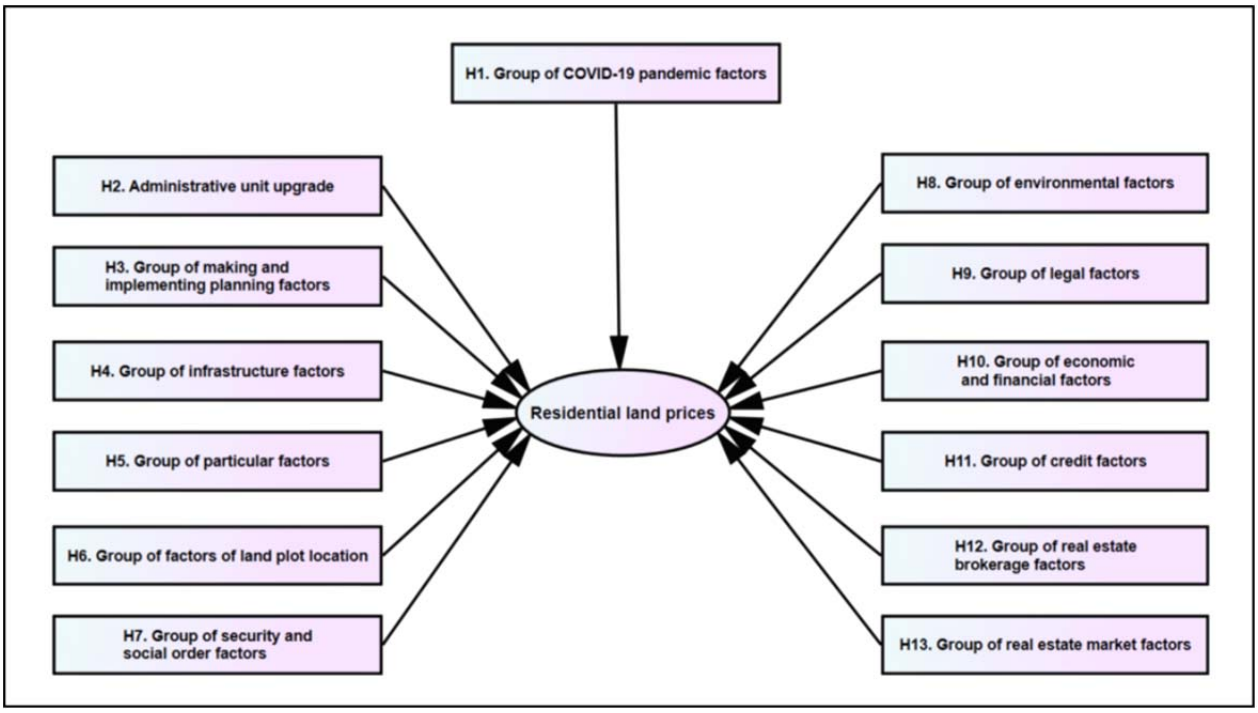


**Fig. 3.** Hypothetical research model of factors affecting residential land prices. *Sources*: own study.

The equation evaluating the factors affecting residential land prices is shown in formula 1.

$$Y = \beta o + \beta 1*CO + \beta 2*AD + \beta 3*PL + \beta 4*IN + \beta 5*PA + \beta 6*LO + \beta 7*SO + \beta 8*EN + \beta 9*LE + \beta 10*EC + \beta 11*CR + \beta 12*BR + \beta 13*RE + \varepsilon \quad (1)$$

where:

Y - the dependent variable representing the price of residential land;

Bo - constant;

β1; β2; β3; β4; β5; β6; β7; β8; β9; β10; β11; β12; β13 - the regression coefficients of the independent variables including the following groups: Group of COVID-19 pandemic factors; Group of administrative unit upgrade factors; Group of making and implementing planning factors; Group of infrastructure factors; Group of particular factors; Group of factors of land plot location; Group of security and social order factors; Group of environmental factors; Group of legal factors; Group of economic and financial factors; Group of credit factors; Group of real estate brokerage factors; Group of real estate market factors;

CO; AD; PL; IN; PA; LO; SO; EN; LE; EC; CR; BR, RE - independent variables, respectively Group of COVID-19 pandemic factors; Group of administrative unit upgrade factors; Group of making and implementing planning factors; Group of infrastructure factors; Group of particular factors; Group of factors of land plot location; Group of security and social order factors; Group of environmental factors; Group of legal factors; Group of economic and financial factors; Group of credit factors; Group of real estate brokerage factors; Group of real estate market factors;

Ɛ -impact value of unknown factors and random error.

