Araştırma Makalesi / Research Article ESTU R 8(2), 2024, sy(161-183) DOI: 00.12345/resilience.1557650

RESILIENCE
e-ISSN: 2602-4667

Eskişehir Teknik Üniversitesi
Resilience
https://dergipark.org.tr/tr/pub/resilience

Geographical Analysis of the Urban Reconstruction Process After the Earthquake in Elazığ
Elazığ'da Deprem Sonrası Kentsel Formun Yeniden İnşaa Sürecinin Coğrafi Analizi

Aşır Yüksel KAYA [1]*

ORCİD 0000-0003-0398-7069

[1] *Fırat Üniversitesi, Insan Ve Toplum Bilimleri Fakültesi, Beşeri Ve İktisadi Coğrafya Bölümü, Elazığ, Türkiye*

Öne Çıkanlar / Highlights

▪ Afetlerin Elazığ'ın kentleşmesi üzerindeki etkisinin sorgulanması.	▪ Questioning the effect of disasters on the urbanization of Elazığ.
▪ Elazığ'da Kentsel Dirençliliğin Değerlendirilmesi.	▪ Assessment of Urban Resilience in Elazığ.
▪ 2020 ve 2023 Deprem Dizisinin Kapsamlı Sonuçları.	▪ Comprehensive Outcomes of the 2020 and 2023.
▪ Depremlerin Sosyal, Ekonomik ve Fiziksel Yapılar Üzerindeki Etkileri.	▪ Effects of Earthquakes on Social, Economic, and Physical Structures.

Makale Bilgisi / *Article Info*

Gönderim / Received: 28/09/2024
Kabul / Accepted: 27/12/2024

Anahtar Kelimeler

Dirençlilik
Depremler
Binaların yeniden inşası
Kentsel Dönüşüm

Keywords

Resilience
Earthquakes
Building reconstruction
Urban Transformation

Özet

Şehirler, birçok insanı etkileyen ani olayların ortaya çıkabildiği, sosyo-kültürel ve ekonomik bağlamda oluşmuş yerleşim yerleridir. Kentleşme oranındaki artış, kaynakların aşırı tüketimi, yetersiz altyapı, düzensiz planlama ve verimsiz hizmetlerin neden olduğu çevresel etkiler, kentleri afetlere karşı savunmasız hale getirmektedir. Şehirleri geleceğe hazırlamak ve olası risklere karşı önlem almak için dirençlilik önemli bir kavram haline gelmiştir. Kentsel dirençlilik, kentlerin sosyal, ekonomik ve fiziksel altyapı sistemlerinin bir afet ya da felaketten en az zararla kurtulmasını sağlayan bir yaklaşımdır. Böylelikle kentsel yerleşimler sürdürülebilir ve daha güvenli yerler haline gelebilir. Bu çalışmanın amacı, Elazığ'da meydana gelen depremler sonrasında kentsel formun yeniden yapılandırılması ve kentsel dirençlilik süreçlerini incelemektir. 2020 ve 2023 yıllarında meydana gelen depremlerin ardından Elazığ, fiziksel, sosyal ve ekonomik yapısında ciddi tahribat yaşamıştır. Bu bağlamda, çalışma, Elazığ'ın kentleşme sürecinde kentsel dirençliliğin artırılması için mekânsal planlamanın ve afet risk azaltma stratejilerinin önemine vurgu yapmaktadır. İlk olarak Elazığ'ın tarihsel gelişimi ve kentsel form değişiklikleri incelenmiş, ardından bu değişimlere sebep olan doğal ve beşerî süreçler değerlendirilmiş ve şehrin dirençlilik durumu ortaya konulmuştur.

Abstract

Cities are settlements formed within socio-cultural and economic contexts, where sudden events affecting large populations can occur. The increasing rate of urbanization, excessive consumption of resources, inadequate infrastructure, unplanned development, and inefficient services make cities vulnerable to disasters. Resilience has become a crucial concept for preparing cities for the future and mitigating potential risks. Urban resilience refers to an approach that enables the social, communal, economic, and physical infrastructure systems of cities to recover from disasters or catastrophes with minimal damage. Through this, urban

*Corresponding author, e-mail: aykaya@firat.edu.tr

settlements can become more sustainable and safer places. This study aims to examine the reconstruction of urban form and the processes of urban resilience following the earthquakes in Elazığ. The earthquakes of 2020 and 2023 caused significant damage to the physical, social, and economic structures of Elazığ. In this context, the study highlights the importance of spatial planning and disaster risk reduction strategies in enhancing urban resilience within the urbanization process of Elazığ. First, the historical development and changes in the urban form of Elazığ are analyzed. Subsequently, the natural and human-induced processes that caused these changes are evaluated to assess the city's resilience status.

1. INTRODUCTION

Cities are settlements formed within a socio-cultural and economic context, where sudden events affecting large populations can occur (Türkoğlu & Elmastaş, 2022). Environmental impacts resulting from the increase in urbanisation, excessive consumption of resources, inadequate infrastructure, irregular planning, and inefficient services make cities increasingly vulnerable to disasters (Büyüközkan et al., 2022). Historically, urbanisation progressed slowly. Before the 1600s, merely 5% of the world's population resided in urban areas. This figure rose to 7% by the 1800s and 16% by the 1900s (Ritchie et al., 2024). However, with the onset of the 20th century, urbanisation trends reached their peak. According to the UNPD (2024), 55% of the world's population currently resides in cities, while 45% lives in rural areas. This ratio is expected to shift further in favor of urban areas in the coming years. By 2050, projections suggest that 68% of the world's population will reside in urban areas (UNPD, 2024). While cities are growing rapidly on the one hand, on the other hand, especially in developing countries, they have become places that are unplanned, lack adequate transport and infrastructure, urban services are not developed in a sufficiently inclusive manner throughout the city, crowded, and vulnerable to disasters and other risks (Tuğaç, 2019).

Natural and man-made disasters affect urban settlements at different rates. Especially cities undergoing rapid urbanisation processes are caught unprepared against disasters. Rapid population growth, excessive urban growth, inadequate infrastructure and superstructure and insufficiency of urban functions reduce the resilience of cities against disasters. The preparedness of cities for disasters and their adaptation capacity show their resilience. Urban resilience is the preparedness of the city against all natural, human, sudden or slow, expected or unexpected hazards. Resilience refers to the capacity of a system, community, or society exposed to risks to endure, assimilate, adjust to, transform, and recover from the impacts of the hazard in a timely and efficient way, encompassing the safeguarding and restoration of its essential structures and the management of risks (Figueiredo et al., 2018; Wannous & Velasquez, 2017).

The concept of resilience initially arose as a way to describe how ecological systems address the risks they encounter and adapt to the consequences of changes (Holling, 1973). The concept has since been applied across various disciplines, such as engineering, natural sciences, social sciences, information technology, and disaster science (Koliou et al., 2020; Sajjad et al., 2021). The scope and applications of resilience vary according to the area where it is used. Resilience is the capacity of a system to react to unforeseen events, risks, and changes in a manner that prevents or reduces their impacts (Büyüközkan et al., 2022). Urban resilience is a system that can take measures against possible disasters that cities may encounter and make the socio-economic structure of the city resistant to disasters. This resilience is defined as preparing the city for risks before and after disasters, managing them and reorganising urban life (Berkes & Ross, 2013; Yoon et al., 2016).

Resilience has become an important concept to prepare cities and take precautions against possible future risks. Urban resilience is a practice that will enable the social, social, economic and physical infrastructure systems of cities to survive a disaster or catastrophe with minimum damage. In this way, urban settlements can become sustainable and safer places. However, by its very nature, resilience can be observed and characterized after a disaster, which makes it difficult to measure and therefore analyze before a disaster occurs. In this context, it has become important for politicians, urban and regional planners, urban regeneration experts, geographers, and other researchers to prepare cities, which are the

most significant population hubs, for disasters and to organize and implement post-disaster decisions effectively. However, the main challenge in creating the organization scheme of urban resilience is how to best predict the spatial and temporal conditions of the disaster (Sajjad et al., 2020). In this context, factors such as different population density in rural and urban areas, land use, etc. limit the administrative organisations.

The most damaging disasters that cities encounter today are natural events like earthquakes, floods, landslides, wildfires, climate change, as well as epidemics such as COVID-19. Existing large cities are less resilient to disasters as they are unable to organise well the basic form and function characteristics inherited from the plans made 70-80 years ago and the growing uncertainties and changing needs of today (Gerçek, 2021). In addition, factors such as excessive urban growth, maximization of carbon emissions and improper land use also increase this vulnerability. One of the key strategies to enhance the resilience of existing cities is to implement preventive measures before a disaster occurs. A resilient city is a structure that can change itself by resisting the stress arising from the negative effects of social, economic and environmental problems and can construct itself according to the new situation, which can generally be defined as a smart city. Therefore, a smart and resilient city is the result of contemporary and resilient planning of urban settlements to manage urban changes (Lfarakh, 2021). OECD has explained urban resilience through four important components: social, economic, managerial and environmental (Figueiredo et al., 2018) (Figure 1).

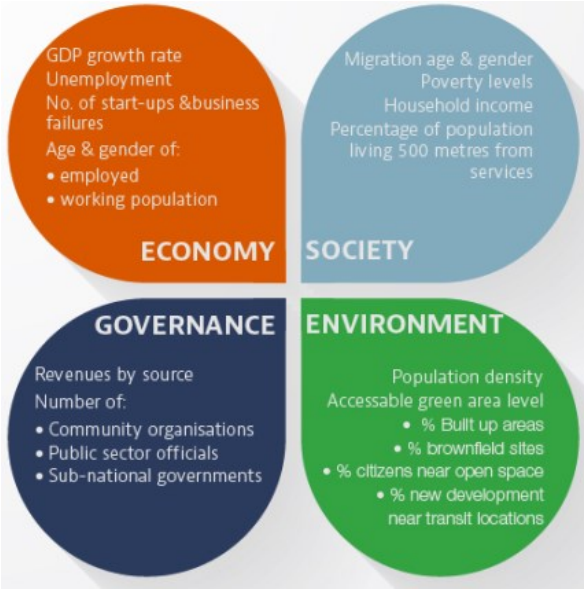

Figure 1. Measuring resilience. (Figueiredo et al., 2018)

The OECD approach evaluates the core economic, social, environmental, and institutional dimensions of urban resilience collectively and in relation to one another. The basic logic here is that isolated policies that are not associated with each other will prevent the correct determination of measures against risks and will prevent the achievement of urban resilience(Tuğaç, 2019). In other words, resilient cities are settlements that show social, spatial, institutional and economic integrity in terms of sustainability.

Türkiye's geography has a high disaster risk potential due to natural hazards such as earthquakes, floods, landslides, and demographic pressures like overpopulation. Recent earthquakes reveal the importance of spatial planning and risk mitigation action plans. A spatial planning approach that includes urban risk assessment studies for predetermining the hazards that constitute risks and determining the level of vulnerability can reduce the negative social and economic impacts of possible disasters (Türkoğlu, 2014). Therefore, it is critically important to engage in proactive planning to mitigate disaster risks in cities. Resilience of a city to disasters is related to the capacity of urban individuals, institutions, urban functions to survive, adapt and develop against all kinds of disasters regardless of their source.

