



## Investigation of the areas that will enable mixed use in the real estate development with risk analysis

Semih Dede\*<sup>1</sup>, Begüm Koruyucu Yurdagel<sup>2</sup>, Fatih Tükenmez<sup>3</sup>, Şeyma Ekizoğlu<sup>3</sup>

<sup>1</sup>Municipality of Toroslar, Türkiye, [semih\\_dede@yahoo.com](mailto:semih_dede@yahoo.com)

<sup>2</sup>Mersin University, Department of Remote Sensing and Geographical Information Systems, Türkiye, [begumkoruyucu@gmail.com](mailto:begumkoruyucu@gmail.com)

<sup>3</sup>T.C. Ministry of Transport and Infrastructure, General Directorate of Highways, 5. Regional, Türkiye, [f.tukenmez@hotmail.com](mailto:f.tukenmez@hotmail.com); [syma.ekizglu6026@gmail.com](mailto:syma.ekizglu6026@gmail.com)

Cite this study: Dede, S., Yurdagel, B. K., Tükenmez, F., & Ekizoğlu, Ş. (2021). Investigation of the areas that will enable mixed use in the real estate development with risk analysis. *Advanced Land Management*, 1 (1), 16-22

### Keywords

Real Estate Development  
Risk Analysis  
Risk Management

### Research Article

Received: 13.10.2021

Revised: 11.11.2021

Accepted: 20.11.2021

Published: 15.12.2021

### Abstract

Real estate development is a versatile business area that aims to create new added values to the country through land development and building construction by combining land, capital, and project thinking. The real estate is physically an integral part of the land and its buildings on the other hand, immovable development includes actions related to land development, building construction, marketing, operation and management. In order to be able to respond to economic demands in real estate development projects, financial analyzes must be carried out. Financial analysis allows us to see the risks on development projects through risk analysis as well as whether the development project is profitable or not. Identifying risks facilitates the risk management process and minimizes the financial risks of the company. In this study, mixed-use structures in the development of real estate, which are among the immovable development types determined in the common area determined within the boundaries of Mersin Province, Toroslar district and Yenişehir districts, were analyzed by the risk analysis method and it was observed that the determined sanatorium area and residential area could be profitable areas as an opportunity risk within the scope of immovable development.

## 1. Introduction

A real estate development project is a combination of location, project thinking and capital factors with the creation and profitable use of real estate objects; that have competitive capacity from an individual economy standpoint; create and ensure new employment opportunities; and are compatible with the social situation and the environment from the general economy standpoint. This definition describes the effects of the development project on both individual and general economy [1]. In conclusion, from the general economy perspective, the real estate development project must be able to meet public needs and from the individual economy perspective, it must have competitive ability and be consistently profitable. The research done in the framework of real estate development contain commercial decisions as well as economic, financial and legal subjects and analysis on the planning and preparation of the construction project [2-3].

The framework of real estate development contains two types of real estates: business-oriented real estate and residential real estate.

Because of the growing need for housing as a result of the increasing urban population, residential real estate development is more dominant in the market compared to the other forms of real estate. Global climate change,

potential water shortage, environmental pollution and the rapid consumption of natural resources brought the building of environmentally friendly structures onto the agenda. With the growing interest in building environmentally friendly structures, a new breed of building called green buildings came into being. Green buildings are advanced real estates that are built with the effects of buildings on environmental and human health in mind. Today, green buildings are the ones that come to mind when one thinks of sustainable, ecological and environmentally friendly building. Green buildings are defined as structures; that are built with a holistic approach that shapes the design of the building throughout its life-cycle, starting all the way from the choice of landscape; that are designed with a sense of social responsibility; in accordance with the climate and landscape conditions; that only consume as needed; that utilize renewable energy resources; that are built out of natural materials and are sensitive to the ecosystem and sustainable structures. With the growing number of green buildings, work started regarding standardization and certification systems. Certification systems aim to put forth universal and effective standards in order to define what a green building is, increase consumer awareness on the benefits of green buildings and create a transition in buildings. Benefits of green buildings can be listed as follows [4]:

- Decrease in CO<sub>2</sub> emissions that originate from buildings
- Minimizing the environmental destruction during the construction stage
- Decrease in operating expenses
- Utilization and improvement of renewable energy resources
- Recycling the waste material that result from excavation
- Accumulation and use of rain water through green roof method
- Utilization of natural light
- Energy conservation
- Reducing the cost of heating and cooling through insulation systems
- Increase in the value of the building
- Providing users, a healthier and more efficient environment
- Adding value to urban living spaces.