Next, to have data for testing the hypothetical research model, the study conducted a survey using a printed questionnaire of the people who responded to

the survey in the previous step. The content of the questionnaire consisted of 47 factors selected in Step 1. Each factor has 5 corresponding ratings according to the Likert scale (very impactful - 5 points, quite impactful - 4 points, medium impactful). - 3 points, little impactful - 2 points, very little impactful - 1 point) (Likert, 1932) for respondents to choose 1 out of 5 levels for each factor. In addition, respondents were also asked to write down comments to clarify the impact of factors on residential land prices.

According to Hoang & Nguyen (2008), the number of survey samples was determined based on the requirements of the exploratory factor analysis (EFA) with at least 5 observations for 1 measurement variable (n1 = 5* p). Therefore, with 47 measuring variables belonging to 13 groups of factors, the sample size was n1 = 5*47 = 235. According to Tabachnick & Fidell (1996), for multivariate regression analysis, the minimum sample size that was necessary to be achieved was n2 = 50 + 8*q (q was the number of latent variables/factor group - q = 13), so the minimum number of survey samples was n2 = 50 + 8*13 = 154. To ensure both requirements for the exploratory factor analysis and multivariable regression analysis, it was necessary to have a sample of at least 235 (the max of n1 and n2). To increase the reliability of the data, the study selected a sample equal to 241 (equal to the number of people who answered the first survey).

The hypothetical research model was tested through testing criteria including Cronbach's Alpha coefficient, KMO coefficient, Bartlett test, and Eigenvalues coefficient. The reliability of the scale was tested by Cronbach's Alpha coefficient (Cronbach, 1951). The scale can be used when the Cronbach Alpha coefficient is greater than or equal to 0.6 and the variables have a total correlation coefficient greater than 0.3 (Hoang & Nguyen, 2008; Hair et al., 2009). The exploratory factor analysis is used to shorten many measurement variables into a set of variables (factors) to make them more meaningful but still contain most of the information of the original set of variables. The exploratory factor analysis was assessed through the KMO appropriate coefficient, Bartlett test, Eigenvalues coefficient, total explanatory variance, and factor loading. Variables are only accepted when KMO is in the range from 0.5 to 1.0 and its weight factors in other factors are less than 0.35 (Igbaria et al., 1995). According to Hair et al. (1998), with a sample size of about 250, weights of 0.35 should be chosen, so for a sample size of 241 in this study, a load weight must be greater than 0.35. Besides, the scale is only accepted when the total variance explained is greater than 50%; Barlett's coefficient with Sig significance level less than 0.05 to ensure the factors are correlated with each other; Eigenvalue coefficients must be greater than 1 to ensure the groups of factors are different.

The impact level of each factor on land prices is determined according to the value of the impact index according to 5 levels (Very impactful - the impact index ≥ 4,20; quite impactful - the impact index 3,40 ÷ 4,19; medium impactful - the impact index 2,60 - 3,39; little impactful - the impact index 1,80 ÷ 2,59; very little impactful - the impact index < 1,80) (Likert, 1932). The impact index of each factor is determined according to formula 2 (Nam & Yen, 2022).

$$G_i = \frac{1}{n} * \sum_{i=1}^{q} \sum_{j=1}^{n} x_{ij} \quad (2)$$

where:

$G_i$ - is the impact index of the i factor;
$n$ -number of respondents;
q -number of impact factors;
$x_{ij}$ -the jth respondent's score for factor i.

The impact index of kth factor group is determined according to formula 3 (Nam and Yen, 2022).

$$Gav_k = \frac{1}{p} * \sum_{k=1}^{m} \sum_{z=1}^{p} G_{kz} \quad (3)$$

where:

$\mathrm{Gav_k}$ - is the average impact index of kth factor group;
m - number of factor groups;
p - number of factors of group k;
$G_{kz}$ - the impact index of the zth factor in the kth group.

The general impact level on land prices is determined by formula 4 (Nam & Yen, 2022).

$$Gav = \frac{1}{m} * \sum_{k}^{m} Gav_k \quad (4)$$

where:

Gav - is the average impact index of all the factor groups (general impact level on land prices);
m - number of factor groups;
$Gav_k$ - average impact index of the kth factor group.

## 4. Results and Discussion

The results of assessing the reliability of the scale through Cronbach's Alpha coefficient for 13 groups of factors showed that Cronbach's Alpha coefficient ranged from 0.709 to 0.915 (Table 2). The correlation coefficient of most of the observed variables was

greater than 0.3, satisfying the test conditions, except that the variables for distance to the city center and the market had values of less than 0.3 (Table 2). Therefore, these two observed variables were excluded, and the second test was performed. The results of the second test showed that the test criteria met the requirements (Table 3). Thus, the scale that was used to evaluate the factors affecting the price of residential land was reliable and suitable for further analysis. The suitability test of the EFA was carried out through the KMO suitability coefficient. The KMO was equal to 0.893 and satisfied the condition 0.500 <KMO< 1.000, so exploratory factor analysis was appropriate with actual data. Besides, the results of the Barlett test indicated that the Sig value was equal to 0.000 and less than 0.050 (Table 4). This proved that the measured variables were linearly correlated with the representative factor.

