TÜRKİYE'DE VE DÜNYADA KENTSEL DÖNÜŞÜM PROJELERİNDE COĞRAFİ BİLGİ SİSTEMLERİNİN (CBS) KULLANIMI: BİR ARAŞTIRMA

USE OF GEOGRAPHICAL INFORMATION SYSTEMS (GIS) IN URBAN TRANSFORMATION PROJECTS IN TÜRKİYE: A REVIEW

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ÖZET

Ülkemizin büyük bir kısmının fay hattı üzerinde yer alması ve her an deprem yaşamanın mümkün olması, konutların mevcut durumunu sorgulamamıza neden olmaktadır. Gerek yaşanılan depremler gerekse zamanla yapının yıpranması, yapıların dönüştürülmesini zorunlu hale getirmiştir. Teknolojinin gelişmesi ile kentsel dönüşüm projelerinde faklı teknoloji ve teknikler kullanılmaya başlanmıştır. Bu tekniklerden biri de Coğrafi Bilgi Sistemleri (CBS)'dir. Bu çalışmada, Türkiye'de kentsel dönüşüm projelerinde CBS kullanımı üzerine yapılmış akademik çalışmalar irdelenmiştir. Çalışma sonucunda, kentsel dönüşüm projelerinde CBS kullanımının oldukça faydalı olduğu tespit edilmiştir. CBS kullanımı ile gerek yapı stoğu gerekse imar bilgilerine ulaşımın kolaylaşacağı görülmüştür. CBS'nin sadece kentsel dönüşüm uygulamalarında değil, aynı zamanda harita, mimarlık ve şehircilik alanında da aktif bir şekilde kullanılması gerektiği anlaşılmıştır.

Anahtar Kelimeler: Kentsel dönüşüm, CBS, mimarlık, haritalama

ABSTRACT

The fact that a large part of our country is on a fault line and that an earthquake can occur at any time has caused the current status of housing to be questioned. Both the earthquakes experienced and the deterioration of the structure over time have made it necessary to transform the structures. With the development of technology, different technologies and techniques have begun to be used in urban transformation projects. One of these techniques is Geographic Information Systems (GIS). In this study, academic studies on the use of GIS in urban transformation projects in Turkey were examined. As a result of the study, it was determined that the use of GIS in urban transformation projects is quite useful. It was seen that access to both building stock and zoning information will be facilitated with the use of GIS. It was understood that GIS should be used actively not only in urban transformation applications but also in the fields of mapping, architecture and urban planning.

Keywords: Urban transformation, GIS, architecture, mapping

1. INTRODUCTION

Cities are seen as more attractive areas by a large portion of the country's population due to the wide range of opportunities they offer. Today, the opportunities and facilities offered by cities lead people to live in cities rather than rural areas. As a natural result of this, the dangers and risks in urban life are shared by more people day by day. (Bilgehan, 2023).

After the industrial revolution, rapid migration to cities caused the formation of unplanned and unhealthy structures (Eserler and Gençkaya, 2023). In order to eliminate this situation, the "Law on the Transformation of Areas at Disaster Risk" No. 6306 came into force in 2012 (CMBS, 2025). Within the scope of this law, areas at risk of disaster are included in the scope of urban transformation. Urban transformation is the general name of the practices carried out to rehabilitate old, deteriorated and unusable areas of the city (Eyidiker, 2021).

Urban transformation is one of the important agenda items in Turkey as well as in the world. In order to combat unhealthy housing areas, taking multi-dimensional measures is one of the most important tools to solve the problem. Therefore, in urban transformation projects, all social, economic, spatial, cultural and environmental components must be taken into consideration equally (Özdemir, 2010).

In an urban transformation process, in order for decisions to be sound, data such as zoning plans, real estate value, property information, infrastructure, etc. must be obtained. In addition, many data related to each other and the land must be collected and analyzed. Information systems are needed for all of these. For this reason, effective use of geographic information systems is important and necessary in urban transformation applications. Geographic information systems are a set of advanced systems used for the collection, verification and storage of data belonging to geographic objects, the conversion of these data into geographic information through database operations, queries, transformations and analyses, and the display

of geographic data information (Sönmez and Sarı, 2004). The geographic data required of GIS are obtained from many sources (Villi ve Yakar, 2023).

In this study, it is aimed to examine academic studies on the use of GIS in urban transformation projects in Turkey. Articles, theses, books and papers written on this subject have been examined in detail.