Business-oriented real estate describes industrial, private service and commercial structures which include manufacturing plants, storage spaces, workshops, industrial center spaces, distribution centers etc. Special service and commercial sector structures consist of building structures, restaurants, clinics, sanitariums, private education spaces, tourism structures, shopping malls, large hops, boutiques, public structures, cultural structures, charity organizations etc. Residential real estate consists of single and two-story houses, apartments etc. Users of these structures known as built real estate are industrial partners, service sector partners, commercial partners, non-profit organizations and residential users [2].

In a real estate development project, the type and method of the real estate in question is important. Types of real estate are landscape development, residential improvement, commercial spaces and mixed-use spaces. Methods of real estate development are divided into verbal and operational methods. Verbal methods include risk analysis, most effective and efficient use analysis and SWOT analysis. Operational methods include multiple decision support methods, analytic hierarchy process (AHP), build-up method, multiplication method etc.

In this study, the verbal real estate development method of risk analysis was employed. Risk, in the context of economics and finance, can be described as uncertainty or consequences of uncertainty. Risk is related to the inability to estimate the consequences in the planning environment and is described through the term probability.

Risk analysis is the assessment of the factors of a project's stability based on future events [5]. Risk analysis has two main components: Probability and Effect.

Risk analysis must be conducted in the investment decision stage before the application stage. In order to analyze the project risk, first, the risk needs to be identified and afterwards, measured. The amount of risk a project contains describes the variability of the project's potential returns [6].

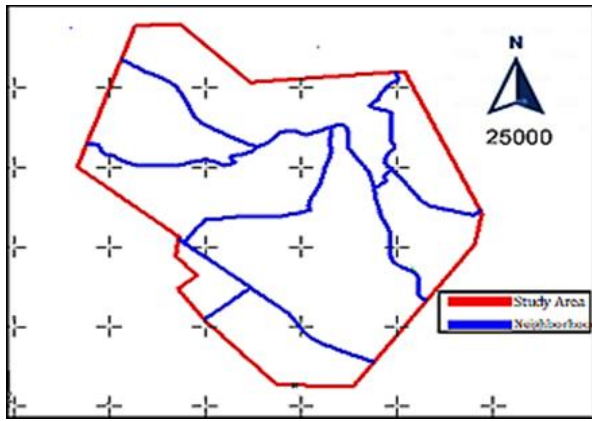
Risk analysis methods include probability, scenario, sensitivity and simulation. Out of these methods, probability and simulation were used in this study for the sanitarium space and residential development spaces. These methods allow the project manager to assess the order and tendency of the risks and how to prevent them based on the income, time, cost and the ability to complete the project [7].

These risk analysis methods were used to assess the profitability and efficiency of the mixed-use sanitarium area and the residential area for the investor in every scenario.