The load factor coefficients of the components were all greater than 0.60 (Table 5), so the EFA analysis had practical significance, and the independent variables ensured accuracy.

**Table 2**

Results of the first analysis of the scale reliability

| Groups of factors and Cronbach Alpha | Total variablecorrelation | Groups of factors and Cronbach Alpha | Total variable correlation |
|---|---|---|---|
| H1. Group of COVID-19 pandemic factors (CO – Alpha=0.837) | | Distance to entertainment facilities (LO5) | 0.772 |
| Impact of the pandemic (CO1) | 0.867 | Distance to fitness and sports centers (LO6) | 0.803 |
| Measures to prevent and combat the pandemic (CO2) | 0.768 | H7. Group of security and social order factors (SO -Alpha=0.709) | |
| The cycle of the pandemic repeats (CO3) | 0.672 | People's knowledge of the law (SO1) | 0.792 |
| H2. Group of administrative unit upgrade factors (AD- Alpha=0.810) | | Obey the laws of the people (SO2) | 0.837 |
| Urban upgrading policy (AD1) | 0.739 | Security and social order management (SO3) | 0.774 |
| Urban upgrading plan (AD2) | 0.881 | H8. Group of environmental factors (EN - Alpha=0.792) | |
| Carrying out urban upgrading (AD3) | 0.764 | Smog (EN1) | 0.893 |
| H3. Group of making and implementing planning factors (PL -Alpha=0.844) | 0.769 | Noise (EN2) | 0.741 |
| Socio-economic development planning (PL1) | 0.864 | Waste collection and treatment (EN3) | 0.834 |
| Land useplanning (PL2) | 0.871 | H9. Group of legal factors (LE - Alpha=0.856) | |
| Construction planning (PL3) | 0.793 | Legal status of the land plot (LE1) | 0.783 |
| H4. Group of infrastructure factors (IN - Alpha=0.738) | | Restrictions on construction planning (LE2) | 0.829 |
| Transportation system (IN1) | 0.758 | Restrictions on land use rights (LE3) | 0.761 |
| Energy power supply system (IN2) | 0.843 | H10. Group of economic and financial factors (EC -Alpha=0.915) | |
| Water supply and drainage system (IN3) | 0.805 | Income-generating ability of the land plot (EC1) | 0.857 |
| Communication systems (IN4) | 0.837 | Land finance (EC2) | 0.794 |
| System of education and health facilities (IN5) | 0.775 | Land buyer's income level (EC3) | 0.692 |
| System of cultural, physical training, and sports facilities (IN6) | 0.882 | H11. Group of credit factors (CR-Alpha=0.854) | |
| H5. Group of particular factors (PA-Alpha=0.861) | | Loaninterestrate (CR1) | 0.783 |
| Area of the land plot (PA1) | 0.834 | Loan procedure (CR2) | 0.792 |
| The shape of the land plot (PA2) | 0.761 | Amount borrowed (CR3) | 0.881 |
| Facadewidth (PA3) | 0.798 | H12. Group of real estate brokerage factors (BR - Alpha=0.871) | |
| The length of the parcel of land (PA4) | 0.801 | Real estate brokerage form (BR1) | 0.847 |
| The direction of the land plot (PA5) | 0.864 | Professional qualifications of brokers (BR2) | 0.872 |
| H6. Group of factors of land plot location (LO - Alpha=0.851) | | The broker's sense of compliance with the law (BR3) | 0.763 |
| Distance to the city center (LO1) | 0.130 | H13. Group of real estate market factors (RE - Alpha=0.840) | |
| Distance to markets (LO2) | 0.298 | Real estate supply (RE1) | 0.877 |

| | | | |
|---|---|---|---|
| Distance to schools (LO3) | 0.874 | Real estate demand (RE2) | 0.739 |
| Distance to medical facilities (LO4) | 0.674 | Forecast of real estate supply and demand (RE3) | 0.815 |

*Sources*: own study.

