TITLE: ANALYSIS OF URBAN TRANSFORMATION APPLICATIONS USING GIS METHOD

(ÇALILIÖZ NEIGHBORHOOD/KIRIKKALE EXAMPLE)

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Research Article

ANALYSIS OF URBAN TRANSFORMATION APPLICATIONS USING GIS METHOD (ÇALILIÖZ NEIGHBORHOOD/KIRIKKALE EXAMPLE)

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Abstract

In this study, it is purposed to examine the urban transformation practices carried out in Kırıkkale city center with Geographic Information System (GIS). For this purpose, neighborhoods in Kırıkkale city center were researched and neighborhoods with a high number of risky buildings were identified. The study was carried out in 3 phases. In the first stage, information and data of risky structures located within the borders of Kırıkkale center were obtained from relevant institutions and organizations. In the second stage, in line with the information obtained, the neighborhood with the most risky buildings in the central district was determined and information about the neighborhood was collected. In the third stage, mapping of the neighborhood was done using satellite images and GIS. As a result of the study, it was seen that the neighborhood with the highest number of risky buildings was Çalılıöz neighborhood. It has been observed that after urban transformation, the building and population density of the neighborhood increased, causing a lack of social facilities.

Keywords: Urban transformation, Geographic information systems, Kırıkkale, Çalılıöz neighborhood, Architecture

KENTSEL DÖNÜŞÜM UYGULAMALARININ CBS YÖNTEMİYLE ANALİZİ (ÇALILIÖZ MAHALLESİ/KIRIKKALE ÖRNEĞİ)

Özet

Bu çalışmada, Kırıkkale il merkezinde yapılan kentsel dönüşüm uygulamalarının Coğrafi Bilgi Sistemi (CBS) ile incelenmesi amaçlanmıştır. Bu amaç doğrultusunda, Kırıkkale il merkezinde bulunun mahalleler araştırılmış ve riskli yapı sayısı fazla olan mahalle tespit edilmiştir. Çalışma 3 aşamada geçekleştirilmiştir. İlk aşamada, Kırıkkale merkez sınırları içerisinde bulunan riskli yapıların bilgileri ve verileri ilgili kurum ve kuruluşlardan temin edilmiştir. İkinci aşamada, elde edilen bilgiler doğrultusunda, merkez ilçede riskli yapıların en fazla olduğu mahalle belirlenmiş ve mahalle hakkında bilgiler toplanmıştır. Üçüncü aşamada, mahallenin uydu görüntüleri ve CBS kullanılarak haritalama işlemi yapılmıştır. Çalışma sonucunda, riskli yapı sayısı en yüksek olan mahallenin Çalılıöz mahallesi olduğu görülmüştür. Kentsel dönüşüm sonrasında mahallenin yapı ve nüfus yoğunluğunun arttığı, bu durumun sosyal donatı yetersizliğine neden olduğu görülmüştür.

Anahtar kelimeler: Kentsel dönüşüm, Coğrafi bilgi sistemleri, Kırıkkale, Çalılıöz mahallesi, Mimarlık.

1. INTRODUCTION

Urban Transformation has been widely used in terms of planning in recent years. A distinctive feature of Turkish modernization is the adaptation of developments in the West to our country. This adaptation has increased considerably in our country since 1980. The most important example of this is the Habitat II meeting held in Istanbul. After this meeting, capacity development, governance, sustainability, etc. terms began to be used frequently (Terzi & Karaşahin, 2004).

The concept of urban transformation and its practices were introduced for the first time in the World during World War II. It was seen after World War II. These concepts and practices came to our country after 1980 (Yavuz, 2019).

After 1960, with the increase in industrialization in our country, there was migration from villages to cities (Çamurdan, 2020).After the 1960s, there was migration from villages to cities with the increase in industrialization in Turkey (Çamurdan, 2020). Developments in agriculture, increased industrialization, and decreased need for labor in rural areas have led to an increase in this need in urban centers.

As the branches of industry have increased, the need for employees has also increased. Accordingly, a sheltering problem occurred. The excessive population growth in the provinces has negatively affected the cities. Slums of poor quality and inadequate infrastructure have formed in the city center (Ministry of Environment and Urbanization, 2023). In short, unplanned urbanization and illegal construction have occurred. Over time, these slum neighborhoods were damaged and turned into areas that made the life of the users difficult. All these have made urban transformation important (Çamurdan, 2020).