In this study, which has experienced such great disasters, a history and geography based urban morphology approach has been adopted to define how the city has reacted to many of these disruptions, with a special emphasis on the experiences of Elazig from 1923 to the present. In this study, in order to make an urban and morphological settlement history analysis, a number of interdisciplinary literature, especially history and geography studies (Tezer & Özgür, 2018), were brought together to have an overview of the facts, and a critical analysis of the processes was made, focusing on the processes of exposure to disasters over several generations. Thus, the changes caused by the disasters affecting the city since the formation of the first urbanization core of Elazig to the urban physical space, macroform and area size, administrative structure, transportation infrastructure, population size and structure, economic, social and cultural structure have been explained. At the same time, how these changes affected urban resilience was discussed from a critical standpoint.

1.1. Study Area

In this study, we are talking about the reconstruction process of Elazig -one of the youngest cities of Türkiye-, after natural disasters (Figure 2). Throughout history, the city and its inhabitants have been transformed by many periods of disruption, transition, and recovery. Elazig is a city which was established on a plateau surrounded by fertile agricultural plains which are 5 km away from the city itself. The city is the surviving continuation to the historic city of Harput. Harput, one of the oldest settlements in Anatolia, has served as a home to numerous civilizations throughout history (Akdemir, 2013; Karakaş, 1999).

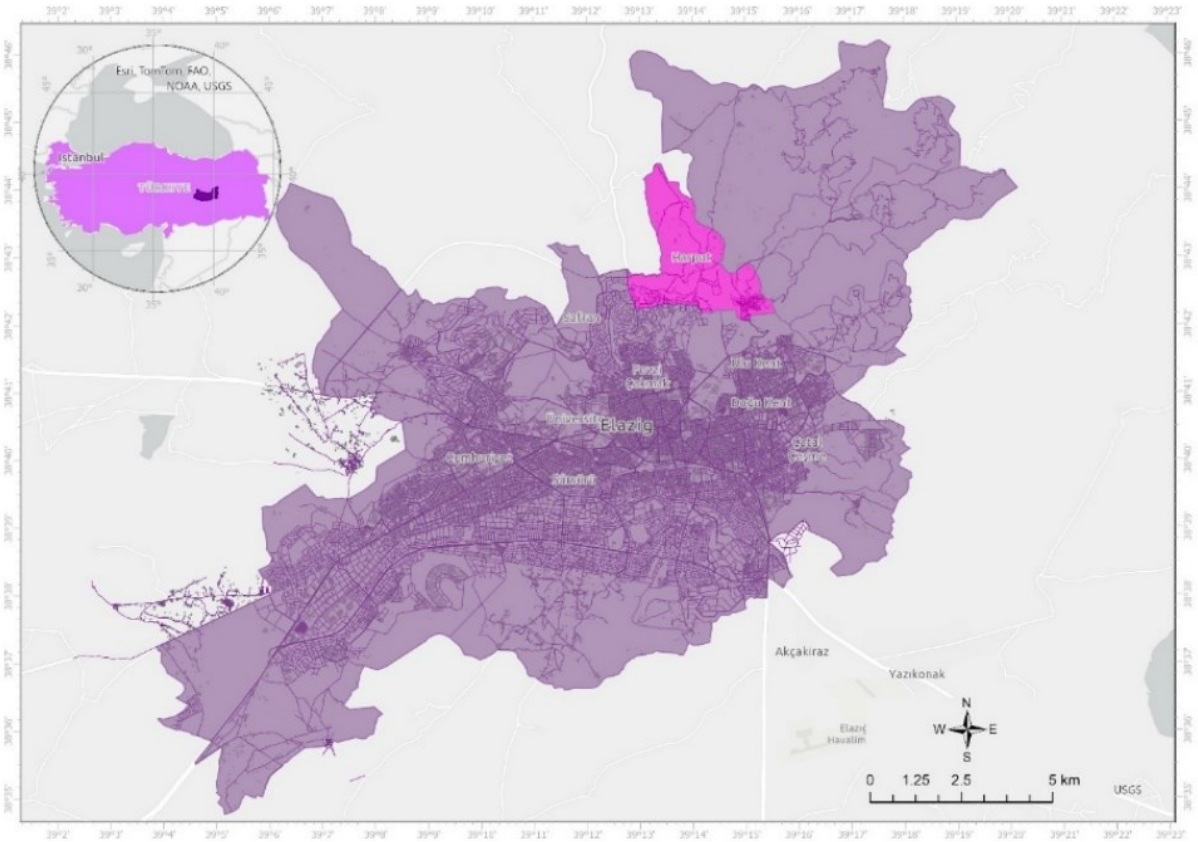

Figure 2. *Study Area Location Map*

Until the twentieth century, Elazig was a rural neighborhood of Harput. Its current population is 443,448. However, exactly a century ago, the opposite was the case. In particular, the excess of topographically habitable areas, the developments in transportation and communication lines and the political, social and economic developments experienced throughout the country have accelerated the urbanization process.

2. METHOD

In studies on disaster resilience 62% of the publications are conceptual, 12% are literature reviews and 26% are analytical studies(Büyüközkan et al., 2022; Ribeiro & Pena Jardim Gonçalves, 2019; Sharifi, 2020; Witt & Lill, 2018). In these studies, the methods to be used in the measurement and evaluation of resilience are divided into two categories as qualitative and quantitative (Yüksel & Karaçor, 2021) (Figure 3).

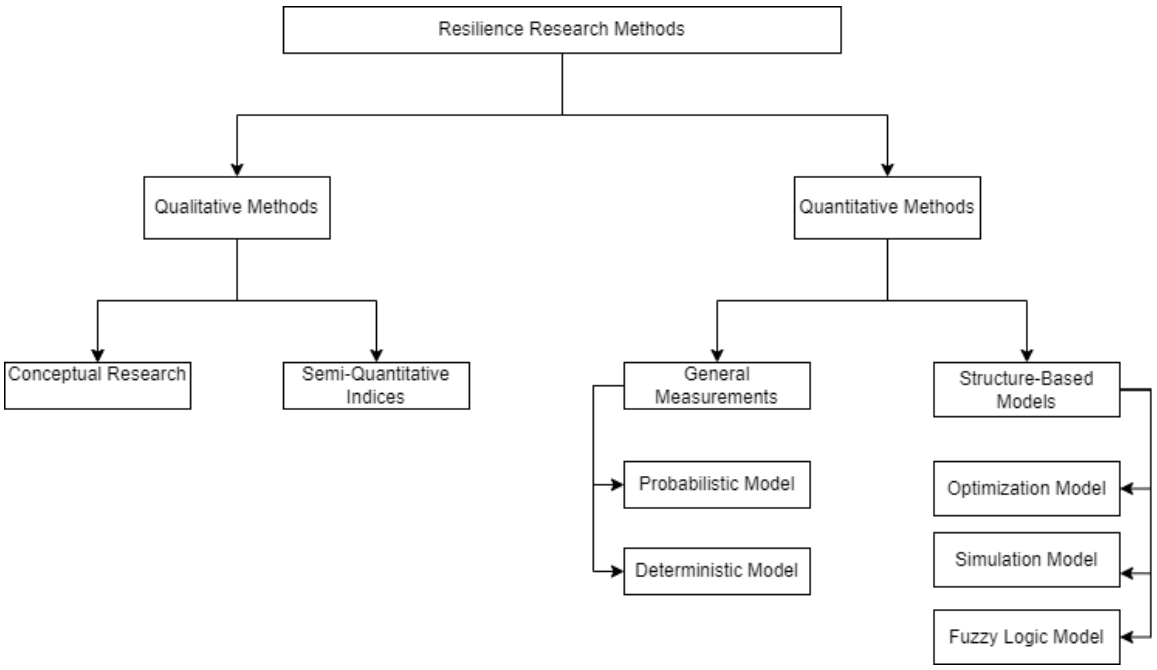

***Figure 3**. Urban Resilience Research Methods*

Qualitative and quantitative methods differ according to the location and the subject to be focused on. However, a model is required to construct the relationship between vulnerability and resilience in urban scale studies. Cutter et al. (2008) emphasizes that it is difficult to measure resilience in absolute terms, so indicators should be used to determine a comparative approach and ranking. This helps to identify the key elements of the targeted system or unit of analysis, make a comparison, identify weak and strong points, and make it easier to know how to make plans to improve the system and where to direct funds (Cimellaro, 2016). In this context, the method to be followed in the research was "Top-down approach" and "Semi-Qualitative Indexes" were used to analyses the city, neighborhood and building scales. Within the framework of the top-down approach, the analysis of urban resilience starts with an emphasis on the evolution of the city through its historical development journey. Subsequently, the natural and human factors influencing changes in the urban form are assessed.

3. THE RESEARCH FINDINGS AND DISCUSSION

3.1. Historical evolution: History of Elazig and the Turkish context

The socio-cultural history of Elazig is important to understand its urbanization process. Because the city, which is considered as Elazig today, was established as a continuation of the old city of Harput. Harput was a city located in the east of Anatolia, at the intersection of important roads connecting many regions(Kopar, 2007). This historical city, which was approximately 1450-1500 meters above sea level, was surrounded by important water resources such as the Euphrates and Murat rivers, as well as fertile plains (Şengün, 2012). Geographically, it is integrated with some trade routes in Northern and Central Anatolia and Northern Mesopotamia, the Caucasus, Syria and Iran due to its location connecting cities

in the south, north, east and west directions. Owing to these characteristics, the city has been a significant settlement center since ancient times and has served as a host to numerous civilizations (Uzun & Çakar, 2016). Since 1085, it has been developed and organized as an administrative center (Kopar, 2007). However, factors such as the loss of the importance of Harput as a fortress city, the lack of space for spatial development, and the difficulty of transportation caused it to be moved to the area where today's city of Elazig is located (Akdemir, 2013; Erinç, 1953; Hayli, 1998; Karakaş, 1999; Sarıbeyoğlu, 1951; Sergün, 1975).

The historical city of Harput began to lose its importance after the 1900s, while Elazig began to grow socially, economically and physically. Up to the first quarter of the 20th century, Harput was the dominant city. However, with the proclamation of the Turkish Republic in 1923, the concept of central governance shifted, marking the official end of the Ottoman Empire and the establishment of the Republic of Türkiye. With the establishment of the Republic, Elazığ officially became the city center. However, the new Republic, founded after the collapse of the deeply rooted Ottoman Empire, faced numerous challenges, particularly in social, economic, educational, and healthcare sectors, which constrained the development of cities. Additionally, during the first half of the twentieth century, Türkiye, despite maintaining neutrality in World War II, was still impacted by globally significant events. (Ersoy, 2013). During this period, the newly established Republic adopted a policy of distributing the population more evenly throughout the country by creating new development centers in Anatolia. As a result of these policies, state supported investments have increased in Elazig. In the early stages of Elazig's development as a young Anatolian city, state investments accelerated its urbanization process. The increase in infrastructure, industry and state investments in the city has caused intense migration from rural areas. After 1956, the widespread use of electricity, the establishment of cement, sugar and yarn factories, the development of road infrastructure throughout the country, the Keban dam, which is Türkiye's first major investment in the field of energy, and the establishment of the hydroelectric power plant, led to the acceleration of the city's urbanization (Akdemir, 2013; Karakaş, 1999). All these investments have created new fields of work, and therefore caused the population to increase exponentially. In addition, the flooding of many rural settlements due to the construction of the Keban dam caused many settlements to become uninhabitable and the population once living in those areas were introduced into the city with state resources. During the latter half of the twentieth century, Elazig, a medium-sized Anatolian settlement, began to form a distinct identity and a distinctive urban character.