**Table 3**

Results of the second analysis of the scale reliability

| Groups of factors and Cronbach Alpha | Total variablecorrelation | Groups of factors and Cronbach Alpha | Total variablecorrelation |
|---|---|---|---|
| H1. Group of COVID-19 pandemic factors (CO – Alpha = 0.847) | | Distance to fitness and sports centers (LO6) | 0.805 |
| Impact of the pandemic (CO1) | 0.793 | H7. Group of security and social order factors (SO -Alpha=0.893) | |
| Measures to prevent and combat the pandemic (CO2) | 0.834 | People's knowledge of the law (SO1) | 0.892 |
| The cycle of the pandemic repeats (CO3) | 0.726 | Obey the laws of the people (SO2) | 0.847 |
| H2. Group of administrative unit upgrade factors (AD- Alpha = 0.861) | | Security and social order management (SO3) | 0.853 |
| Urban upgrading policy (AD1) | 0.805 | H8. Group of environmental factors (EN - Alpha=0.847) | |
| Urban upgrading plan (AD2) | 0.847 | Smog (EN1) | 0.817 |
| Carrying out urban upgrading (AD3) | 0.711 | Noise (EN2) | 0.892 |
| H3. Group of making and implementing planning factors (PL – Alpha = 0.873) | 0.802 | Waste collection and treatment (EN3) | 0.766 |
| Socio-economic development planning (PL1) | 0.853 | H9. Group of legal factors (LE - Alpha=0.831) | |
| Land useplanning (PL2) | 0.860 | Legal status of the land plot (LE1) | 0.805 |
| Construction planning (PL3) | 0.752 | Restrictions on construction planning (LE2) | 0.683 |
| H4. Group of infrastructure factors (IN - Alpha=0.705) | | Restrictions on land use rights (LE3) | 0.854 |
| Transportation system (IN1) | 0.796 | H10. Group of economic and financial factors (EC -Alpha=0.884) | |
| Energy power supply system (IN2) | 0.878 | Income-generating ability of the land plot (EC1) | 0.722 |
| Water supply and drainage system (IN3) | 0.821 | Land finance (EC2) | 0.840 |
| Communicationsystems (IN4) | 0.893 | Land buyer's income level (EC3) | 0.701 |
| System of education and health facilities (IN5) | 0.772 | H11. Group of credit factors (CR-Alpha=0.813) | |
| System of cultural, physical training, and sports facilities (IN6) | 0.793 | Loaninterestrate (CR1) | 0.659 |
| H5. Group of particular factors (PA-Alpha=0.830) | | Loanprocedure (CR2) | 0.771 |
| Area of the land plot (PA1) | 0.857 | Amountborrowed (CR3) | 0.860 |
| The shape of the land plot (PA2) | 0.705 | H12. Group of real estate brokerage factors (BR - Alpha=0.860) | |
| Facade width (PA3) | 0.888 | Real estate brokerage form (BR1) | 0.872 |
| The length of the parcel of land (PA4) | 0.826 | Professional qualifications of brokers (BR2) | 0.819 |
| The direction of the land plot (PA5) | 0.873 | The broker's sense of compliance with the law (BR3) | 0.842 |
| H6. Group of factors of land plot location (LO – Alpha = 0.871) | | H13. Group of real estate market factors (RE - Alpha = 0.798) | |
| Distance to schools (LO3) | 0.775 | Real estate supply (RE1) | 0.775 |
| Distance to medical facilities (LO4) | 0.843 | Real estate demand (RE2) | 0.826 |
| Distance to entertainment facilities (LO5) | 0.776 | Forecast of real estate supply and demand (RE3) | 0.790 |

*Sources*: own study.

**Table 4**

Results of the KMO Test and Bartlett's Test

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.893 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 739.671 |
| | Df | 197 |
| | Sig. value | 0.000 |

*Sources*: own study.

**Table 5**

Weight of rotation matrix

| Groups | Factors | Weights | Groups | Factors | Weights | Groups | Factors | Weights |
|---|---|---|---|---|---|---|---|---|
| H1. Group of COVID-19 pandemic factors (CO – Alpha=0.837) | CO1 | 0.689 | H5. Group of particular factors (PA Alpha=0.861) | PA1 | 0.776 | H9. Group of legal factors (LE Alpha =0.856) | LE1 | 0.773 |
| | CO2 | 0.784 | | PA2 | 0.825 | | LE2 | 0.834 |
| | CO3 | 0.841 | | PA3 | 0.876 | | LE3 | 0.794 |
| H2. Group of administrative unit upgrade factors (AD- Alpha=0.810) | AD1 | 0.834 | | PA4 | 0.897 | H10. Group of economic and financial factors (EC - Alpha=0.901) | EC1 | 0.881 |
| | AD2 | 0.749 | | PA5 | 0.762 | | EC2 | 0.673 |
| | AD3 | 0.804 | H6. Group of factors of land plot location (LO - Alpha=0.851) | LO3 | 0.830 | | EC3 | 0.820 |
| H3. Group of making and implementing planning factors (PL - Alpha=0.844) | PL1 | 0.755 | | LO4 | 0.719 | H11. Group of credit factors (CR - Alpha=0.854) | CR1 | 0.864 |
| | PL2 | 0.817 | | LO5 | 0.697 | | CR2 | 0.839 |
| | PL3 | 0.846 | | LO6 | 0.781 | | CR3 | 0.792 |
| H4. Group of infrastructure factors (IN - Alpha=0.738) | IN1 | 0.694 | H7. Group of security and social order factors (SO - Alpha=0.709) | SO1 | 0.776 | H12. Group of real estate brokerage factors (BR - Alpha = 0.871) | BR1 | 0.845 |
| | IN2 | 0.782 | | SO2 | 0.864 | | BR2 | 0.764 |
| | IN3 | 0.837 | | SO3 | 0.839 | | BR3 | 0.679 |
| | IN4 | 0.687 | H8. Group of environmental factors (EN - Alpha=0.792) | EN1 | 0.867 | H13. Group of real estate market factors (RE - Alpha=0.840) | RE1 | 0.815 |
| | IN5 | 0.694 | | EN2 | 0.724 | | RE2 | 0.743 |
| | IN6 | 0.770 | | EN3 | 0.739 | | RE3 | 0.681 |