Urban transformation is a concept that emerged to eliminate the loss of life and property of people. The ideal transformation should be an application that listens to the wishes of the people of the region, increases their social, cultural and economic levels, improves the infrastructure and superstructure areas, and includes healthy living areas (parks, playgrounds, parking lots, social facilities, etc.). In the transformations to be made, in addition to social and economic changes, vitality in dysfunctional areas, originality in the new texture of the city and improved infrastructure areas should be created. However, the meaning of the concept of urban transformation is much broader. It also includes the processes of renewing, providing new functions and revitalizing collapsed areas and historical regions in city centers (Tekeli, 2011). GIS is the most preferred method among today's technologies used to evaluate and analyze complex structures together. GIS is a computer-based system that maps and analyzes all existing and subsequent data on Earth. GIS combines common database operations such as querying, viewing, statistical analysis and maps. These features distinguish GIS from other systems (Goodchild et al., 2005).

In this study, it was goaled to investigate the Çalılıöz District, which underwent urban transformation between 2000 and 2023, using the Geographic Information Systems (GIS) method. For this purpose, mapping of the neighborhood was done using satellite images and GIS.

2. MATERIALS AND METHODS

Urban transformation is a term defined by different disciplines in their own fields. This concept is defined as rehabilitating structures that have been damaged over time and transforming them into newer and healthier ones (Erbulak, 2023). Many different definitions of urban transformation have been made in the literature.

According to Eyidiker (2021), urban transformation refers to the disfunctioning of the damaged, worn-out and harmful parts of the city and bringing them back to the city. Yılmaz (2019) defined urban transformation as solving the problems of the human-made built environment and rebuilding it from a new angle. In Article 73 of the Municipality Law No. 5393, improvement is defined as the creation of areas such as residential areas, industrial and commercial areas, public service areas, recreation areas within the borders of the Municipality, and the reconstruction and restoration of old sections.

Even before the emergence of the concept of urban transformation, cities have been rebuilt throughout the history of civilization. It has changed over time and taken on forms that represent the period it passed through. However, the word transformation has created a new term with the concept of city. A faster and faster 'spontaneous change' has emerged in living centers, beyond human control. On the other hand, it points out that human beings take a planned action

This "spontaneous change" that occurs in cities and brings people to the definition and action of urban transformation is partly degradation and partly differentiation. This degradation and differentiation is a result of cities' failure to adapt to changes in other areas of life, their failure to plan and predict. For this reason, urban transformation action is an action that will bring the pace of life, the transformation of the city and all planned works into a harmonious rhythm (Erbulak, 2023).

Urban transformation in the 20th century is examined under four headings.

- ➤ Modernism and urban transformation (1910-1940)
- ➤ Industrial development and urban rehabilitation (1940-1960)
- ➤ Post-modernism and urban revival (1960-1980):
- ➤ Post-Industrial Development and Urban Renaissance (1980-Present).

2.1. Urban Transformation Methods

Since urban transformation is affected by many factors such as time, place, location, population, building type, legal structure, urban transformation does not have a definitive format (Ifcioğlu, 2016; Şişman & Kibaroğlu, 2009). 9 different formats are used for urban transformation. These;

- ➤ *Renovation;* In cases where it is impossible to improve the living conditions of existing buildings, it is called rebuilding all or part of the buildings (Hui et al., 2018).
- ➤ *Improvement;* It means repairing and making valuable the existing structure and collapsed areas of the old city fabric (Keleş, 1998).
- ➤ *Protection;* It refers to the destruction of the physical structure of the society due to the transformation and developments, the integration of the urban texture with contemporary life and the rehabilitation of cultural values. (Yazar, 2006).
- ➤ *Animation;* It refers to the revitalization of the city, whose historical and cultural areas have been damaged physically, socially and economically, by eliminating the causes of destruction or by making physical, social and economic changes (Özden, 2008).
- ➤ *Redevelopment;* Reconstruction is defined as the demolition of houses whose economic and structural features are damaged. Redevelopment and the construction of urban parts with a new architectural design are not allowed (Lai et al., 2017).
- ➤ *Development;* These are projects implemented to develop the urban area within a certain plan or to prevent uncontrolled developments. Old houses are demolished and rebuilt according to the determined rules, depending on the initiative of the owners, legal regulations and the support of the state (Yazgan, 2021).
- ➤ *Urban clearing;* It means completely cleaning the collapsed area and building new structures in its place. A collapsed area becomes part of the city. The tissue disappears completely and a new tissue forms in its place. Land is often expropriated (Lai et al., 2018).
- ➤ *Gentrification;* The gentrification method emerges with the renewal of the built environment in city centers, the separation of the old inhabitants of the region, and the settlement of middle and upper class people in these areas (Es, 2012).
- ➤ *Infill Development;* It is the practice of creating a more valuable and rich environment by adding new buildings and social facilities next to existing buildings in certain parts of the city, without displacing the residents (Erbulak, 2023).