2. URBAN TRANSFORMATION AND GEOGRAPHICAL INFORMATION SYSTEMS

2.1. Urban Transformation

In our country and the world, cities need projects and practices aimed at renewal, transformation, resettlement and improvement due to reasons such as economic reasons, inadequate social development, overpopulation, wrong location selection and natural disasters. New urban areas, new infrastructure and transportation systems created as a result of renewal and transformation projects must be city parts that are suitable for today's needs and expectations. Therefore, partnerships that will be formed with the cooperation of the public, private sector, civil organizations and universities are needed. Legal regulations that will allow this should be made (Şişman and Kibaroğlu, 2009).

Urban transformation is the transformation of areas that have become socially, culturally, historically, economically and physically out of living space into healthier areas worthy of humanity. From a legal perspective, urban transformation is the collective name for the improvement of places that do not have a zoning plan or are constructed in violation of zoning plans during the construction process, in order to make them compatible with the basic objectives of zoning planning activities and the renewal of old and deteriorated urban texture (Öngören, 2018).

The action known as urban transformation includes many notions. To summarize these notions;

- ✓ **Urban protection;** protecting the old environment in the new order,
- ✓ **Development;** restoring different features to areas that have lost their rehabilitation feature,
- ✓ **Animation;** Restoration of urban areas that have lost their characteristics (social, cultural, economic and historical),
- ✓ **Renovation-reconstruction;** construction of new structures instead of old and unsafe ones,
- ✓ **Gentrification;** Instead of low-income citizens living in old settlements, people who are prominent in every respect come and settle,
- ✓ **Rehabilitation;** to restore structures that have undergone interventions over time but have not lost their originality,
- ✓ **Cleaning:** Transforming poor areas into a new face (Doğan, 2024).

Urban transformation is defined as a comprehensive vision and action that attempts to provide a permanent solution to the economic, physical, social and environmental conditions of a changing region in order to produce solutions to urban problems (Thomas, 2003).

The aim of urban transformation is to fulfill the four basic criteria stated below. These are;

- ✓ To stop physical collapse and ensure the sustainability of the historical texture,
- ✓ To revitalize economic life,
- ✓ To increase the quality of architecture and urban life and to activate culture-based dynamics,
- ✓ To ensure the participation of relevant actors at all scales in the project process.

Depending on the nature of the region's problems and potentials, one or more of these goals may come to the fore (Polat and Dostoğlu, 2007).

The foundations of the idea of urban transformation were laid in the demolition and reconstruction of the built environment in order to produce solutions to the unhealthy urban environment, inadequate infrastructure system and social and economic problems that emerged during the industrialization (Yenice, 2014).

For the first time in the world, urban transformation emerged in Western Europe after the 1850s (Üstün, 2008). As part of the industrialization process, the rapid and unhealthy growth experienced in industrial cities led to the reconsideration of cities in France (Paris), England (London and Manchester) and Germany (Berlin-Hamburg). In recent years, high-impact and striking urban transformation areas have been created in New York, Rio de Janeiro, Seoul, Shanghai, Tokyo, and Amsterdam. Thus, urban transformation projects were created by taking into account squares, wide streets and avenues, parks and green areas where people can live more comfortably.

After World War II, urban transformation movements began to take place in the United States of America (USA) and the Union of Soviet Socialist Republics (USSR), which experienced the industrialization process later.

With the declaration of the Republic of Turkey in 1924, the first urban development plan for Izmir was enacted. Zoning regulations were made for Ankara with laws numbered 583 in 1925, 1351 in 1928, and 5218 in 1948. Later;

- ✓ In 1930, General Municipality Law No. 1580,
- ✓ In 1948, Building Construction Incentive Law No. 5228,1949'de 5431 sayılı Ruhsatsız Yapıların Yıktırılması,
- ✓ In 1953, Law No. 6188 on Encouraging Building Construction and Buildings Constructed Without Permission,
- ✓ In 1957, No. 6185 Zoning Regulation Law
- ✓ In 1959, changes were made in zoning regulations with the law numbered 7367.
- ✓ In 1965, the Condominium Law No. 634 became law.
- ✓ In 1966, the Slum Law was enacted
- ✓ In 1972, additional articles were added to the Zoning Law No. 1605,
- ✓ In 1983, new additional articles were added to the Zoning Law with Law No. 2905.
- ✓ In 1983, Zoning Amnesty was also issued with Law No. 180.