*Sources*: own study.

**Table 6**

Correlation between the dependent variable and independent variable

| | | Dependent variable (Y) | CO | AD | PL | IN | PA | LO | SO | EN |
|---|---|---|---|---|---|---|---|---|---|---|
| Dependent variable (Y) | Pearson Correlation (r) | 1 | 0.821** | 0.503** | 0.746* | 0.379** | 0.470** | 0.392* | 0.253* | 0.249** |
| | Sig. (2-tailed) | | 0.000 | 0.000 | 0.024 | 0.000 | 0.000 | 0.028 | 0.027 | 0.004 |
| | N | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 | 241 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

*Sources*: own study.

According to Table 6, the Sig Pearson correlation of independent variables CO, AD, PL, IN, PA, LO, SO, and EN with dependent variable Y was less than 0.05, so there was a linear relationship between the independent variables and the dependent variable. The CO variable and Y variable had the strongest relationship with the r coefficient of 0.821. SO variable and Y variable had the weakest relationship with the r coefficient of 0.253. This ensured eligibility for multiple linear regression analysis.

The results of the multivariate regression analysis in Table 7 showed that the Sig coefficients were all smaller than 0.005, so the regression model was significant, and the independent variables had an impact on the dependent variable Y. The adjusted R2 value equal to 0.873 showed that the independent variables included in the regression affected 87.3% of the change of the dependent variable (residential land price), and the remaining 12.7% were due to variables outside the model and random error. Besides, the Durbin-Watson coefficient had a value of 1.859, ranging from 1.5 to 2.5, so no first-order sequence autocorrelation occurred (Table 7). The variance inflation factor (VIF) of all variables included in the

model was less than 2, so the research model did not exhibit multicollinearity. In addition, the variables included in the study were all statistically significant (Sig. was less than 0.05). Thus, all 13 groups of factors in the research model affected the price of residential land.

**Table 7**

Results of multivariable regression analysis

| Independent variables | Standard sized regression coefficients | t | Multicollinear Statistics | | Impact order |
|---|---|---|---|---|---|
| | | | Error (Sig.) | VIF | |
| CO | 2.968 | 4.389 | 0.000 | 1.452 | 1 |
| AD | 2.563 | 5.347 | 0.001 | 1.293 | 2 |
| PL | 1.364 | 4.674 | 0.000 | 1.371 | 3 |
| IN | 0.586 | 5.347 | 0.002 | 1.284 | 8 |
| PA | 0.404 | 6.247 | 0.000 | 1.336 | 10 |
| LO | 0.444 | 7.398 | 0.003 | 1.641 | 9 |
| SO | 0.179 | 6.149 | 0.000 | 1.295 | 13 |
| EN | 0.350 | 5.346 | 0.002 | 1.179 | 12 |
| LE | 0.383 | 4.243 | 0.000 | 1.467 | 11 |
| EC | 0.814 | 6.214 | 0.000 | 1.536 | 5 |
| CR | 0.806 | 3.347 | 0.000 | 1.672 | 6 |
| BR | 0.695 | 4.783 | 0.001 | 1.325 | 7 |
| RE | 0.993 | 5.346 | 0.000 | 1.478 | 4 |
| βo | 5.762 | | | | |
| Sig. F = 0.000; Coefficient R2 = 0.985; Corrected R2 coefficient = 0.873; Durbin-Watson = 1.859 | | | | | |

*Sources*: own study.