After World War II, the state implemented policies aimed at promoting the entire national territory to achieve balanced economic growth (Brenner, 2004). However, by the late 1970s, the state's development strategy shifted focus to the urban level (Yıldırım, 2021). Türkiye has adopted a similar policy and has implemented an economic development model that embraces balanced development between regions at the spatial level (Ersoy, 2013). These policies, the increasing oil prices on a global scale in the 1970s, the decline in the profit rates of multinational companies, the economic embargoes imposed by the United States and European countries due to the 1974 Cyprus peace operation, the political debates within the country (right-left conflict) and the social, economic and cultural instability that followed, has prepared a suitable ground for the formation of marginal groups, terrorist organizations and their actions (Şahinalp & Günal, 2016). This situation has pushed the rural population in Eastern Anatolia and Southeastern Anatolia, where different ethnic groups live together, to migrate to other locations (Karakaş, 1999). During this period, Elazig was subjected to an intense migration due to the terror incidents taking place in the surrounding provinces. In fact, despite the political and economic stagnation across the country, the growing urban population brought with it a rapid urbanization, and sadly, urban resources could not meet the demands of the new inhabitants of the city. Thus, the housing problem, which is one of the most fundamental problems in cities, has emerged. The inadequacy of the economic resources of the newly introduced population into the city and the lack of a plan and project to solve this problem by the state, created the slums within the city. Slums can be defined as houses built in a hurry on vacant lands belonging to third parties or state-owned lands, in violation of zoning regulations. This problem has become commonplace in almost every city throughout the country, especially in big cities such as Istanbul, Ankara, Adana and Izmir, but also in other cities in Anatolia. Since the 1980s, with

neoliberal policies, the state has systematically intervened in slum areas and provided incentives for the commercialization of these areas (Yıldırım, 2021). During this period, new neighborhoods were added to the urban pattern of Elazig. After the 1980s, the urbanization process continued with the new housing projects for the increasing population, the transformation of slum areas, mass housing constructions and post-disaster construction processes. As a result, Elazig, the new city of the new Republic, which was established with the collapse of the Ottoman Empire, has developed as a city affected by global developments with its socio-cultural and economic structure, not particularly as the continuation of Harput of the past.

3.2. Understanding Elazig in the Earthquake Disaster Context

Disaster risk is a significant threat for dense urban areas, as recent events have shown (Hochrainer & Mechler, 2011). Despite the abundance of scientific knowledge on the causes and effects of hazards triggered by natural disasters and the significant advancements in technical methodologies to mitigate their impacts, disasters continue to have devastating consequences, particularly in developing countries. (Sengezer & Koç, 2005). Disasters occurring in medium-sized cities of developing countries such as Türkiye have caused social, economic and environmental damages. Elazig, a medium-sized city in Anatolia, has been shaken by earthquakes with severe and ongoing effects on its social, economic, built and natural environments. There are three important fault zones in Türkiye. These fault zones are the North Anatolian Fault, the Aegean Region faults and the Eastern Anatolian fault. The Eastern Anatolian Fault is about 550 km long (Figure 4). There are a large number of settlements along this fault. Many earthquakes have occurred on the East Anatolian fault line since 1900 (Figure 5). Settlements located over the fault line have been identified as the areas with the highest earthquake hazard (AFAD, 2023).

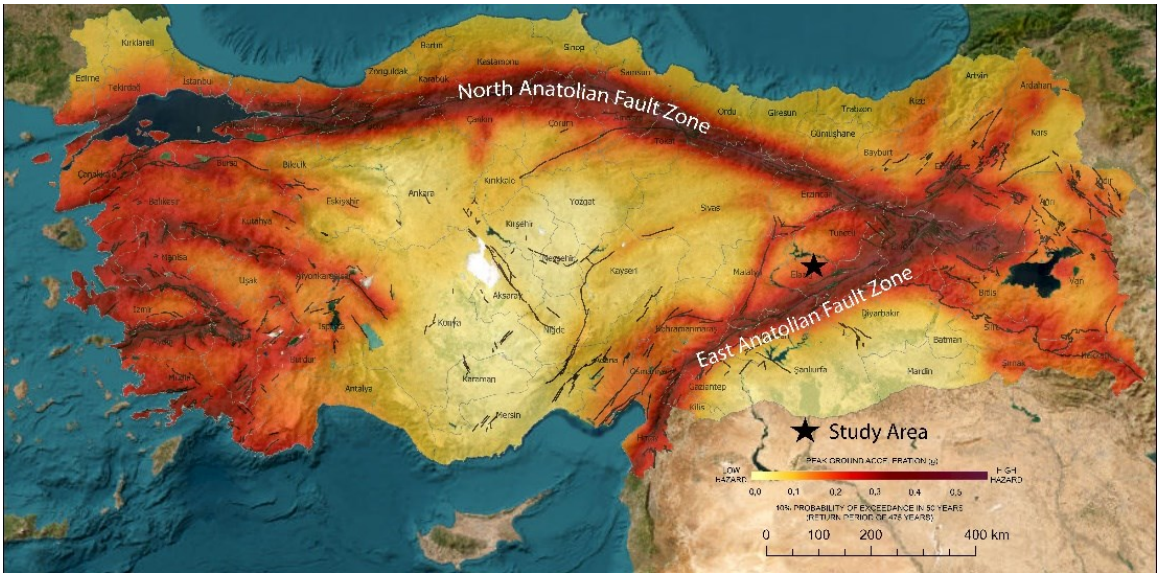

Figure 4: *The location of the study area on Türkiye's earthquake hazard map (AFAD, 2023)*

Elazig, which is located on a 1st degree earthquake hazard area, was shaken by many major earthquakes in its history, and thus, the rural settlements near the city had to be relocated many times as well (Köküm & Özçelik, 2019; Sunkar, 2018). There have been many earthquakes which were felt by Elazig residents and even caused various casualties. These earthquakes have had significant social, economic, and environmental impacts on the city and its residents, affecting them from the past to the present. Especially in the last 20 years, earthquakes in Sivrice have caused structural damage in various rural settlements and in the city center of Elazig (Figure 5) (Sahin et al., 2020).

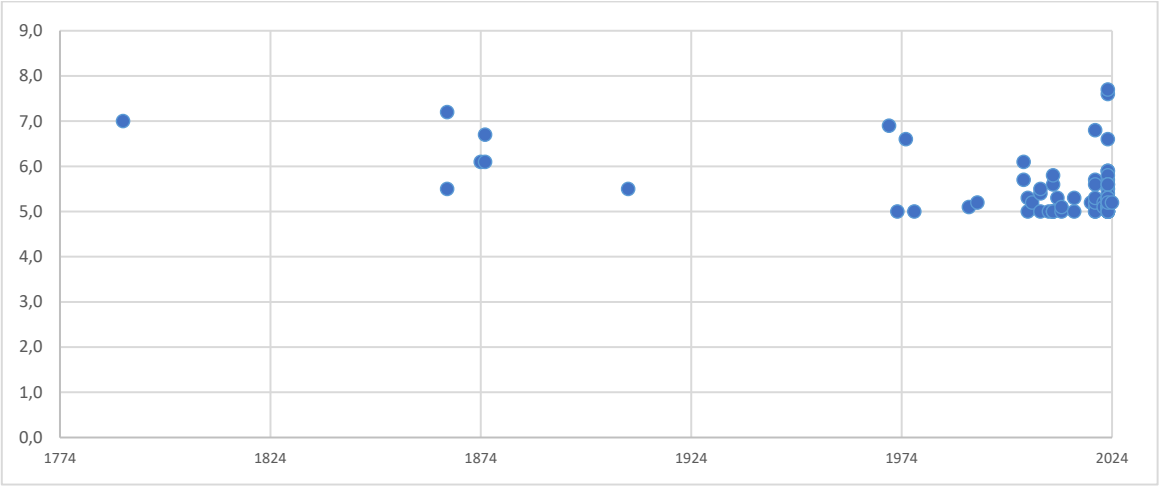

Figure 5: *Distribution of Earthquakes of 5 Mw and above in Elazig*

The urban building stock, which was damaged in the 2007 Sivrice earthquake, was heavily affected on January 24, 2020. In fact, 30% of the buildings damaged in the city of Elazığ during the 2007 earthquake were multi-story and masonry structures (Sahin et al., 2020). Of these structures, the heavily damaged ones were demolished in a slightly controlled manner. However, during this process, especially in the damaged buildings, the necessary arrangements were not made, and these buildings were allowed to be used, although it was known that they would potentially collapse in future earthquakes. Such negligence reveals an inadequacy in the city's disaster management. It is known that most of the buildings that were destroyed or damaged in the earthquake on January 24 were structurally vulnerable, 2020, received prior damages in previous earthquakes and continued to be used without making the necessary arrangements. Dilek apartment building (Figure 4), which was destroyed in the January 24 earthquake, went through a similar fate and collapsed in the last earthquake, causing 14 people to lose their lives. In the research carried out after the earthquake, it was revealed that the building was heavily damaged in 2007, but it was not demolished and continued to be used with minor repairs URL 1 (Saymaz, 2020).

Figure 6: *14 people died in Dilek apartment building. Source URL 1.*

The earthquake of January 24, 2020 was an important turning point for Elazig. The earthquake caused significant damage to numerous structures in the city. After the primary damage observations after the earthquake by the Ministry of Environment and Urbanization MOE (2020), the type of damage of buildings by neighborhoods with rapid scanning Figure 7 it is given in. Following the rapid assessment, it was reported that 230 buildings in the city were destroyed, 9,070 buildings sustained slight damage, 1,278 buildings were moderately damaged, and 2,019 buildings suffered severe damage. (Şikoğlu & Güney, 2020) (Figure 7). After the 2020 earthquake, the buildings that received minor damage continue to be used with minor repairs. Heavily damaged buildings have been evacuated and made ready for demolition. After the inspections, moderately damaged buildings were allowed to be used, if reinforcement works were carried out.