2.2. Geographic Information System (GIS)

GIS is defined in two ways: technical and theoretical. Technically; It is defined as the creation, processing and storage of geographical information (Longley et al., 2001). In theory; It is an approach that enables decision-making based on analyzes made on spatial data in order to get better results according to the analysis results (Almashharawi, 2021).

Geographic Information Systems are not defined only as a software system or a method of producing and processing data. It is defined as a set of methods in which the thematic data requested in line with different demands on the earth's crust in terms of environmental, social and economic aspects (Ekmen, 2019) are processed and analyzed, and thematic maps and visuals are prepared (Heywood et al., 2006; Kapluhan, 2014).

In terms of the role of GIS, it is clear that it has become an important dimension of modern information systems. It allows people to analyze problems by storing, organizing and managing spatial information and to produce solutions by researching, processing, synthesizing and presenting this information (Longley et al., 2005).

2.3. Geographic Information System Components

GIS, like any system consisting of parts, can be seen as a combination of several parts that make up the overall system (Tomaszewski, 2014). GIS consists of five basic components: hardware, software, people, methods and data (Dağhan, 2018).

Hardware; The computer system on which GIS runs is defined as hardware (Swalehe, 2016). Auxiliary products such as plotter, graphics processor, auxiliary memory, digitizer and scanner constitute the hardware (Bostancı, 2023). *Software;* It is defined as the GIS application itself (Almashharawi, 2021). Software is algorithms written with multi-relational and advanced programming languages used to produce, manage, process geographical data and information into the database, store, analyze, visualize and update spatial data (İnce, 2023). **People;** It is a set of systems consisting of field workers, database developers and managers, data processor experts and end users (Almashharawi, 2021). **Method;** A successful GIS operates according to a well-designed implementation plan and business rules, which are models and operating practices specific to each organization (Almashharawi, 2021). **Data;** The most important component of a GIS is data. The data is available in various formats in the form of digital maps, aerial photographs, space images, digital elevation models, and metadata (Almashharawi, 2021).

3. ANALYSIS OF ÇALILIÖZ DISTRICT
3.1. General Situation of Çalılıöz District

Çalılıöz neighborhood is the district with the highest population in the province, with Kırıkkale-Kırşehir highway on its left side and Atatürk Boulevard on its right side. Under this heading, brief information is given about the parks and green areas, health areas, education and training areas, and building floor status of Çalılıöz neighborhood. Figure 1 shows the satellite image of Çalılıöz neighborhood. In Table 1, the buildings in the neighborhood are evaluated on a provincial basis. According to the table, it was seen that most of the risky buildings were demolished. In addition, it was observed that 105 of the risky buildings were built with the masonry construction system.

Table 1. Evaluation of buildings on a provincial basis (Kırıkkale Municipality, 2023)

	Risky structure		Out of scope structure	Total	Construction system of risky structure		
	Destroyed structure	**Indestructible structure**			**Masonry**	**Wood/Adobe**	**Rein. concrete**
Kırıkkale	1324	39	1399	2762	664	604	114
Çalılıöz	191	7	193	391	105	74	19

Figure 1. Satellite view of Çalılıöz neighborhood

❖ *Park/Green Area Status of Çalılıöz Neighborhood*

There are currently 16 parks and green areas in Çalılıöz neighborhood. The largest of these parks is Adnan Menderes Park. It has been observed that the number of parks is sufficient for the current situation, but not at a level that can meet people's social needs.

❖ *Health Areas Status of Çalılıöz Neighborhood*

According to 2022 data; There is one health center (3 doctors) in the neighborhood with a population of 23,586. Since this number is not sufficient for the neighborhood, health institutions in the nearby Yaylacık and Ovacık neighborhoods are used. After the urban transformation practices carried out since 2012, the population of the neighborhood has increased, but progress has not been made in the field of health. On the contrary, it was determined that one health center was closed.