- ✓ In 1984, the Metropolitan Law No. 3030 and the Coastal Law No. 3086 came into force.
- ✓ In 1984, changes were made to the Zoning and Slum Legislation with Law No. 2981 and to the Zoning Legislation with Law No. 6785.
- ✓ In 1984, the Mass Housing Law came into force.
- ✓ Taking the earthquake into consideration, additional articles were added to the Slum Laws previously enacted in 2000.
- ✓ Urban transformation efforts emerged with the Municipality Law enacted in 2005.
- ✓ Urban transformation was addressed for the first time in the 9th Five-Year Development Plan (2007-2013) (Doğan, 2024).

Urban transformation has sustainable targets with its economic, environmental, social and cultural dimensions (Figure 1) (Almedia et al., 2005).

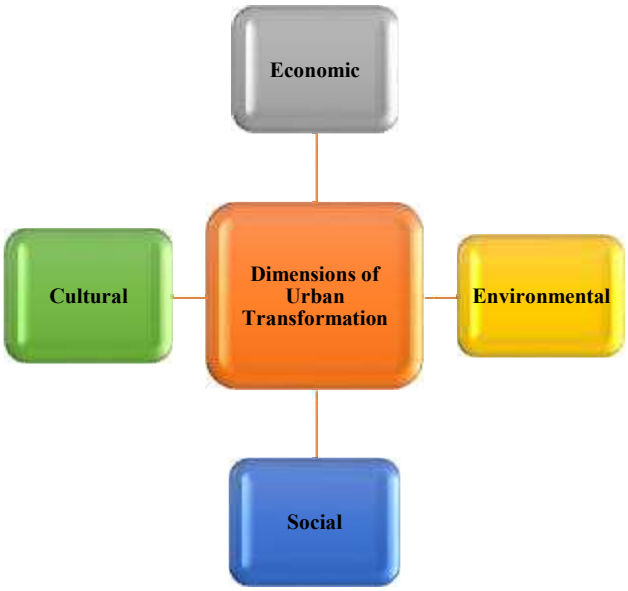

Figure 1. Dimensions of urban transformation

Economic dimension: Cities need to be productive, a sustainable system and economy, countries need to make their external debts manageable, and the imbalance created by the sector that harms industrial production and agricultural production must be eliminated.

Environmental Dimension: Avoiding the use of renewable resources for investment purposes by keeping the basis of the resources to be used constant is an environmentally sustainable system.

Social Dimension: It should ensure to present adequate provision of social services, including a sustainable system, political responsibility, gender equality, health and education and participation.

Cultural Dimension: It can be defined as a concept that includes many dimensions of inter-societal diversity (Bayram, 2001; Gönen vd., 2023).

2.2. Geographic Information Systems (GIS)

Geographic Information Systems are defined as a set of systems used to collect, manage, analyze, visualize, share and store geographic data. It also helps users in location-based decision support processes to solve complex social, economic, environmental, etc. problems on Earth (Esri, 2023; Başarsoft, 2023).

With the effective use of GIS, it is possible to understand many problems better and produce analytical solutions to them. There are some situations where GIS can produce solutions or help users (Villi and Yakar, 2023). These are;

- ✓ Determination of areas suitable for investment,
- ✓ Detection of landslide areas,
- ✓ Detection of earthquake concentration areas,
- ✓ Selection of suitable locations for dam construction,
- ✓ Detection of locations for hospitals, schools, industrial establishments,
- ✓ Shortest route planning,
- ✓ Detection of locations for solar power plants,
- ✓ Detection of locations for wind turbines,
- ✓ Analysis of disasters such as floods, inundations, etc.,
- ✓ Development of irrigation strategies,
- ✓ Land use analyses,
- ✓ Analysis related to meteorology,
- ✓ Analysis related to traffic,
- ✓ Analysis within the scope of environment and urban planning

GIS is evaluated within the framework of at least five main elements (Thompson, 2016). These are hardware, software, data, people and methods (Figure 2).

Figure 2. GIS components (Ankageo, 2025)

Hardware: all processes connected to the computer and the peripherals connected to it (printer, plotter, scanner, digitizer and data recording units) constitute this component. The network provides communication between the hardware and other components.

Software: This component is the algorithms created with high-level programming languages. These algorithms provide the user with the necessary functions to record, analyze and visualize geographic data through the interface established in the computer environment.