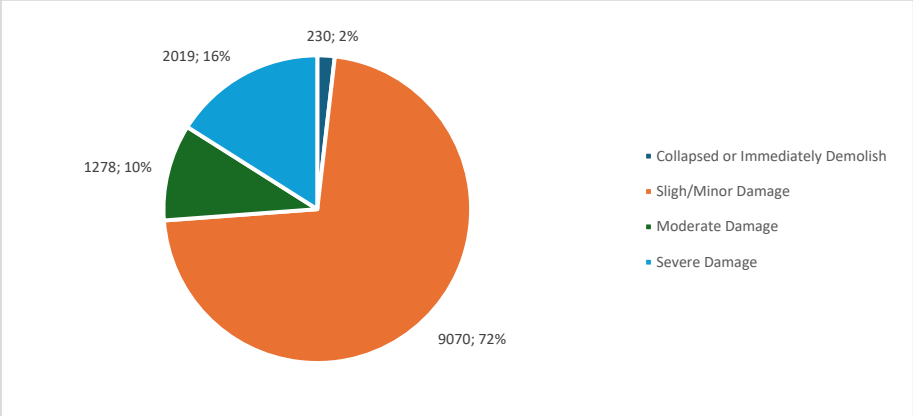

Figure 7: *January 24, 2020 Earthquake damage status (Şikoğlu & Güney, 2020)*

While the post-earthquake reconstruction process continued, two major earthquakes with magnitudes of Mw7.7 (depth = 8.6km) and Mw7.6 (depth = 7km) occurred on February 06, 2024, at 04:17 Türkiye time and again at 13:24 on the same day, with the epicenters being Pazarcik and Elbistan districts of Kahramanmaraş (Presidency of the Republic of Türkiye, Presidency of Strategy and Budget Directorate, 2023). Eleven provinces were directly impacted by the Kahramanmaraş-centered earthquake. In these affected provinces, damage assessment surveys were conducted for 1,712,182 buildings. As a result, it was determined that 35,355 buildings had collapsed, 17,491 required urgent demolition, 179,786 were severely damaged, 40,228 were moderately damaged, and 431,421 sustained minor damage. (Presidency of the Republic of Türkiye, Presidency of Strategy and Budget Directorate, 2023). In a statement issued by AFAD, it was reported that 50,096 people lost their lives due to the earthquake, while 107,204 individuals were injured (URL 2). In such a big earthquake, only two people lost their lives in Elazig. However, numerous buildings within the city, especially moderately and slightly damaged structures in the previous earthquake, were severely damaged. In examinations conducted by the Elazığ Directorate of Environment and Climate (2023), it was determined that 9 buildings in Elazığ had collapsed, 19 required urgent demolition, 2,306 were severely damaged, 163 were moderately damaged, and 4,931 sustained minor damage (Figure 8).

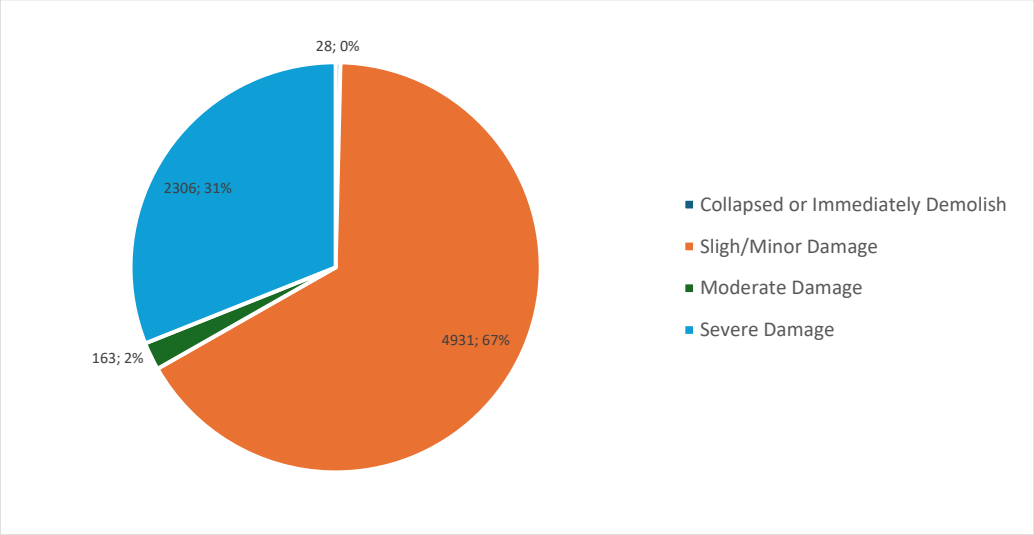

Figure 8: *February 06, 2023, Earthquake damage status (Elazig Directorate of Environment and Climate 2023)*

Following the earthquake on January 24, 2020, it turned out that the desired result could not be achieved with the earthquake that occurred three years later, although measures were taken such as the production of quality housing in areas with high suitability for settlement throughout the city, the evaluation and strengthening of the earthquake resistance of the existing building stock, the reorganization of the zoning plan in a nature sensitive to disasters (Caglar et al., 2023). There are numerous reasons for this, including structural deficiencies and errors such as inadequate seismic reinforcement details, non-earthquake-resistant construction techniques, the use of low-quality concrete, and substandard workmanship (Dogan et al., 2021). In fact, the use of readily-mixed concrete in building construction in Elazig started after the concrete companies established in the city in 1991 and 1993. In addition, building construction and building inspection in accordance with earthquake regulations started to be implemented after the year 2000. Considering the seismicity of the city and the fact that no lesson was learned from the earthquakes experienced in the past, it is possible that similar outcomes will occur in future earthquakes.

In the field studies conducted following the earthquakes, the reasons for the damage the building stock incurred in Elazig were determined as the problems arising from the design and the deficiencies arising from the constructions of the buildings (Sahin et. Al., 2020). The main shortcomings caused by the design are the lack of use of earthquake curtains (reinforced concrete curtains), highlighting architectural usability rather than durable design, discontinuous arrangement of frame axles in a way that negatively affects the transmission of earthquake load to vertical carriers, soft floor / weak floor irregularities, the condition of buildings (adjacent order, discrete order), the number of building floors, and the fact that buildings built before the year 2000 do not receive engineering services (Avcil et al., 2024; Caglar et al., 2023; Dogan et al., 2021; İnce, 2024; Zengin & Aydin, 2023). The defects caused by the construction are insufficient material strength and the arrangement of the carrier system elements without taking into account the ductile design rules (Figure) (Sahin et al., 2020; Dogan et al., 2021).

Figure 9: A view of the fully collapsed Aykent Building. URL 3: (Dogan et al., 2021)

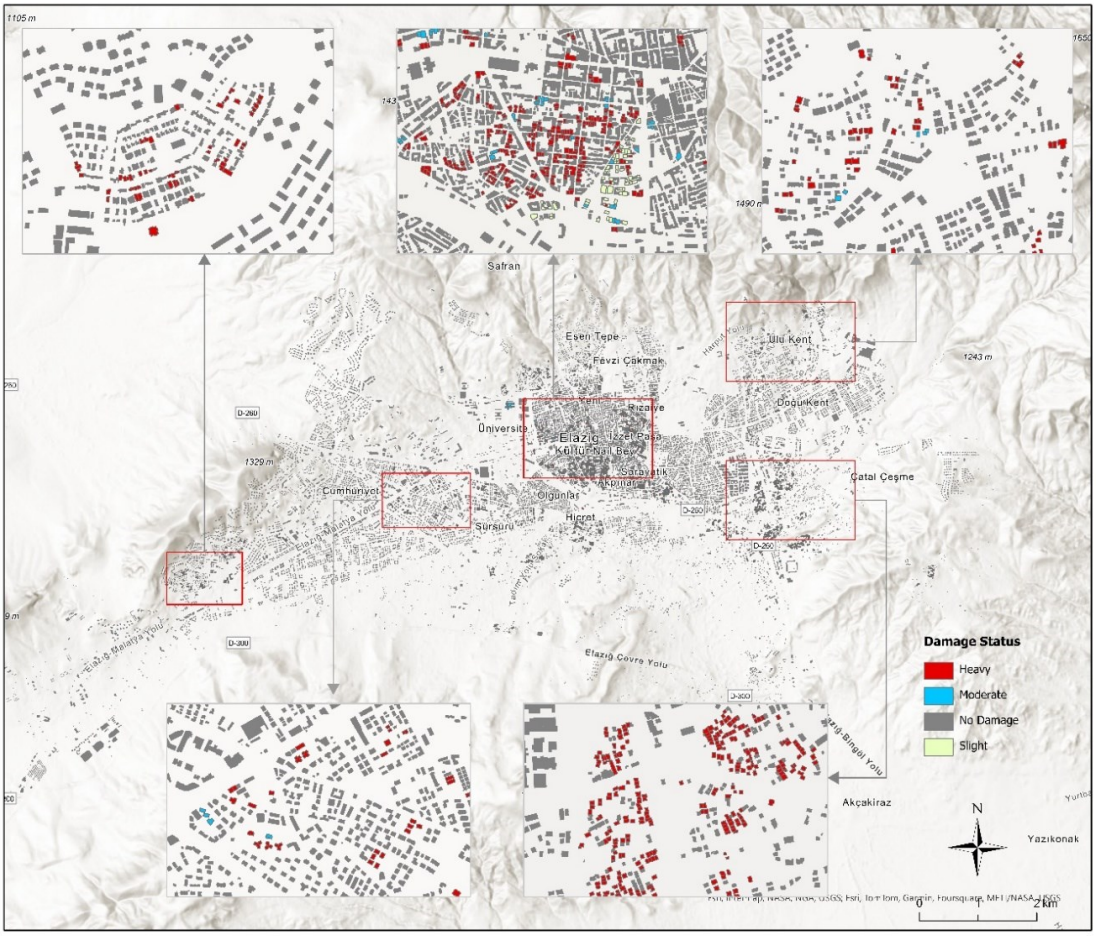

Figure 10: *Distribution of structural damage in different urban patterns*

3.3. Urban Growth: Between Earthquake and Calamity

The theory of rapid urbanization in urban growth (Bodo, 2019) in Elazig it is one of the exemplary cities. Among the reasons for the rapid growth of Elazig are rural to urban migration and the increase in birth rates after the 1950s, as in most developing countries. In addition, the economic development models implemented on a national scale, the terror events in the region, the integration of the rural population living in the flooded areas after the construction of the Keban Dam and the changing socio-economic conditions throughout the country were effective in the growth of Elazig.

In fact, the first urban core of Elazig emerged with the transformation of rural settlements. Until 1950, the spatial development of the city was limited. In this period, Elazig was mostly a city in the making. Of course, it can be said that among the reasons for this is the effect of the newly established Republic and the wars taking place on a global scale (Akdemir, 2013). The shift of the political center of the country to Central Anatolia has also caused changes in terms of accessibility. Especially due to the developments in road and railway networks, Elazig has started to cover a larger land area. The construction of Elazig Train Station was the first state investment that has a positive effect on the spatial development of the city. During this period, the establishment of various educational institutions and the establishment of the town hall, led to the rapid transformation of the city center. During this period, two-storey, masonry buildings, each floor of which is residential, began to become widespread in the city. These buildings were structures built without engineering services. With the increasing need for housing and changing urban income rates, these structures started to leave their places to apartment blocks.

In the 1950s and 1960s, there was no effective urban planning that could cope with the size and speed of growth in the region. To address the new housing demands of the growing population, a single and simple zoning permit could be obtained with the sole decision of the local government, regardless of any potential problems such as zoning status, suitability for settlement, adequate transportation network and infrastructure. Consequently, the rural areas on the outskirts of the city have been swiftly integrated into the urban fabric. In particular, due to the small industrial zone established to accelerate industrial activities in the city, the nearby village of Kersik (Kizilay neighborhood) were rapidly incorporated into the urban area. The elements that are effective in the spatial growth of the city were not the result of a planning process but are only about to meet the need for new housing spaces of the growing population. Due to the slum tendencies that emerged in this period, the houses built by the newcomers to the city with their own means began to become widespread on lands without any zoning plans. Slums, which are a collection of village-like structures built on state owned and private lands on the periphery of the cities without permission, were innocent shelters at first, but they became widespread due to the zoning amnesties practiced and gained commercial value over time with the acquisition of zoning rights and turned into apartment blocks(Tuğaç, 2021).