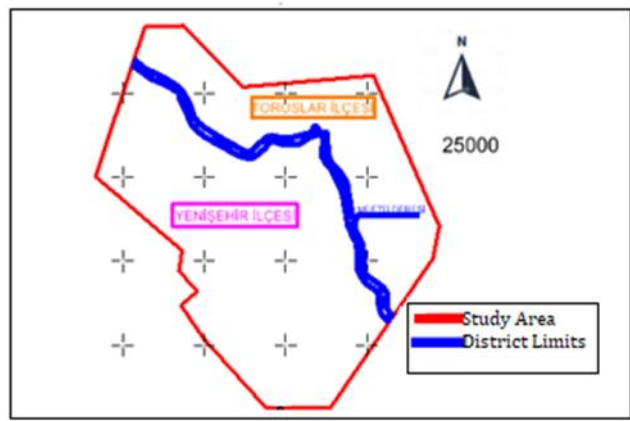
## **2. Material and Method**

### **2.1. Study area**

This study area for this study was determined to be the 900 ha (Figure 1) space encompassing a portion of the Karaisalı, Fuat Morel, Portakal, Kocavilayet, Okan Merzeci, Çavak, 50. Yıl and Deniz neighborhoods that are situated within the limits of the Yenışehir and Toroslar districts of the Mersin province (Figure 2).



**Figure 1.** The study area (red line) and neighbourhood limits (blue lines)



**Figure 2.** The study area (red line) and district limits (blue line-Müftü Stream)

The cadastre parcels where a Zoning Plan was implemented and those where it is not, consist of forest, agricultural and residential areas. There is also a stream bed that runs from the northwest to the southeast of the workspace (Müftü Stream). The stream continues on in the same direction and empties into the Mediterranean.

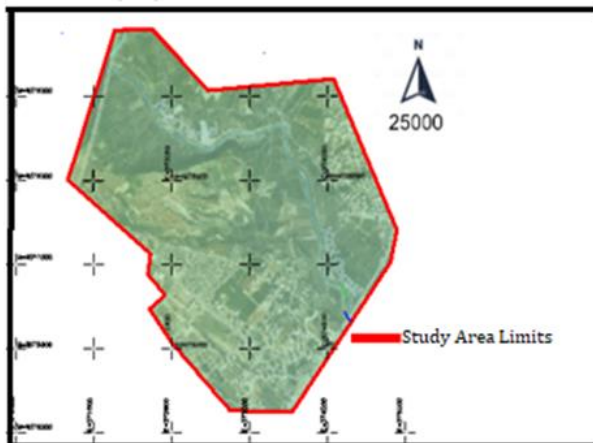
In the study, a sanitarium area and a residential area are planned to be built in these mixed-use building areas.

## 2.2. Data

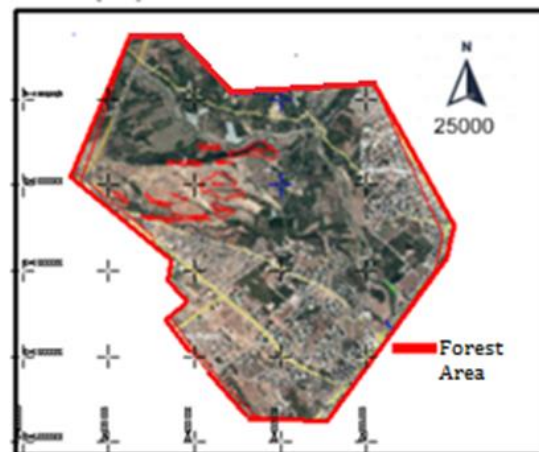
In order to ensure reliability of the risk analysis for the effective and efficient use of the sanitarium area that will allow for mixed-use in the real estate development, the following data was acquired: The orthophoto map (Figure 3), the architectural map, the forest map (Figure 4), the General Directorate of State Hydraulic Works (DSI) flooding map of the Müftü River (Figure 5), cadastral state, development and DEM (Digital Elevation Model) maps (Figure 6), and archeological site data [8].

The study area consists of the land with 2-3% incline, situated on the south side of the sanitarium and residential areas that were determined based on the result on the DEM map.

According to the agricultural land use layer map, the areas determined as the sanitarium space and the residential area are situated on the IV and VII layers and there is no available the Zoning Plan for these areas. Also, according to the Soil Protection and Land Use Law No. 5403 [9], lands of IV and VI capability are classified as low-yield agricultural lands. Therefore, even in the event that there is a demand for the Zoning Plan, there is no obstacle in the way of this area being turned into a residential area.