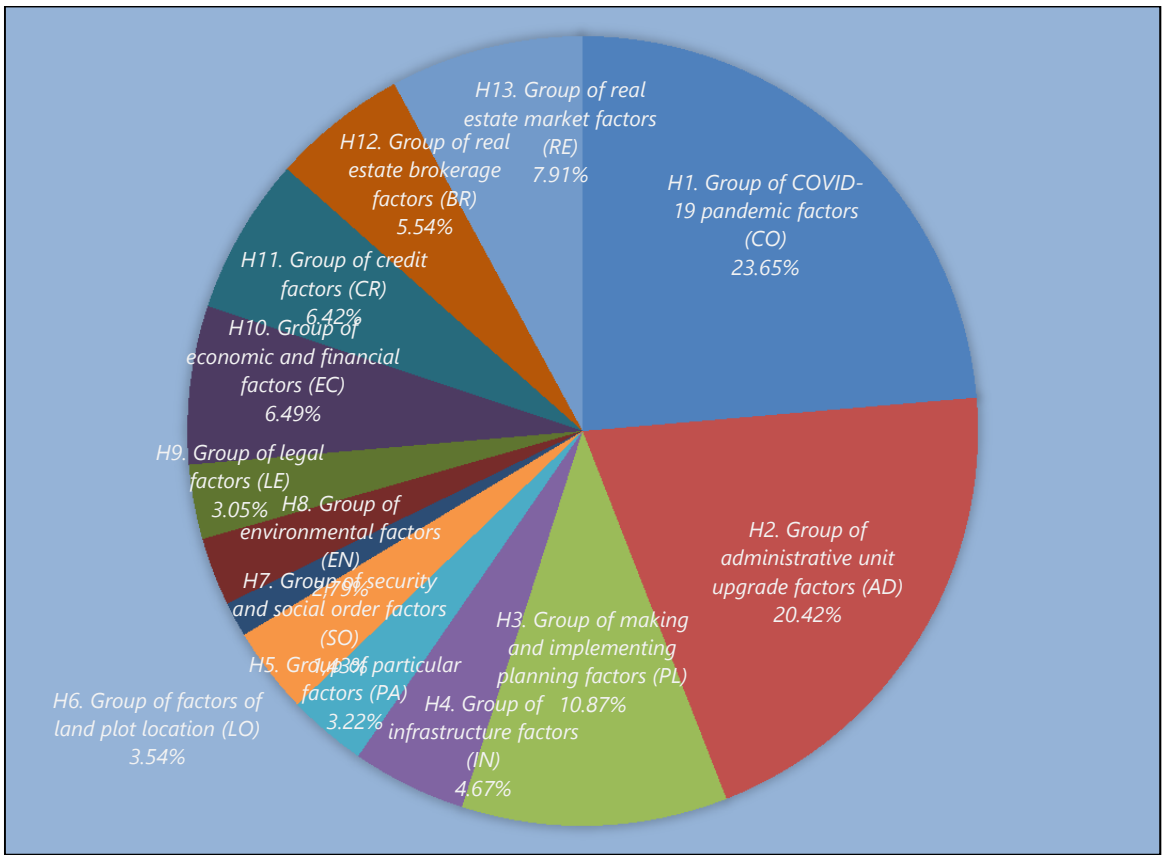


**Fig. 4.** Impact rates of groups of factors affecting the residential land. *Sources*: own study.

From the normalized regression coefficients (Table 7), the study determined the regression equation of the following form:

Y = 2.968*CO + 2.563*AD + 1.364*PL+ 0.586*IN + 0.404*PA+ 0.444*LO + 0.179*SO + 0.350*EN + 0.383*LE + 0.814*EC + 0.806*CR + 0.695*BR + 0.993*RE + 5.762 (5)

The impact indexes of factor groups and each factor on residential land prices were shown in Table 8. Of the 13 factor groups, four of them had the strongest impact on residential land prices, including a group of COVID-19 pandemic factors, a group of factors for upgrading administrative units, a group of economic-financial factors, and a group of credit factors. Four groups of factors had a medium level of impact on residential land prices, including infrastructure factors, individual factors, and land plot location factors. Three factor groups had an average impact on land prices including the group of factors for planning and implementing the plan, the group of factors for social security and order, and the group of real estate brokerage factors. Two groups that had little impact on land prices included environmental factors and legal factors.

The impact index of individual factors ranged from 1.20 to 4.96. The most influential factor was the impact of the COVID-19 pandemic, and the smallest influential factor was the form of real estate brokerage (Table 8).