In the 1970s and 1980s, the developments happened in the axis of "migration-industrialization-urbanization" had an important place in the change of the urban landscape (Akdemir, 2013, Türkoğlu & Akdemir, 2022). The city tended to develop in line with transportation routes. In this period, the establishment of the community college, the incorporation of the population living in the flooded rural areas due to the construction of the Keban Dam, and the rural-to-urban migration trends that started throughout the country, accelerated the spatial growth of Elazig. In addition, reinforced concrete apartment buildings have become increasingly common with the Condominium Ownership Law published in 1965, which has changed (Keleş, 2015). In Elazig, after 1975, masonry apartment buildings that did not receive engineering services and did not comply with earthquake regulations started to become widespread.

The global adoption of neoliberal policies in the 80s affected the growth of Elazig. A rapid construction process has been started in the urban space, and the slum areas on the periphery of the city have been considered as a problem. Within this scope, the Housing Development Administration of Türkiye (TOKI) was established in 1984 (Yılmaz, 2016). The purpose of the public housing administration has been to create new housing areas suitable for the lower and middle income level population in the areas on the periphery of the city in order to meet the housing needs of the newly added population to the city. After 1984, with the establishment of mass housing constructions, the neighborhood of Doğukent, 4 km from the city center, in the east of Elazig, and Abdullahpaşa neighborhood, 8 km from the southwest, were made available, cheaply, for development by the municipality together with an infrastructure(Akdemir, 2013). In this period, with the effect of additional zoning plans for housing construction, Sürsürü and the Hilalkent neighborhoods were established (Karakaş, 2008), and the city grew westward on the transportation axes and this determined its current morphological boundaries.

With the continued impact of neoliberal policies and the lessons learned from the 1999 Marmara earthquake, since the 2000s, basic housing and shelter needs have transformed into secure and disaster-resistant urban growth. Particularly after the 1999 Marmara earthquake, the resilience of the existing housing stock began to be addressed. After 2005, due to changes in building regulations and individuals' desire to live in safer areas, individuals from middle and upper-income groups started to settle on the slopes located in the northern part of the city. These construction trends initially led to the rapid development of Cumhuriyet Neighborhood, followed by Çaydaçıra Neighborhood.

This trend towards disaster-resistant development was further reinforced after the January 24, 2020 earthquake. Urban growth continued with the establishment of new earthquake-resistant urban structures built by the Housing Development Administration of Türkiye (TOKI) on state-owned lands, mostly on the perimeter of the city. With the completion of the new housing projects initiated by TOKI after the earthquake, the city has grown towards areas with lower earthquake hazard in the northern and southern directions (Figure 11).

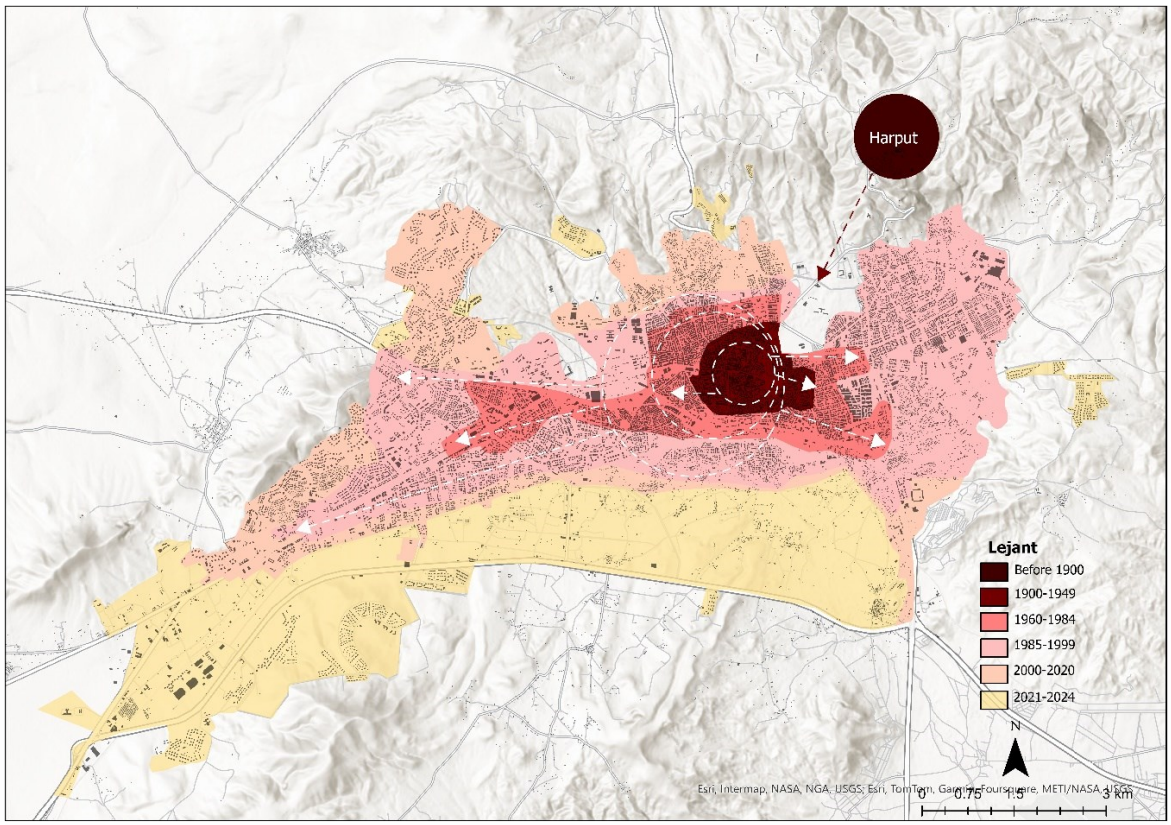

Figure 11: *Development of Elazig Urban Form. Source: Elazığ Kentsel Strateji Belgesi, (2017) (The graphic arrangement has been renewed by the author and the developmental periods have been updated)*

3.4. Impact of Earthquake Disasters on the Structure of Development and Urban Form

Urban form is the spatial expression of a complex and dynamic interplay among diverse social, economic, geographical, cultural, physical, and technological factors that play a critical role in shaping and transforming cities, influencing the spatial and temporal dynamics of human activities and the flow of materials and information (Sharifi, 2019). On post-disaster recovery planning, the literature treats the urban form as a place that needs improvement, not as a place to support post-earthquake recovery activities (Irajifar et al., 2016). A similar situation applies to Elazig. So how did the post-earthquake transformation of the urban form in Elazig differ between the two earthquakes? The rest of the study explores this question.

As previously mentioned, Elazig is a city highly susceptible to earthquake hazards. Over the past twenty years, it has experienced numerous earthquakes with magnitudes exceeding 5. The largest earthquakes affecting the urban environment were the Sivrice earthquake on January 24, 2020, and the Kahramanmaraş earthquake on February 6, 2023. In this study, rapid visual scanning (RVS) components were used to determine the risk of damage to buildings located in earthquake hazard areas. Because this type of classification of the existing building stock makes it easier to quickly determine the susceptibility of a building to earthquakes by grouping together buildings made of similar materials and with systems resistant to similar seismic forces ((FEMA, 2015; Gerçek & Güven, 2023). In the study area, while evaluating for two different periods, the existing RVS indicators were used. (Demirbaş et al., 2022)It has been revealed that there is a large agreement between the damage risk results obtained from rapid assessment methods and the damage levels that occurred after the Elazig-Sivrice Earthquake (2020). In the physical condition assessment of the existing building stock, the current situation was evaluated by using the parameters of building age, number of floors, construction year, layout status, apparent

building quality and damage status in the evaluations, it was seen that many buildings in different areas of the city were vulnerable to earthquake hazards (Figure 12).

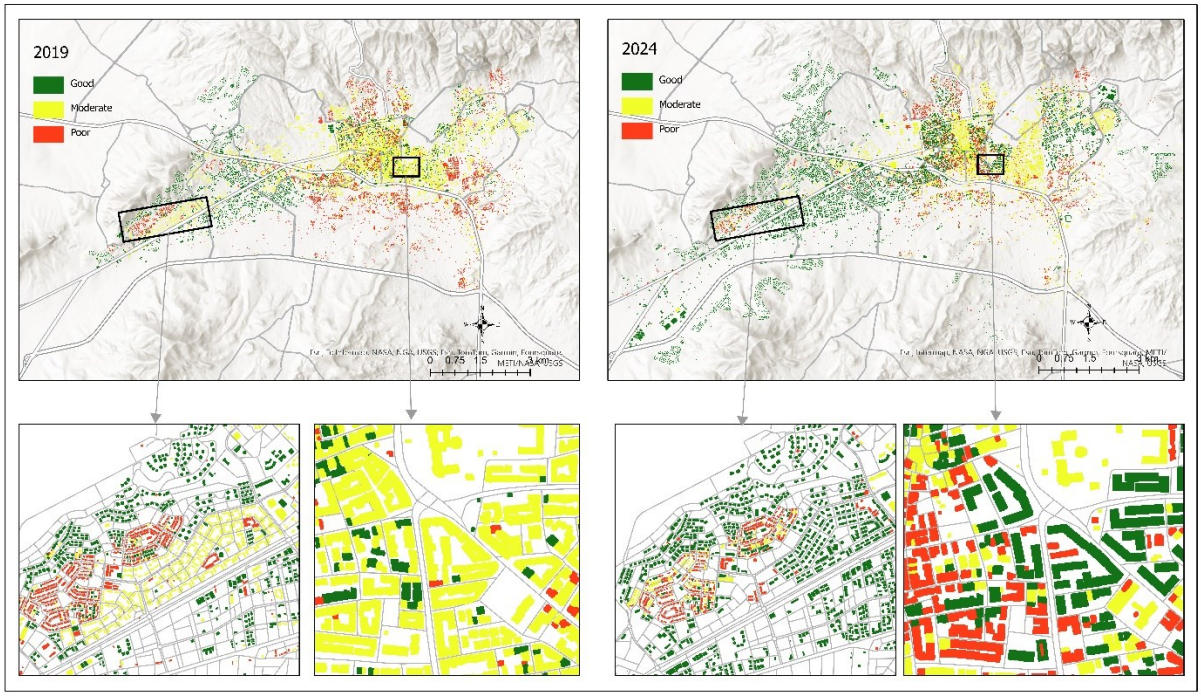

Figure 12. *Physical Condition Comparison of Building Stock Before and After Earthquakes*

In 2019, it is observed that the current building stock is in 43% bad, 41% medium and 16% good condition. In the 2020 earthquake, this adversely affected the earthquake resistance of the urban building stock and many buildings were damaged and destroyed. After the earthquake, the efforts to improve the existing urban fabric continued without non-stop. However, after the earthquake that occurred in 2023, the urban building stock was once again adversely affected, and many buildings were damaged (Figure 14). Although many measures have been taken to increase the resilience of the urban form in Elazig, it is obvious that the city is still not fully resistant to future earthquakes. After the two major earthquakes, 26% of the existing urban building stock is in good condition, 47% is in moderate condition and 27% is considered bad (Figure 13).