❖ *Educational Areas Status of Çalılıöz District*

The types and numbers of educational institutions in Çalılıöz neighborhood are given in Table 2. In the table, educational institutions are classified as high school, secondary school, primary school and pre-school. There is 1 high school, 3 secondary school and 4 primary school buildings in the neighborhood. As for pre-school education, there are 3 pre-kindergarden, 1 kindergarten is an independent building. Additionally, education is provided in 4 kindergarten classes within the primary school buildings. Based on the population of the neighborhood, it is seen that the number of educational institutions is insufficient (Kırıkkale Municipality, 2023).

Table 2. Types and numbers of educational institutions in the neighborhood

Educational Institution Type	Number (Piece)
High school	1
Middle school	3
Primary school	4
Pre-school	4+4 (Located in the primary school building)

❖ *Building-Floor Situation of Çalılıöz District*

It was observed that mostly consisted of single storey or ground + 1 floor of risky buildings in the neighborhood that the study area. After urban transformation, buildings were mostly planned as ground + 4 floors. Almost all single-storey buildings have been converted or are waiting to be transformed within the scope of urban transformation. Risky buildings are scatter within the borders of the neighborhood. Urban transformation was applied to risky buildings located on Atatürk Boulevard, Halide Edip and Nene Hatun Streets in Çalılıöz neighborhood. These structures contributed positively to the aesthetic structure of the street. The majority of risky buildings are located on side streets such as 433rd Street, 360th Street, 429th Street. Figure 4.6 shows building images before and after urban transformation.

Before   After

Before   After

Before   After

Figure 2. Images before and after urban transformation

3.2. Zoning Status of Çalılıöz District

There are 424 buildings in Çalılıöz District. 198 of these buildings are in risky building (residence) status. Demolition was carried out on 191 houses in the neighborhood. Apart from the demolished houses, 7 residential buildings are awaiting demolition in the neighborhood. There are 193 residences that are not included in the scope of urban transformation. Additionally, there are a total of 1635 independent units (flats) in 391 buildings.

Types and numbers of structures are given in Table 2. When the Table 2 is examined, there are 391 residences, 13 educational institutions, 9 mosques, 5 gas stations, 5 official institutions and 2 health facilities in the neighborhood. It has been observed that urban transformation application is applied only to residences. It is seen that 49.1% of the neighborhood has been transformed, with a total of 391 houses in the neighborhood and 192 of these houses being demolished (Kırıkkale Municipality, 2023).

Table 2. Building types and numbers in Çalılıöz neighborhood

Building Type	Number (Piece)
Housing	391
Place of Worship (Mosque)	9
Educational Institution	13
Official institutions	5
Health Facility	1
Gas station	5

The zoning plan of Çalılıöz District is given in Figure 3. The development plan includes police headquarters, which are official institutions with a large usage area, parks and gardens. Since a mass urban transformation project has not been implemented in the city, a transformation project that will cover the entire neighborhood has not been prepared. Building owners who apply for urban transformation transform their buildings that have lost their usable functions within the scope of urban transformation through contractors. As a result of the interviews, the inherited buildings were applied to urban transformation by contractors in exchange for flats.
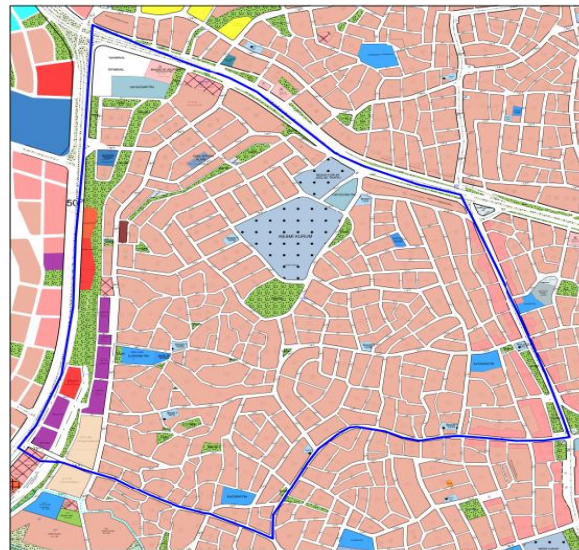

Figure 3. Çalılıöz neighborhood development plan (Kırıkkale Municipality, 2023)

The buildings included in the scope of urban transformation are located on the narrow streets of the neighborhood. Instead of old buildings with a maximum of 2 floors, buildings with 4 or more floors are built. This situation causes density in a narrow area. Therefore, it is thought that the population density increases in parallel with the building density of the neighborhood, social facilities such as education, health and culture are insufficient, and there will be serious infrastructure problems.