**Table 8**

Impact indexes and impact levels of factor groups

| Groups of factors | Impact index | Impact level | Averageim pact index | Average impact level | Groups of factors | Impact index | Impact level | Average Impact index | Average impact level |
|---|---|---|---|---|---|---|---|---|---|
| H1. Group of COVID-19 pandemic factors (CO) | | | 4.50 | VI | Distance to fitness and sports centers | 3.77 | QI | | |
| Impact of the pandemic | 4.96 | VI | | | H7. Group of security and social order factors (SO) | | | 3.27 | MI |
| Measures to prevent and combat the pandemic | 4.34 | VI | | | People's knowledge of the law | 3.02 | MI | | |
| The cycle of the pandemic repeats | 4.21 | QI | | | Obey the laws of the people | 3.21 | MI | | |
| H2. Group of administrative unit upgrade factors (AD) | | | 4.40 | VI | Security and social order management | 3.57 | QI | | |
| Urban upgrading policy | 4.65 | VI | | | H8. Group of environmental factors (EN) | | NI | 2.07 | LI |
| Urban upgrading plan | 4.55 | VI | | | Smog | 2.22 | LI | | |
| Carrying out urban upgrading | 4.01 | QI | | | Noise | 1.93 | LI | | |
| H3. Group of making and implementing planning factors (PL) | | NI | 3.09 | MI | Waste collection and treatment | 2.05 | LI | | |
| Socio-economic development planning | 3.98 | QI | | | H9. Group of legal factors (LE) | | | 2.25 | LI |
| Land useplanning | 4.11 | QI | | | Legal status of the land plot | 2.45 | LI | | |
| Construction planning | 4.27 | VI | | | Restrictions on construction planning | 2.33 | LI | | |
| H4. Group of infrastructure | | | 3.47 | QI | Restrictions on land use rights | 1.96 | LI | | |


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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| factors (IN) | | | | | | | | |
| Transportation system | 3.56 | QI | | | H10. Group of economic and financial factors (EC) | | 4.41 | VI |
| Energy power supply system | 3.11 | MI | | | Income-generating ability of the land plot | 4.04 | QI | |
| Water supply and drainage system | 3.65 | QI | | | Land finance | 4.66 | VI | |
| Communication systems | 3.41 | QI | | | Land buyer's income level | 4.52 | VI | |
| System of education and health facilities | 3.79 | QI | | | H11. Group of credit factors (CR) | | 3.75 | QI |
| System of cultural, physical training and sports facilities | 3.28 | MI | | | Loan interest rate | 4.32 | VI | |
| H5. Group of particular factors (PA) | | | 4.15 | QI | Loan procedure | 3.32 | MI | |
| Area of the land plot | 4.03 | QI | | | Amount borrowed | 3.61 | QI | |
| The shape of the land plot | 4.22 | VI | | | H12. Group of real estate brokerage factors (BR) | 3.04 | MI | 3.04 | MI |
| Facade width | 4.43 | VI | | | Real estate brokerage form | 1.20 | NI | |
| The length of the parcel of land | 4.1 | QI | | | Professional qualifications of brokers | 4.32 | VI | |
| The direction of the land plot | 3.96 | QI | | | The broker's sense of compliance with the law | 3.61 | QI | |
| H6. Group of factors of land plot location (LO) | | | 3.49 | QI | H13. Group of real estate market factors (RE) | 3.70 | QI | 3.70 | QI |
| Distance to schools | 3.54 | QI | | | Real estate supply | 3.56 | QI | |
| Distance to medical facilities | 3.71 | QI | | | Real estate demand | 3.51 | QI | |
| Distance to entertainment facilities | 2.95 | MI | | | Forecast of real estate supply and demand | 4.03 | QI | |

Abbreviation: VI - very impactful, QI - quite impactful, MI - medium impactful, LI - little impactful, NI – very little impactful

*Sources*: own study.

The results in Tables 3 and Table 8 show that residential land prices are affected by 55 factors belonging to 13 groups of factors. Compared with the results of previous studies, this study showed more factors and more groups of factors. Groups of factors that are different from the previous groups of factors include the group of COVID-19 pandemic factors, the group of real estate brokerage elements, and the group of administrative and planning elements. Some weak groups have the same name, but their factors can also be similar to and different from those pointed out in previous studies, including real estate market factors; a group of economic factors; a particular group of factors. The research results also show that the impact rates of factors on land prices are also different and also different from the impact rates of the groups of factors that have been shown in previous studies. The group of COVID-19 pandemic

factors and the group of real estate brokerage factors are both new and have the highest impact rate (Table 8). Moreover, their factors also have a strong impact on land prices (Table 8). This is the difference compared with the research results of Tra et al. (2020) because the infrastructure factor had the largest impact rate. Nguyen's research (2017) showed that the distance to political centers, schools, hospitals, etc has the strongest impact on land prices. According to Phan et al. (2017), regional factors had the strongest impact. The main reasons are that the studies were carried out in different locations with different natural, socio-economic and disease conditions.

The impact rates of 13-factor groups on land prices range from 1.43% to 23.65% (Fig. 4). The group of COVID-19 pandemic factors has the largest impact, followed by the group of real estate brokerage factors, the group of urbanization factors, industry, handicrafts, and other groups of factors. The group of individual factors including the area of the land plot, the shape of the land plot, the width of the facade, etc. has the smallest impact ratio because the land plots have the same area, shape, and width as the facade and meet the requirements. meet the needs of land users. The average impact indexes of the groups of factors are also different and range from 2.07 to 4.50 (Fig. 5). The group of COVID-19 pandemic factors has the largest impact index, and the group of environmental factors has the smallest impact index because Tu Son city has good environmental conditions. Thus, the group of COVID-19 pandemic factors has both the largest impact rate and the largest impact index on residential land prices.