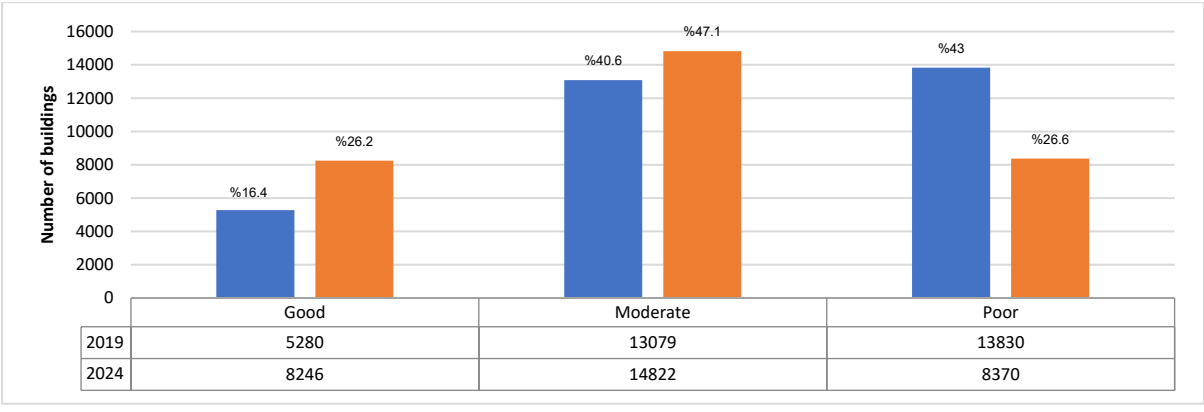

Figure 13*. Physical Condition Comparison of Building Stock Before and After Earthquakes*

Figure 14: *Abdullahpaşa neighborhood before and after the earthquake URL 4.*

In 2020, the urban area of Elazığ was classified into Urbanization Promotion Areas (UPA) and Urbanization Restricted Areas (URA) in accordance with the Turkish Zoning Planning Law (Figure 15). With the changing zoning plan, UPA covers the currently built environment and areas that will be built in the future. The UPAS have been planned taking into account the general land use. The construction in these areas should be in accordance with the rules of the zoning plan. Otherwise, construction is not allowed. Conversely, URAs are areas where urban development is limited, with a maximum of two storeys, and are more suitable for public space use. Following the earthquake on January 24, 2024, additional restrictions were implemented for structures to be constructed in these areas. The purpose of this was to prevent unplanned development and to support the earthquake-resistant recovery of the Elazig urban area. These restrictions were put into effect immediately after the earthquake, with the decision of the local government. After the 2020 earthquake, the buildings damaged by the disaster were promptly evacuated and demolished. To meet the housing needs of the existing population, designated reserve areas on the city outskirts were allocated for settlement and development. The areas severely impacted by the earthquake were re-planned and made available for construction in compliance with earthquake regulations.

In the period from 2020 to 2024, 4040 licensed buildings were built in Elazig (TUIK 2023). In 2020, when the first major disaster occurred, 798 buildings were built. In the 2021-2022 period, after building construction reached the highest level (2418), this figure decreased to 824 in 2023, when the Kahramanmaras earthquakes occurred. However, although the number of building constructions seems to be decreasing, after the earthquake in 2023, it can be concluded that recovery efforts are continuing.

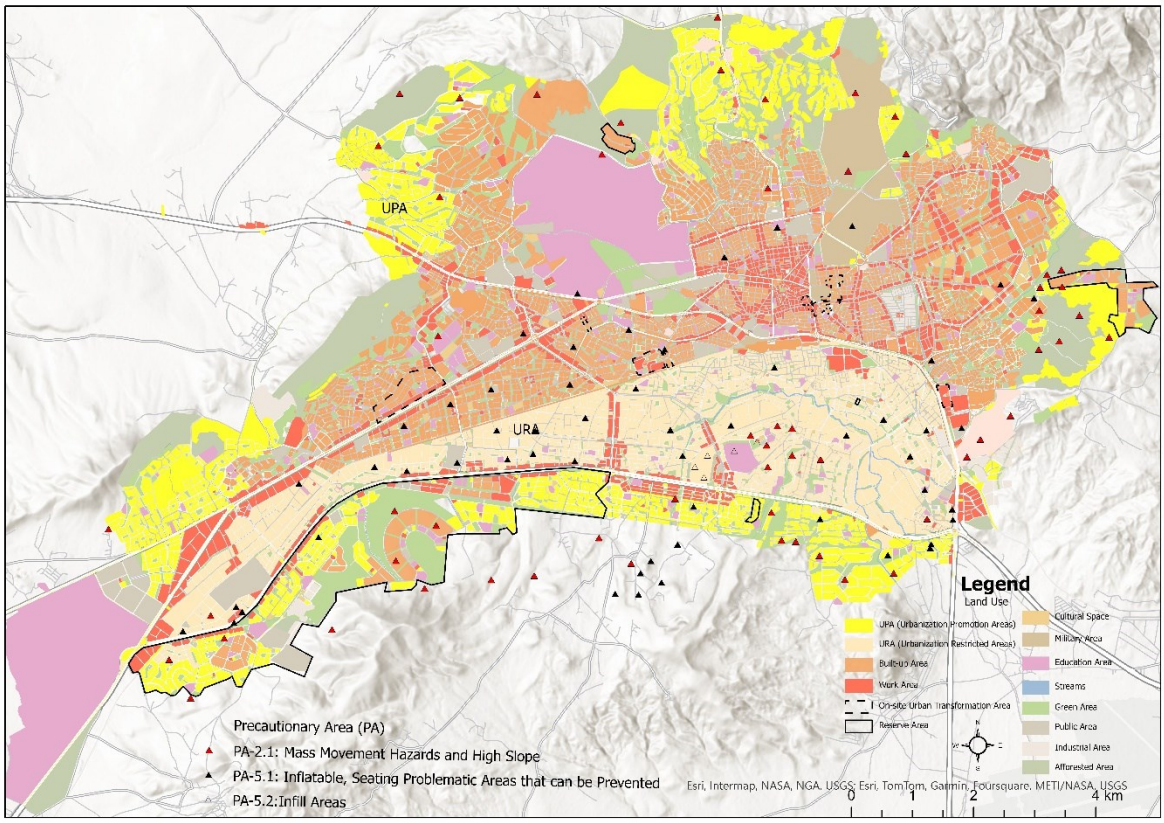

Figure 15. *Land use restrictions in Elazig.*

Most of these building constructions are UPAs (about 93.7%). Since the disaster, almost all new buildings have been built in these areas. This number has not changed significantly over time. This is due to the strict restrictions imposed on building construction in URAS, and the fact that most of these areas are agricultural lands with conservation clauses. In addition, these areas are alluvial terrains that are geologically inconvenient to settle, and they have slope values around ≤10%. In the Elazig zoning plan, these areas were defined as "not suitable for urban settlement". Therefore, the construction of maximum two-story detached houses with gardens is allowed in URAs. In these areas, houses with a maximum height of 6.5 meters can be built. In general, the lower floors of these buildings are 3.5 m, while the upper floors are 3 m high (Figure 15).

84.6% of the buildings constructed in UPAs were built on previously vacant land. In addition, 29.74% of the structures built after the earthquake were built on urban reserve lands. In the second article of the Law No. 6306 on the Transformation of Areas under Disaster Risk, the reserve area is defined as "the areas determined by the Ministry to be used as a new settlement area in the applications to be carried out in accordance with this Law, upon the request of TOKI or the Administration or ex officio, with the approval of the Ministry of Finance" (Özlüer, 2012). These areas are independent of the existing urban fabric, do not have the quality of agricultural land and are owned by the state. On the other hand, 8% of the existing buildings were built on the lands where the previous structures were damaged due to previous earthquakes, with a new planning, using state resources. While 91.5% of these buildings are residential buildings, 8.5% are other types of buildings (schools, hotels, offices, etc.).

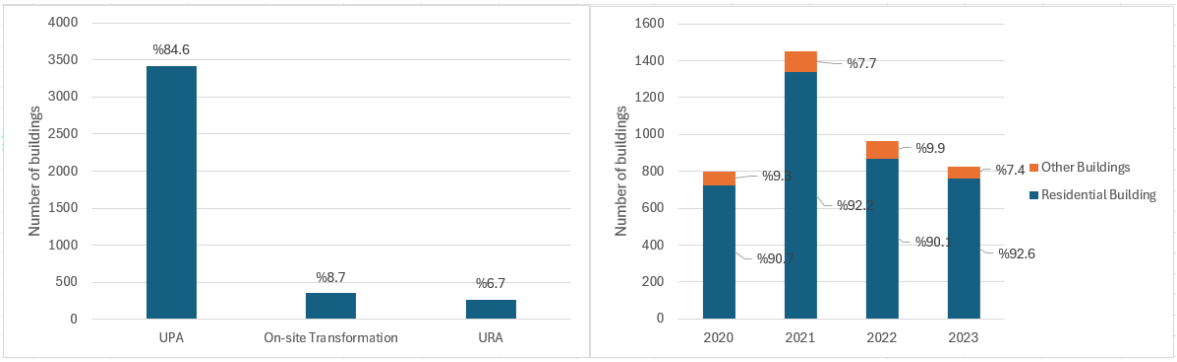

Figure 16. *Building construction according to zoning plan area utilization and Building Type in Elazig*

Elazig is inclined to transform its building stock, an important component of urban form, due to the earthquakes experienced in the last three years. With the transformation of the building stock, the goal is to minimize the effect of earthquakes on the urban form. However, reasons such as the fact that the houses built before 2000 are built before earthquake regulations and that many of them were built without engineering services prove that they will likely be adversely affected by future earthquakes.

3.5. Effect of Earthquake Disaster on Social, Economic and Demographic Structure

Elazig, just like other cities of Türkiye, has generally experienced an exponential population growth over time. Although it increased gradually from the proclamation of the Republic to 1950, the most important developments took place after the 1950s. Developments in population growth after 1950 have affected the sensitivity to disasters. In particular, the increasing urban population has brought with it unplanned urbanization, uncontrolled housing construction, urbanization without infrastructure and an increase of low-income population.

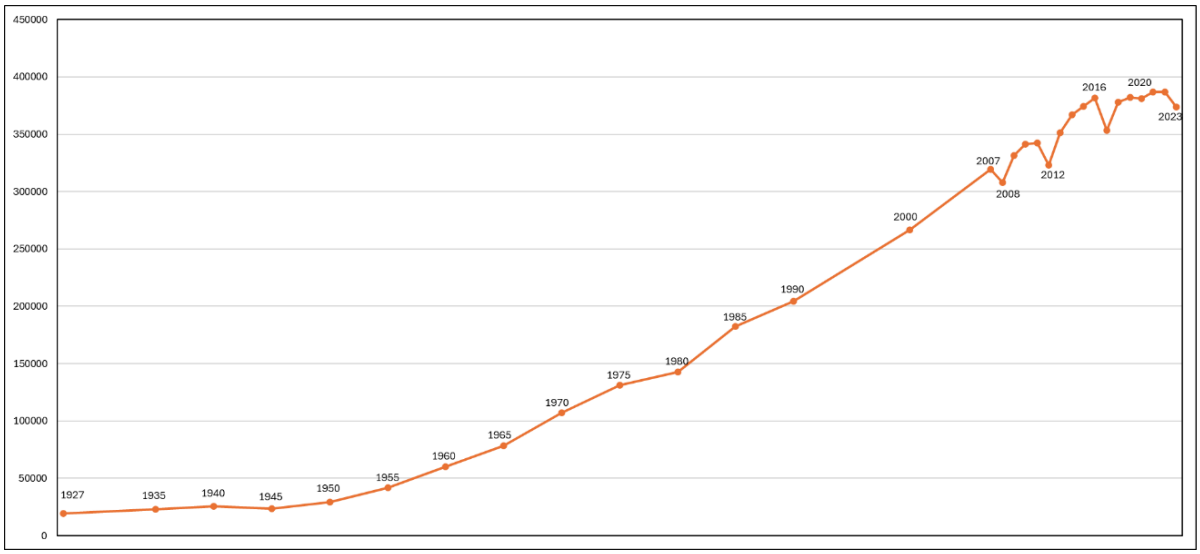

Figure 17*: Development of the population of Elazig (1927-2023)*

The distribution of the population within the city has also been shaped by earthquakes. In the past, transportation networks were mostly effective in the distribution of the urban population, however, after the 5.4 magnitude earthquake that occurred on February 21, 2007, the urban population tended to concentrate towards the Abdullahpaşa and Cumhuriyet neighborhoods, which are considered to be more resilient in to earthquakes. Of course, this earthquake was not the only reason for such a shift. However, it is obvious that it had a triggering effect on the mobility of the urban population. In the following periods, with the new housing needs of the middle- and upper-income groups and the construction of

houses with nice views, Cumhuriyet and Abdullahpaşa neighborhoods have become the most densely populated neighborhoods (Akdemir et al., 2015)