3.3. Satellite Images of Çalılıöz District by Year

Satellite images for 2023 and previous years are taken using the remote sensing method of GIS. There are no satellite images of Kırıkkale, which was granted provincial status in 1989, from that year. In the previous year, 1985, it was seen that there was not a single building belonging to the neighborhood. In the previous year, 1985, it was seen that there was not a single building belonging to the neighborhood. Images can be taken in the Google Earth program used in the study as of 2002. Therefore, images of 2002, 2010, 2020 and 2023 were taken and interpreted. 2002 satellite images of Çalılıöz neighborhood are given in Figure 4, 2010 satellite images are given in Figure 5, 2020 satellite images are given in Figure 6 and 2023 satellite images are given in Figure 7.

According to the 2002 view; It was observed that the building density increased towards the intersection of Atatürk Boulevard and Nene Hatun Street. The region facing the Kırıkkale-Kırşehir D765 highway (left part of the neighborhood) is the region with low building density. Since the urban transformation law came into force in 2012, it is not possible to mention this concept in the 2002 images.

Figure 4. Satellite images of Çalılıöz neighborhood in 2002

When the 2010 image is examined; there are no major visible changes in the neighborhood between 2002 and 2010. While the population of Kırıkkale province was 286,999 in 2002, it was 280,834 in 2010. The decrease in the population of the city supports the lack of change.

Figure 5. Satellite images of Çalılıöz neighborhood in 2010

When 2020 images are examined; It can be seen that new houses have been added in the upper part of the neighborhood (the purple marked area). In this year, where urban transformation applies continued, most of the risky buildings were demolished and rebuilt. It is seen that the area where risky buildings (yellow marked area) are the densest region of the neighborhood. It is seen that there is an increase in building density in the left part of the neighborhood (the area marked in green) compared to other years.
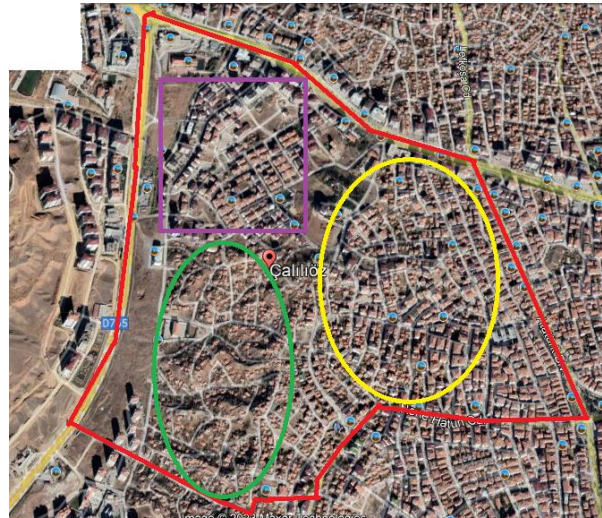

Figure 6. Satellite images of Çalılıöz neighborhood in 2020

When the 2023 image is examined; it was observed that the building density increased throughout the neighborhood. The region called the upper part of the neighborhood (the region in the purple area) is a region close to the key point connecting the West to the Black Sea, the East and the South. For this reason, people concentrated on this region. Another reason is that this area, located in the northwest of the city, is handy to the university and High Specialization hospital. In the region (marked in yellow) between Atatürk Boulevard and Nene Hatun Street, where risky areas and urban transformation applies is mostly, according to the previous year, It has been observed that small-sized structures have transformed into large-sized structures. This supports the fact that single-storey buildings collapse and turn into big buildings. It has been observed that the building density in the area fronting the Kırıkkale-Kırşehir highway (marked green) has not changed much, but the green areas have increased. In the research

conducted in the area, it was determined that there are many buildings that are not included in the scope of urban transformation but that we call abandoned.