**Figure 3.** Orthophoto



**Figure 4.** The forest area

As per the study conducted based on the data obtained from the General Directorate of Land Registry and Cadastre (TKGM) and the associated Municipalities, the area determined to be residential area situated north of Fuat Morel 2894 Street, is made up of cadastre parcels that are mostly considered private property (Figure 7 and Figure 8). The area determined to be the sanitarium area, situated on the southern limit of Çavak and North of Kocavilayet is outside the Zoning Plan and mostly made up of private property.

Arcgis 10.1 and Microstation GIS software's were utilized in the combined assessment of the data acquired. As per Protection of Cultural and Natural Properties Law No. 2863 [10], the study area was surveyed and determined to not contain any archeological sites that could be an obstacle towards real estate development.

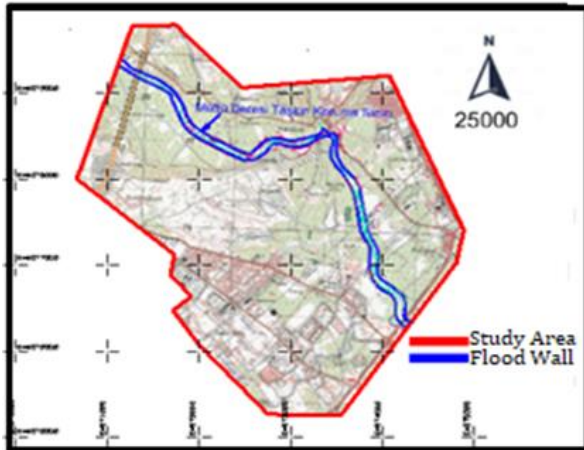


Figure 5. Flooding map of the Müftü River

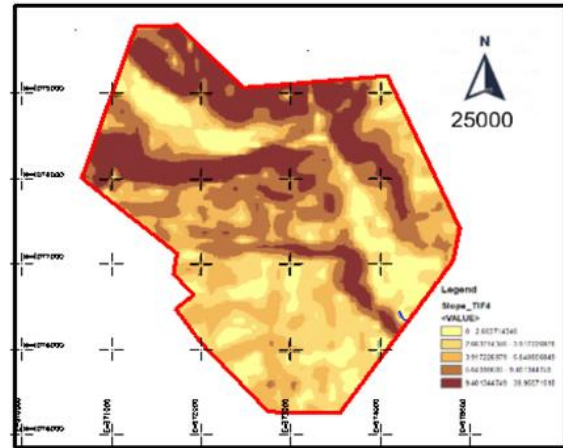


Figure 6. DEM

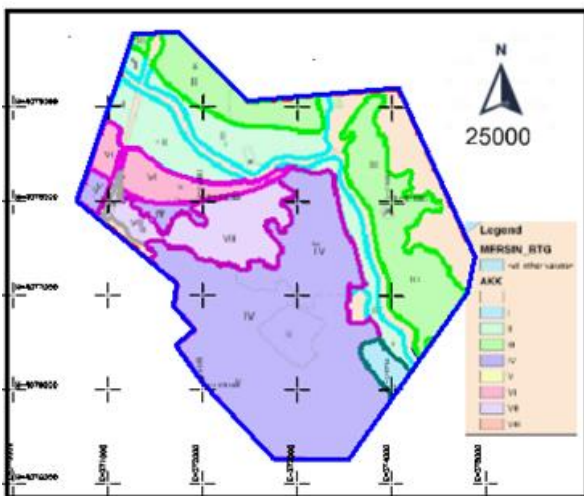


Figure 7. Agricultural estate land use capability (LUC) map

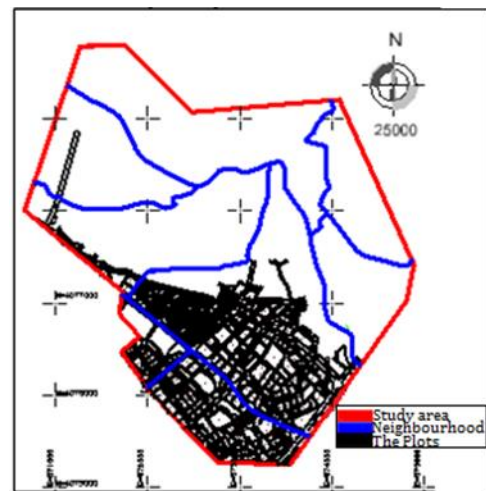


Figure 8. The Zoning Plan of Yenişehir District

### 2.3. Method

In this study, the verbal real estate development methods of qualitative and quantitative risk analysis were employed. Risk, in the context of economics and finance, can be described as uncertainty or consequences of uncertainty. Risk is related to the inability to estimate the consequences in the planning environment and is described through the term probability. Risk analysis is the assessment of the factors of a project's stability based on future events [5]. Risk analysis is important for determining the targeted returns on a certain investment and the variables that affect these returns. Risk analysis methods include probability, scenario, sensitivity and simulation. These methods contribute to evaluating subjects, the order and tendency of the risks and how to prevent them. Risks can be opportunities as well as threats. In this study, methods of scenario, sensitivity probability and the Monte Carlo Simulation were employed.