In 2012, mass housing initiatives aimed at addressing the housing needs of low-income groups, combined with increasing earthquake awareness, transformed the Çaydaçıra neighborhood into the largest neighborhood in the city. Especially after the 2020 earthquake, mass housing projects have become the most population dense areas, as in Çaydaçıra and Safran Neighborhoods in the north and the newly established Güneykent neighborhood in the south. Urban resident mobility has shifted to newly established neighborhoods where earthquake hazard is low. The main reason for this is the collapse of the buildings belonging to the pre-2000 period in the city center due to the earthquakes and the replacement of the earthquake victims in houses with relaxed payment conditions constructed in the mass housing areas built by TOKI, on the slopes of Mount Meryem. Thus, earthquakes shifted the city, which was established on a valley floor, to higher slopes with lower earthquake risk.

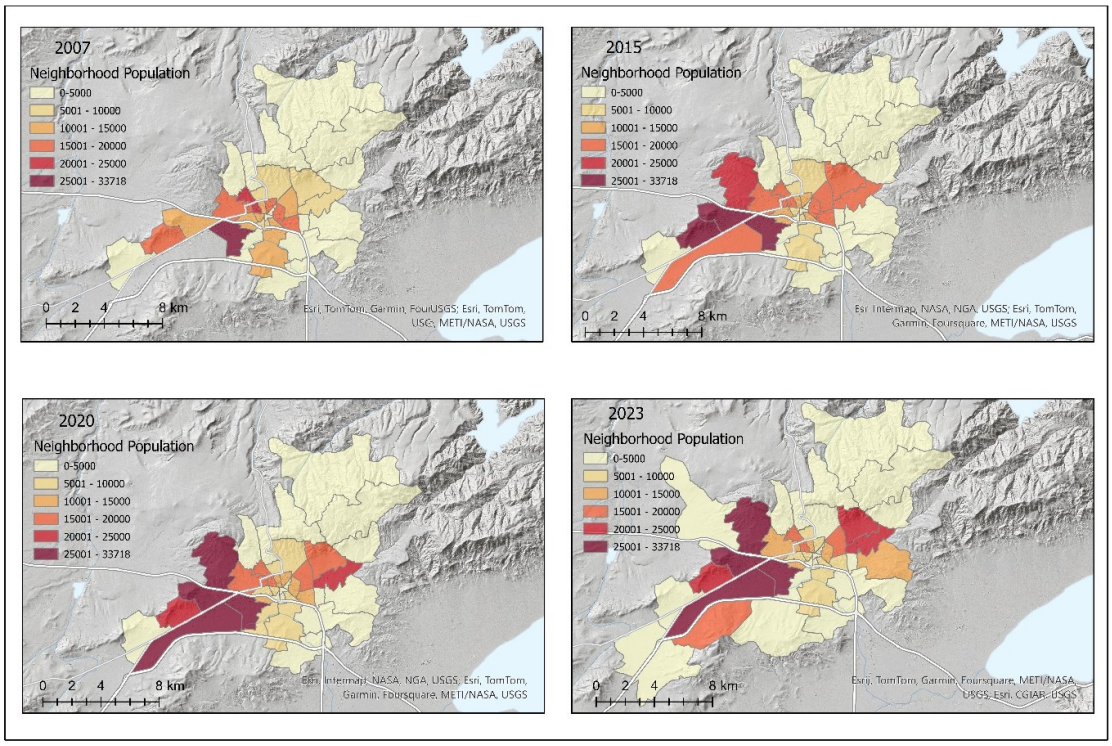

Figure 18. *Spatial distribution of the Population*

Economic indicators in Türkiye are usually explained through the sectoral distribution of the labor force. According to the 2022 data of the TUIK, the labor force participation rate in Elazig was 48%, the employment rate was 44.1% and the unemployment rate was 8.1%. When we look at the sectoral distribution of employees, those working in the service sector seem to be the majority. Considering the distribution of labor force on the basis of sector, the rate of employees in the service sector is 52.1%, the rate of agriculture is 28.20% and the rate of those working in the industrial sector is 28.2% (Sarışık et al., 2023).

In the research conducted on the enterprises where 20 or more people work in Elazig, it was seen that the construction sector was dominant in terms of the sectoral distribution of employees, especially after the earthquake. The number of workplaces in the construction sector, which stood at 66 during the 2020 earthquake period, gradually increased in the aftermath. Earthquakes experienced in the city can be cited as the main reason for this. Because after the earthquakes, the demolition of damaged buildings continued throughout the city, while the construction of new buildings required the construction sector to grow.

Table 2: *Sectoral Distribution of Enterprises with 20 and more employees in Elazig (TUIK 2023)*

Sector	Number of Enterprises			
	2020	**2021**	**2022**	**2023**
Construction	66	84	119	93
Manufacturing	81	93	99	113
Wholesale and Retail	82	76	84	95
HORECA	37	28	33	37
Transportation and Storage	20	28	26	30
Administrative and Support Services	23	23	22	31
Healthcare and social services	16	14	21	20
Education	17	13	19	21
Professional, scientific and technical	8	4	13	9
Mining and quarries	19	14	12	16
Electricity, gas, steam and air conditioning manufacturing and distribution	10	8	11	11
Culture, art, entertainment, recreation and sports	4	3	4	5
Other services	3	3	2	3
Real Estate	3	3	2	3
Information and Communication	3	1	2	2
Water supply: sewage, waste management and treatment	1		1	2
Finance and insurance	1	1	1	0

Elazığ's heavy reliance on the manufacturing, trade, and construction sectors has made the city particularly susceptible to the boom-and-bust cycles inherent in these industries. In recent years, the impacts of national and global economic shocks have become evident, with rising unemployment levels and a surge in construction activities following earthquakes. Although developments in the construction sector might come in hand for the reconstruction process of the city, they may also cause worrying consequences for the future. For this reason, it is necessary to diversify the city's economy towards other sectors such as education and healthcare.

4. RESULTS

This study traces the change and resilience of the urban profile of Elazig, in the wake of one of the deadliest disasters in recent years. The city of Elazığ, an urban center in eastern Türkiye, has been grappling with economic and social structural distortions throughout its ongoing urbanization process, compounded by the persistent earthquake crisis. As in other Turkish cities, after the 1950s, people looking for new job opportunities migrated from rural areas to cities. However, the lack of preparedness of both these individuals and existing cities has led to the creation of neighborhoods that lack urban services, employment options, and basic needs such as transportation and educationIn the process of urban integration of these neighborhoods, transformation practices lacking proper planning and disaster resilience have resulted in significant loss of life and property. Therefore, the damage caused by earthquakes is a big problem for the cities. However, post-earthquake recovery efforts and disaster adaptation strategies offer an opportunity to create a more resilient city and sustainable urbanization.

After large-scale disasters, governments often plan and implement projects themselves (Ubaura et al., 2016). In Elazig, which is the subject of this study, housing projects supported by the central government were quickly built in earthquake-resistant areas, especially on public lands. However, due to the rapid urbanization and the rapid construction requirement that comes with it, the earthquake resistance of the urban pattern before the year 2000, which lacks engineering services, is quite low. These areas also correspond to the central business and commercial areas of the city. It shows that an earthquake of similar magnitude in the future will affect the city socially, economically and environmentally. On the other hand, construction tendencies are increasing in areas where the middle and upper income groups

prefer more and where the government builds earthquake-resistant social housing. These areas are evaluated as areas with high earthquake resistance. This is more than a perception, as a matter of fact, after the earthquakes, almost no structural and environmental damage has occurred in these areas. Buildings in these areas, which used to be indicators of the status of wealthy individuals, are now seen as the key to safe, livable and earthquake-resistant urbanization. In the past, while the city was on the valley floor and in a course of development suitable for transportation networks, after the earthquakes, a rapid construction process was initiated in areas that are more geologically suitable for settlement and have higher earthquake resistance, especially on slopes and plateaus. In this sense, it can be said that the recovery process after the earthquake is more resilient and sustainable. However, after the earthquake, in heavily damaged areas in individual parcels, reconstruction proceedings are very slowly and this reduces the rate of urban parcel utilization. The use of these spaces as green spaces, emergency gathering areas or public spaces in the congested urban fabric will strengthen the discourse of a more resilient city. As a result, given the current urban pattern of Elazig, disasters such as earthquakes, floods, climate change and epidemics continue to threaten the city's urban resilience. Therefore, the city's resilience must be bolstered through disaster preparedness and mitigation strategies, alongside inclusive and risk-reducing policies. It is essential for Elazığ to align its urban resilience strategy with an earthquake-focused agenda and enhance the capacity of vulnerable areas and populations to adapt to adverse scenarios.

4. ACKNOWLEDGEMENT

This study is funded by the TUBITAK (Scientific and Technological Research Council of Türkiye) as part of the research 2219 overseas research scholarship program.

REFERENCES

AFAD. (2023). Earthquake Catalog. https://deprem.afad.gov.tr/event-catalog

Akdemir, İ. O. (2013). Elazığ'ın Kentleşme Sürecinin Coğrafi Analizi. FÜ Harput Uygulama ve Araştırma Merkezi, Geçmişten Geleceğe Harput Sempozyumu, C, 2, 1033-1054.

Akdemir, İ. O., Çağlıyan, A., & Dağlı, D. (2015). Kentsel planlamada coğrafi bilgi: Elâzığ uygulaması. Fırat Üniversitesi Harput Araştırmaları Dergisi, 2(1), 53-76.

Akdemir, İ. O., & Türkoğlu, E. (2022). Göçlerin Mekânın Dönüşümüne Etkisi: Güney Marmara Bölümü Örneği. Göç Araştırmaları Dergisi, 8(2), 191-225.

Avcil, F., Işık, E., İzol, R., Büyüksaraç, A., Arkan, E., Arslan, M. H., Aksoylu, C., Eyisüren, O., & Harirchian, E. (2024). Effects of the February 6, 2023, Kahramanmaraş earthquake on structures in Kahramanmaraş city. Natural Hazards, 120(3), 2953-2991. https://doi.org/10.1007/s11069-023-06314-1

Berkes, F., & Ross, H. (2013). Community Resilience: Toward an Integrated Approach. Society & Natural Resources, 26(1), 5-20. https://doi.org/10.1080/08941920.2012.736605

Bodo, T. (2019). Rapid urbanisation: theories, causes, consequences and coping strategies. Annals of Geographical Studies, 2(3), 32-45.