Figure 7. Satellite images of Çalılıöz neighborhood in 2023

3.4. Ownership Status and Risky Building Map of Çalılıöz District

The ownership status of Çalılıöz neighborhood and the status map where risky buildings are marked in red are given in Figure 8. According to the map; It is seen that risky buildings are concentrated in the area close to Atatürk Boulevard, one of the main arteries of the city. On Samsun Boulevard, another main artery, there are buildings that applied to urban transformation. On Nene Hatun Street, which separates Çalılıöz neighborhood from Yaylacık neighborhood, there are buildings that have been classified as risky buildings and have applied urban transformation. Although there are buildings undergoing urban transformation on the arteries, it is seen that the density of risky buildings is higher in the inner regions. In the on-site investigations, it was seen that the number of floors of the urban transformations carried out on the arteries was at least ground + 4. It has been observed that unification has been made on some of the parcels where the buildings included in the scope of urban transformation are located. It was determined that these parcels were enlarged by assigning a new parcel number.
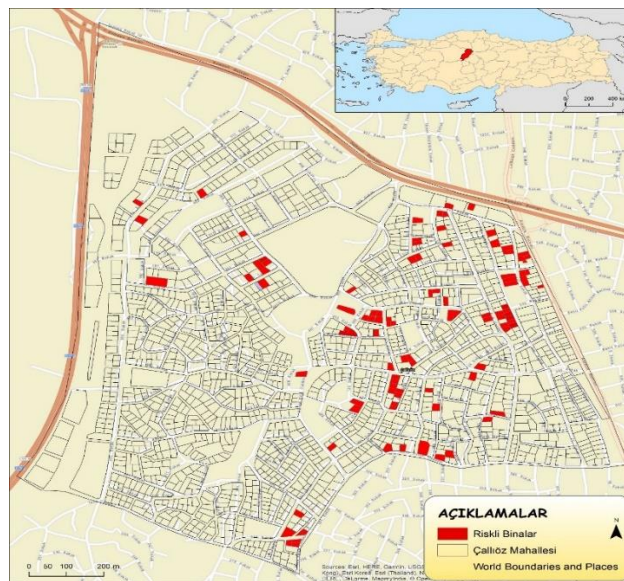

Figure 8. Risky building map of Çalılıöz neighborhood

4. CONCLUSIONS

In the study, urban transformation applications in the Çalılıöz neighborhood located in Kırıkkale city center were analyzed using the GIS method. The results obtained and recommendations to be made are listed below.

- 198 of the 391 houses in the neighborhood are risky buildings. 191 of these risky buildings were demolished and rebuilt within the scope of urban transformation. While 7 buildings are awaiting demolition, 193 buildings are excluded from this scope.
- 105 of the 198 risky buildings in the neighborhood were built using masonry (16%), 74 were built using wood/adobe (19%), and 19 were built using reinforced concrete system (17%).
- As a result of the urban transformation applies implemented since 2012, the neighborhood has been freed from its old and worn-out appearance and has gained a more modern and more aesthetic face.
- Urban transformation applies in the neighborhood were carried out on a plot basis, not on a regional or parcel basis. Almost all buildings were built by contractors using the demolish-and-build method on site.
- Risky buildings consisting of single storey or ground + 2 floors were demolished and replaced with buildings consisting of at least ground + 3 floors.
- The high number of floors of the buildings built within the scope of urban transformation has caused the population of the neighborhood to increase. With the increase in the population of the neighborhood, social and cultural facilities have become inadequate.
- There have been inadequacies in many areas, especially in infrastructure, to meet the needs of the increasing population in the neighborhood.
- After urban transformation, a sustainable neighborhood model has not been formed because many needs of the neighborhood such as social, cultural, technical, education, health and parking have not been fully met.
- A database was created on GIS in line with the data received from the provincial directorate of environment and urbanization and the municipality. It has been observed that this system, in which qualitative and geographical data are stored, analyzed and mapped, facilitates the analysis and mapping processes.
- It has been observed that there are many buildings in the neighborhood that are not included in the scope of urban transformation but can be described as abandoned.
- In Çalılıöz District, which has the largest population, it has been observed that the number of institutions that can provide health services after urban transformation is insufficient.
- It has been determined that the neighborhood has insufficient number of educational institutions, especially high schools and equivalent schools.

AUTHOR CONTRIBUTIONS

CONFLICT OF INTEREST STATEMENT
The authors declare no conflict of interest.

ETHICS COMMITTEE APPROVAL
This study does not require any ethics committee approval.

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