#### 2.3.1. Monte Carlo Simulation

The primary purpose of risk analysis in a project is to run through every single possibility. There are many statistical and theoretical methods to achieve this goal. Some examples are the determining of a risk tolerance based on the project specifications, risk adjusted discount rates (RADR), description of subjective probabilities, formation of stochastic decision trees, sensitivity analysis and the probability analysis method of Monte Carlo Simulation [11].

The "Monte Carlo Simulation" is a term coined by S. Ulam and Nicholas Metropolis based on games of chance that are popular in Monte Carlo. Simulation is a technique in which random numbers and probabilities are used to solve problems [3,12]. Computer models are used to imitate real-life probabilities which assists in forming

predictions. These models are formed using spreadsheets and must contain a certain number of input and output parameters and equations that make use of these parameters. This type of model is usually a deterministic model and gives the same result in repeated calculations. Monte Carlo Simulation allows repeated re-evaluations of a deterministic model by using a series of random numbers as input. Using random inputs in this way allows one to turn an originally deterministic model into a stochastic model. Monte Carlo Simulation is also classified as a sampling method. The resulting data can then be represented as probability distribution and transformed into error lines, reliability estimations, tolerance zones and reliability intervals [3].

Three different Monte Carlo Simulation equations were applied on the mixed-use real estate development areas in the study area (Figure 9).

From the input data, the residential area sale value per square meter data was obtained from the on-the-spot current (at the time this article is being written) real estate sales data.

And the data for the calculation of the expenses was based on the Ministry of Environment and Urbanization Approximate Building Costs per Unit for the year of 2020.

Model Calculations (3 different simulation tests):

180 m<sup>2</sup> (3+1) house sale price=550,000,00 ₺

90 m<sup>2</sup> (2+1) house sale price=250,000,00 ₺

220 m<sup>2</sup> (4+1) house sale price=750,000,00 ₺

Residents are planned to be 2 blocks of 10-story apartments.