From the above analysis, it can be seen that in the traditional factors affecting land prices, the distance to the center does not affect land prices because Tu Son city has a small area, a good transportation system, and infrastructure works are evenly distributed. The COVID-19 pandemic factor was a temporary factor that occurred for a short time but, nevertheless, also affected land prices. In addition, new factors specific to the study area, such as the policy of upgrading administrative units, real estate brokerage activities, and planning, had an influence on land prices.

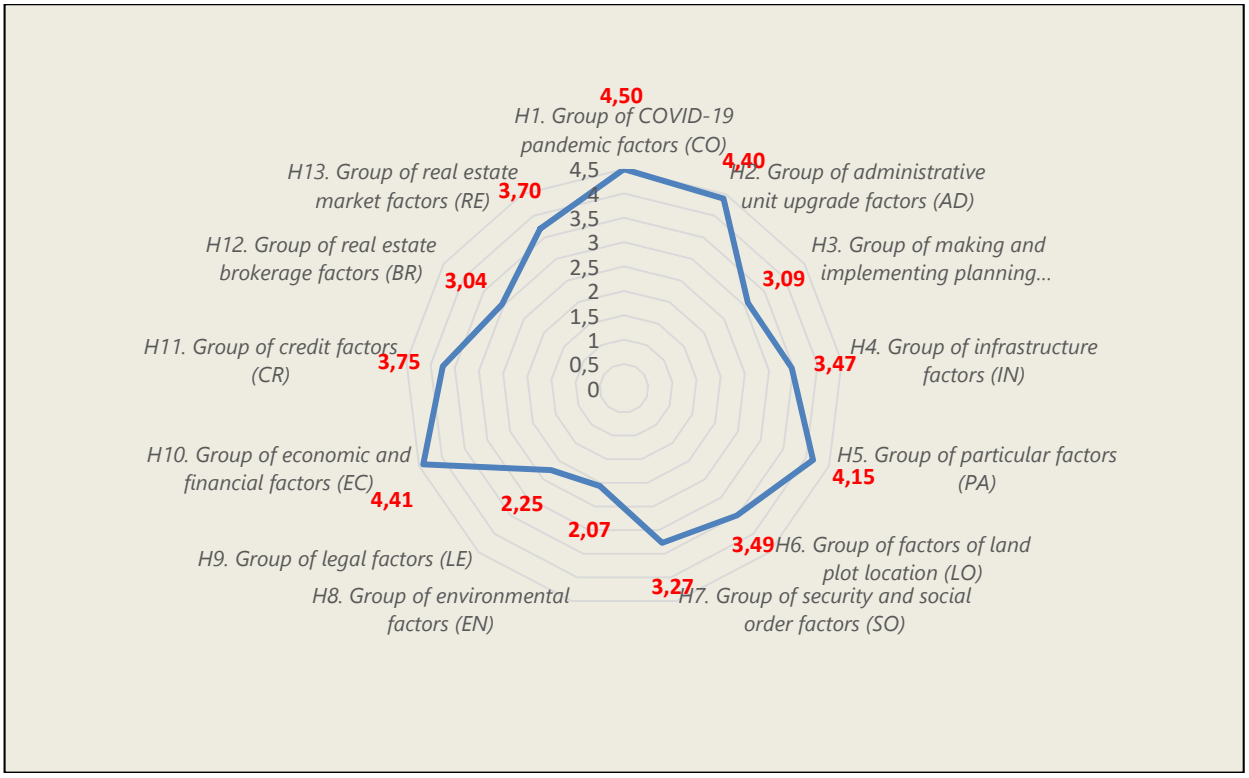


Fig. 5. Average impact indexes of factor groups. *Source*: own study.

## 5. Conclusion and implications

The price of residential land in the study area is affected simultaneously by 45 factors belonging to 13 groups of factors. The group of COVID-19 pandemic factors has the strongest impact (impact rate of 23.65%) on residential land prices. The group of social order and security factors has the smallest impact (rate of 1.43%) on residential land prices. The impact indexes of factors on land prices range from 1.20 to

4.96. For the price of residential land to be more suitable for the interests of the State, individuals, and organizations, it is necessary to pay attention to the impact level of the factors when determining the land price. First, it is essential to pay attention to the groups of factors that have the most substantial impact on land prices, then the groups of factors with smaller impact rates. In particular, when planning financial policies on land, the State needs to pay attention to epidemic factors and prevention measures to have solutions to ensure appropriate budget revenue and achieve the set plan. The research method in this article can be used as a reference when studying issues related to residential land prices. The study has not assessed the factors that cause the residential land price to change, so this issue needs to be further studied.

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