Data: Geographic information systems can use spatial data in an integrated manner with other existing data sources. In this way, data belonging to existing public institutions or private organizations can be organized and combined with spatial data.

People: The human factor also has an important place in GIS. Real world problems and solutions are managed by the necessary systems and plans are prepared for the future. Therefore, it is the people in this system who design and maintain the systems.

Method: A successful management system operates according to a well-designed plan and business rules. These rules include different models and applications for different institutions (Sunbul, 2021).

3. ACADEMIC STUDIES ON THE USE OF GIS IN URBAN TRANSFORMATION PROJECTS IN TÜRKİYE

Aksu (2007) examined the Istanbul/Üsküdar/Ünalan, Esatpaşa and Örnek neighborhoods in his study. He examined the urban transformation projects carried out in these neighborhoods, which are a valuable location in the city and an unhealthy socio-economic and physical area. As a result of the study, he prepared the current situation of the area and area maps with the GIS method. He also applied a questionnaire to the people living in the area and measured their satisfaction.

Özcan et al. (2020), in their study, examined the streets and surroundings of Beyler, Mücellit and Kurşunlu Mosques located in the urban protected area in Eskişehir/Odunpazarı. They created a database for the purpose of collecting and preserving cultural heritage data to use in the examination of these areas. As a result of the study, they explained the benefits of Geographic Information Systems in cultural heritage management.

Özçatal, (2016), in his thesis, combined GIS and Analytical Hierarchy Process (AHP) and created an urban transformation suitability map in a 2500 Ha urban area in Bozhöyük/Bilecik. As a result of the study, he stated that the use of GIS and AHP together can be easily used in the urban transformation process.

Gönen, (2024), in his thesis, examined the urban transformation projects carried out in Çalılıöz Neighborhood of Kırıkkale province using the GIS method. As a result of the study, it was determined that the building density and population of Çalılıöz Neighborhood increased over time. He reported that this increase caused a lack of social facilities.

Kırpık, (2017), in his study, created a model by integrating traditional and Community Participation Geographic Information Systems (CGIS) in the Historical Bazaar in Istanbul/Kadıköy and its surroundings. He applied this model on a sample project. As a result of the study, he compared Community Participation Geographic Information Systems with traditional methods and mentioned their advantages/disadvantages.

Avcıoğlu, (2024), in his study, created a model to be used in urban transformation applications and examined the use of GIS on this model. In the study, he examined the 5.6 ha urban transformation area located in Istanbul/Beykoz/Çubuklu neighborhood. As a result of the study, he obtained a data model using GIS and made queries and analyzes related to this area.

Gün, (2023), in his study, integrated the graphics used in urban transformation processes with table data and used them in GIS application by creating layers. As a result of the study, he stated that analysis, query, data transfer and data processing operations related to the study area can be easily done with this method. He emphasized that this method is a base that decision makers can easily use.

Yavuz (2019), in his study, examined the urban transformation applications carried out in Ünalan Neighborhood of Uşak city center using GIS. As a result of the study, he reported that social facilities such as children's playgrounds and socio-cultural activity areas were insufficient in the urban transformation area. In addition, he stated that health service areas and park areas could meet the needs of the region.

Yağcı (2014), in her thesis, examined the potential of using GIS in determining the current status of the city's lands after urban transformation, observing the physical transformation that has occurred, redesigning urban areas and spatial examinations in revision processes. As a result of the study, she stated that in case of using GIS, it can be useful for decision makers to make correct decisions and more beneficial changes can be made in urban areas.

4. RESULTS

In this study, academic studies on the use of GIS in urban transformation applications were examined. The results obtained are presented below.

- ✓ It has been concluded that the use of GIS is important in the physical transformations of the space that occur after urban transformation.
- ✓ It has been seen that the use of GIS is a useful application for decision makers to make correct decisions.
- ✓ GIS has been effective in identifying the deficiencies of the social facilities of the transformed area after urban transformation.
- ✓ In urban transformation applications, it has been observed that analysis, querying, data transfer and data processing operations can be easily carried out with the use of GIS.
- ✓ It has been understood that with the use of GIS, building density and population characteristics can be determined accurately.

- ✓ It has been understood that the change in urban transformation areas over time can be determined with GIS.
- ✓ It has been observed that with the use of GIS, zoning information such as island parcel information and building density can be accessed accurately and easily.
- ✓ It has been concluded that correct information can be obtained in a short time with the use of GIS.

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