Approximate building costs per unit m<sup>2</sup>= 2000,00 ₺

3+1 total 40 single section

2+1 total 80 single section

4+1 total 20 single section

Test1= 40\*500000-(40\*180\*2000) =5600000 ₺

Test2= 80\*250000-(80\*90\*2000) = 5600000 ₺

Test3=20\*750000-(20\*220\*2000) =6200000 ₺

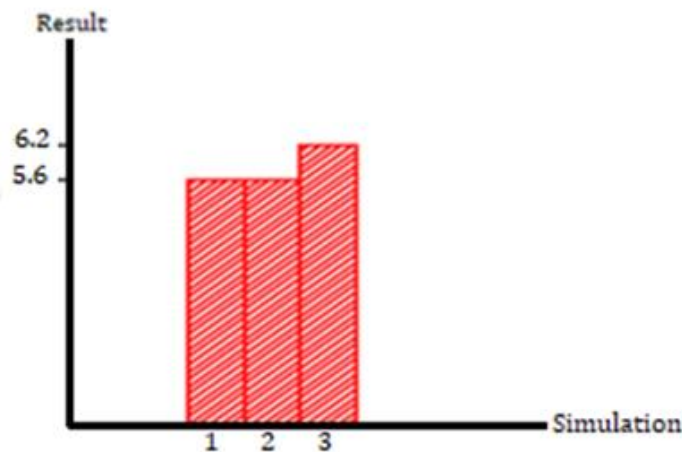


Figure 9. Monte Carlo Simulation results

### 3. Results

Following the analysis of the risks in question and the assessment of the environmental, economic and sector-specific factors and based on the Risk Rate Comparison (Table 1), it was observed that the residential area is compatible with the real estate market conditions.

A land use map of the study area was created (Figure 10). House Sales According to the Annual Data obtained from [13].

Variation Interval; 5 Years

Variable Parameter; Sales Amount

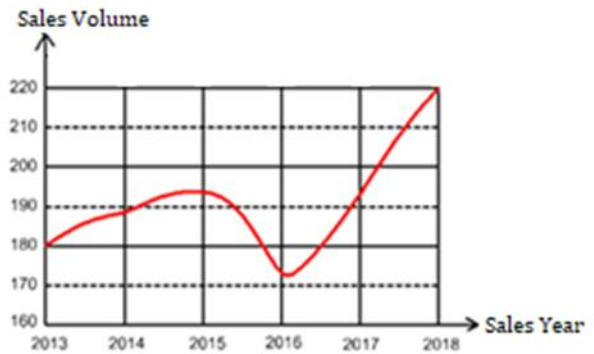
Constant Variable; House Price (Figure 11)

**Table 1.** Residential development area risk factors

	Environmental Risks		Economic Risks		Industry-Specific Risks	
	Kind of risks	100%	Kind of risks	100%	Kind of risks	100%
Residential Area	Destruction of the object	0	Macroeconomic changes	10	Sector movements	15
	Legal changes	10	Unemployment	10	Presentation and request behaviors	10
	Ecological demands	15	Income and purchasing power	20	Empty space risks	20
	Political risks	30	Interest rate change	30	Decline in rental prices	10
					Technological innovations	15



**Figure 10.** Image of the Mixed-Use sanitarium and residential areas



**Figure 11.** Residential development area sensitivity analysis variation figure

The results of the risk analysis conducted in this study with the subject Investigation of the Areas that will enable Mixed Use in the Real Estate:

The sanitarium space subject to real estate development shall satisfy public needs and be able to be used regularly and thus, it is considered that the sanitarium space shall contribute to the public economy.

Following an analysis regarding environmental and economic risks, it was observed that the area determined to be residential area is a profitable investment that contains a very small amount of financial threats and dangers (Figure 11).

Based on the results of the scenario analysis conducted on the sanitarium space, it was determined that the sanitarium space is an investment with no alternatives and was thus determined to be the best-case scenario for the area.

Based on the data obtained from the sensitivity analysis (price, sales amount etc.) conducted on the residential area has been determined that the residential area is a profitable investment (Figure 11).

Based on the sensitivity analysis data, it was observed that the variation intervals between the price and sales amount components of the analysis may be long (the probability of price and sales amount variation is very low) which represents an opportunity risk regarding real estate development (Figure 11).

#### 4. Conclusion

In this study, sanitarium and residential areas were examined within the scope of real estate development in the area determined within the borders of Mersin province Toroslar district and Yenişehir district.

As a result of the researches and analyzes made, it is thought that the sanitarium area will contribute to the public economy by responding to the needs and by its usability. It was evaluated in terms of environmental and economic risks. According to the results of the Monte Carlo Simulation analysis on the residential area and the three different simulation equations showed that the residential area has the potential to be a profitable investment.

## Acknowledgement

DSI 6<sup>th</sup> Regional Directorate, 67<sup>th</sup> Branch Office (Adana), Directorates of Building and Urbanization of the Yenisehir and Toroslar Municipalities, Mersin Regional Directorate of Forestry and Provincial Directorate of Agriculture for their unrelenting support in helping us obtain the data we required for our study;

5<sup>th</sup> Regional Directorate of Highways Chief Engineering of Real Estate for identifying the ownership and qualification status of the spots situated within our workspace;

Our research advisor Dr. Fatma BÜNYAN ÜNEL and Hasan ÖZÜĞURLU for the translation of this article to English.

## Funding

This research received no external funding.

## Author contributions

**Semih Dede:** Conceptualization, Methodology, Software **Begüm Koruyucu Yurdagel:** Data curation, Writing-Original draft preparation, Software, Validation. **Fatih Tükenmez:** Visualization, Investigation, Writing-Reviewing and Editing. **Şeyma Ekizoğlu:** Writing-Reviewing and Editing.

## Conflicts of interest

The authors declare no conflicts of interest.

## References

1. Yakar, M., Kabadayı, A., Yiğit, A. Y., Çıkkıkcı, K., Kaya, Y., & Catin, S. S. (2016). Emir Saltuk Kümbeti Fotogrametrik Rölöve Çalışması ve 3Boyutlu Modellenmesi. *Geomatik*, 1(1), 14-18.
2. Bostancı, B. (2008). Forecasting analysis on real estate development and application of housing area model in Istanbul. *Doctoral Thesis*, Yıldız Technical University, Institute of Science, Istanbul, 217 p (in Turkish).
3. Demir, H., & Bostancı, B. (2010). Decisions Support Analysis for Risk Management, *African Journal of Business Management*, 4(8), 1586
4. Erdede, B. S., & Bektaş, S. (2014). Ecologically Sustainable Development of Real Estate and Certificate Systems of Green Building. *Electronic Journal of Map Technologies*, 6(1), 1-12.
5. Bostancı, B., & Demir, H. (2008). Risk Analysis in Real Estate Development. *Journal of Geodesy, Geoinformation and Land Management*, 2, 5-11.
6. Sarıboyacıyan, A. K. (2006). Reducing Risks of Global Financial Crisis' By Using Financial Investment Analysis Method On Real Estate Development Projects. Master Thesis, Istanbul Technical University, Institute of Science, Istanbul.
7. IKG, (2006). Istanbul Corporate Development. <https://www.projeyonetimi.com/downloads/mak14.pdf,06.04.2006> [Access Date: 25.03.2020].
8. TNGIS, (2020). Turkish National Geographic Information System, Ministry of Environment and Urbanization (MEU). <https://tucbs.atlas.gov.tr/starter.aspx?aspxerrorpath=/#dashboard> [Access Date: 25.03.2020].
9. The Soil Protection and Land Use Law No. 5403 (5403 sayılı Toprak Koruma ve Arazi Kullanımı Kanunu, Kabul Tarihi: 3/7/2005 Yayımlandığı Resmî Gazete; Tarih: 19/7/2005 Sayı: 25880 Yayımlandığı Düstur; Tertip: 5 Cilt: 44).
10. Protection of Cultural and Natural Properties Law No. 2863 (2863 sayılı Kültür ve Tabiat Varlıklarını Koruma Kanunu, Kabul Tarihi: 21/7/1983 Yayımlandığı Resmî Gazete; Tarih: 23/7/1983 Sayı: 18113 Yayımlandığı Düstur; Tertip: 5 Cilt: 22 Sayfa: 444).
11. Birgönül, T. M., & Dikmen, İ. (1996). İnşaat Projelerinin Risk Yönetimi, *IMO Technical Journal*, 1305-1326.
12. Metropolis, N., & Ulam, S. (1949). The Monte Carlo Method. *Journal of the American Statistical Association*, 44-247
13. TKGM, (2020). General Directorate of Land Registry And Cadastre. <https://www.tkgm.gov.tr/tr/icerik/parsel-sorgulama-3> [Access Date: 12.04.2020].