Brenner, N. (2004). New state spaces: Urban governance and the rescaling of statehood. OUP Oxford.

Büyüközkan, G., Ilıcak, Ö., & Feyzioğlu, O. (2022). A review of urban resilience literature. Sustainable Cities and Society, 77, 103579. https://doi.org/10.1016/j.scs.2021.103579

Caglar, N., Vural, I., Kirtel, O., Saribiyik, A., & Sumer, Y. (2023). Structural damages observed in buildings after the January 24, 2020 Elazığ-Sivrice earthquake in Türkiye. Case Studies in Construction Materials, 18, e01886. https://doi.org/10.1016/j.cscm.2023.e01886

Cimellaro, G. P. (2016). Urban Resilience for Emergency Response and Recovery. Geotechnical, Geological and Earthquake Engineering. https://doi.org/10.1007/978-3-319-30656-8

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. Global Environmental Change, 18(4), 598-606. https://doi.org/10.1016/j.gloenvcha.2008.07.013

Demirbaş, N., Şahin, H., & Durucan, C. (2022). Hızlı değerlendirme yöntemlerinin performanslarının depremde hasar görmüş binalar kullanılarak değerlendirilmesi. Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi, 28(3), 389-400. https://doi.org/10.5505/pajes.2021.84115

Dogan, G., Ecemis, A. S., Korkmaz, S. Z., Arslan, M. H., & Korkmaz, H. H. (2021). Buildings Damages after Elazığ, Türkiye Earthquake on January 24, 2020. Natural Hazards, 109(1), 161-200. https://doi.org/10.1007/s11069-021-04831-5

Elazığ Kentsel Strateji Belgesi. (2017) Elazığ Kentsel Dönüşüm Strateji Belgesi, Elazığ Çevre, Şehircilik ve İklim Değişikliği İl Müdürlüğü

Erinç, S. (1953). Doğu Anadolu Coğrafyası. İstanbul Üniversitesi Coğrafya Bölümü Yayınları.

Ersoy, M. (2013). Yeni Liberal Politikaların Türkiye Kentleri Üzerindeki Etkileri KBAM, 4. Sempozyumu,

FEMA, P. (2015). 154: Rapid visual screening of buildings for potential seismic hazards: a handbook (Federal Emergency Management Agency Report, FEMA. P, Issue.

Figueiredo, L., Honiden, T., & Schumann, A. (2018). Indicators for resilient cities.

Gerçek, D. (2021). 21. Yüzyıl ve Dirençli Kentler. Mimarlık(417). http://www.mimarlikdergisi.com/index.cfm?sayfa=mimarlik&DergiSayi=432&RecID=5228

Gerçek, D., & Güven, İ. T. (2023). Urban Earthquake Vulnerability Assessment and Mapping at the Microscale Based on the Catastrophe Progression Method. International Journal of Disaster Risk Science, 14(5), 768-781. https://doi.org/10.1007/s13753-023-00512-y

Hayli, S. (1998). Tarihi coğrafya açısından Harput şehrinin fonksiyonları ve etki sahası Dünü ve Bugünü ile Harput Sempozyumu, Elazığ.

Hochrainer, S., & Mechler, R. (2011). Natural disaster risk in Asian megacities. Cities, 28(1), 53-61. https://doi.org/10.1016/j.cities.2010.09.001

Holling, C. S. (1973). Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics, 4(1), 1-23. https://doi.org/10.1146/annurev.es.04.110173.000245

İnce, O. (2024). Structural damage assessment of reinforced concrete buildings in Adıyaman after Kahramanmaraş (Türkiye) Earthquakes on 6 February 2023. Engineering Failure Analysis, 156, 107799. https://doi.org/10.1016/j.engfailanal.2023.107799

Irajifar, L., Sipe, N., & Alizadeh, T. (2016). The impact of urban form on disaster resiliency. International Journal of Disaster Resilience in the Built Environment, 7(3), 259-275. https://doi.org/10.1108/ijdrbe-10-2014-0074

Karakaş, E. (1999). Elazığ şehrinin gelişmesi. Fırat Üniversitesi Sosyal Bilimler Dergisi, 9(1), 129-154.

Karakaş, E. (2008). Kentsel Gelişmede Konut Kooperatiflerinin Rolü Elazığ Örneği. V. Ulusal Coğrafya Sempozyumu(16-17 Ekim), 281-290.

Keleş, R. (2015). Kentleşme politikası (14. baskı). Ankara, Türkiye: İmge Kitabevi, 422-485.

Koliou, M., Van De Lindt, J. W., McAllister, T. P., Ellingwood, B. R., Dillard, M., & Cutler, H. (2020). State of the research in community resilience: progress and challenges. Sustainable and Resilient Infrastructure, 5(3), 131-151. https://doi.org/10.1080/23789689.2017.1418547

Kopar, M. (2007). Cumhuriyetin İlanından Sonra Elazığ'da Yapılan Yatırım ve Harcamalar (1927-1950). Fırat Üniversitesi Sosyal Bilimler Dergisi, 17(1), 301-314.

Köküm, M., & Özçelik, F. (2019). TARİHSEL DEPREMLERİN YENİDEN DEĞERLENDİRİLMESİNE ÖRNEK BİR ÇALIŞMA: 1789 PALU (ELAZIĞ) DEPREMİ, DOĞU ANADOLU, TÜRKİYE. Bulletin Of The Mineral Research and Exploration, 1-10. https://doi.org/10.19111/bulletinofmre.603929

Lfarakh, R. (2021). Dirençli bir şehre doğru (dirençlilik ve kentsel sistemler arasındaki bağın araştırılması İstanbul Kültür Üniversitesi/Lisansüstü Eğitim Enstitüsü/Mimarlık Ana Bilim …]. İstanbul.

Özlüer, F. (2012). Afet riski altındaki alanların dönüştürülmesi hakkında kanun ve uygulama sorunları. Mimarlık Journal(366).

Ribeiro, P. J. G., & Pena Jardim Gonçalves, L. A. (2019). Urban resilience: A conceptual framework. Sustainable Cities and Society, 50, 101625. https://doi.org/10.1016/j.scs.2019.101625

Ritchie, H., Samborska, V., & Roser, M. (2024). Urbanization. Our world in data. https://ourworldindata.org/urbanization?source=content_type:react|first_level_url:article|section:main_content|button:body_link

Sahin, H., Alyamaç, K. E., Durucan, A. R., Demirel, B., Ulaş Açıkgenç, M., Durucan, C., Demir, T., Ulucan, M. and Demirbaş, N. (2020). 24 Ocak 2020 Mw 6.8 Sivrice Depremi Elazığ Bölgesi Yapısal Hasarlar İnceleme Ve Değerlendirme Raporu. Elazıg.

Sajjad, M., Chan, J. C. L., & Chopra, S. S. (2021). Rethinking disaster resilience in high-density cities: Towards an urban resilience knowledge system. Sustainable Cities and Society, 69, 102850. https://doi.org/10.1016/j.scs.2021.102850

Sajjad, M., Chan, J. C. L., & Kanwal, S. (2020). Integrating spatial statistics tools for coastal risk management: A case-study of typhoon risk in mainland China. Ocean & Coastal Management, 184, 105018. https://doi.org/10.1016/j.ocecoaman.2019.105018

Sarıbeyoğlu, M. (1951). Aşağı Murat bölgesinin beşeri coğrafyası. Dil ve Tarih Coğrafya Fakültesi, Doğu Anadolu Araştırmaları İstasyonu.

Sarışık, N., Ilıkkan, S. S., Alkan, S. and Avcı, G. (2023). 81 İle İlişkin Genel Göstergeler. Ankara.

Sengezer, B., & Koç, E. (2005). A Critical Analysis of Earthquakes and Urban Planning in Türkiye. Disasters, 29(2), 171-194. https://doi.org/10.1111/j.0361-3666.2005.00279.x

Sergün, Ü. (1975). Beşerî coğrafya açısından bir araştırma Uluova (Vol. 82). İstanbul Üniversitesi Edebiyat Fakültesi.

Sharifi, A. (2019). Urban form resilience: A meso-scale analysis. Cities, 93, 238-252. https://doi.org/10.1016/j.cities.2019.05.010

Sharifi, A. (2020). Urban Resilience Assessment: Mapping Knowledge Structure and Trends. Sustainability, 12(15), 5918. https://doi.org/10.3390/su12155918

Sunkar, M. (2018). Palu'da (Elazığ) Tarihsel ve aletsel dönemdeki büyük depremler ve yerleşmeler üzerindeki etkileri. Fırat Üniversitesi Harput Uygulama ve Araştırma Merkezi 297 Uluslararası Palu Sempozyumu.

Şahinalp, M. S., & Günal, V. (2016). Türkiye'de Şehirleşme Hareketleri Üzerine Terer Olaylarının Etkisi Akademik Sosyal Araştırmalar Dergisi,, 37(4), 30-42.

Şengün, M. T. (2012). Harput Platosunda Doğal Ortam İnsan İlişkileri ve Doğal Çevre Planlaması. Elazığ Valiliği Yayınları.

Şikoğlu, E., & Güney, Y. (2020). A Geographical Assessment on the Reflection in the City Center of 24 January 2020 Sivrice (Elazig) Earthquake. Resilience, 4(2), 275-292. https://doi.org/10.32569/resilience.779242

Tezer, S. T., & Özgür, E. F. (2018). Yerleşme Tarihi Analizinde Tarihsel Coğrafya ve Kentsel Morfolojinin Bir Araya Geliş Olanakları Üzerine Yeniden Düşünmek: Antakya Örneği. Türkiye Kentsel Morfoloji Ağı, 297-308.

Tuğaç, Ç. (2019). Kentsel Dirençlilik Perspektifinden Yerel Yönetimlerin Görevleri ve Sorumlulukları. İDEALKENT, 10(28), 984-1019. https://doi.org/10.31198/idealkent.634144

Tuğaç, Ç. (2021). Tarihsel Gelişim Süreci İçinde Anadolu'daki Yerleşimler ve Konut Tipolojileri Üzerine Bir Değerlendirme. Kocaeli Üniversitesi Mimarlık ve Yaşam Dergisi. https://doi.org/10.26835/my.892537

TUIK, (2023). Building Permit Statistics. https://data.tuik.gov.tr/Kategori/GetKategori?p=insaat-ve-konut-116&dil=1

TUIK, (2023). Labour Force Statistics. https://data.tuik.gov.tr/Kategori/GetKategori?p=Employment,-Unemployment-and-Wages-108

TUIK, (2023). Address Based Population Registration System Results. https://biruni.tuik.gov.tr/medas/?kn=95&locale=en

Türkoğlu, E., & Elmastaş, N. (2022). Suriyeli Siğinmacilarin Mekâni Dönüştürücü Etkisi: Gaziantep Kenti Örneği. Fırat Üniversitesi Sosyal Bilimler Dergisi, 33(1), 65-81. https://doi.org/10.18069/firatsbed.1197297

Türkoğlu, H. (2014). Afete Dirençli Şehir Planlama ve Yapılaşma, İSMEP Rehber Kitaplar Beyaz Gemi Sosyal Proje Ajansı. Erişim adresi: http://www. guvenliyasam. org.

Ubaura, M., Miyakawa, M., & Nieda, J. (2016). Land Use Change after Large Scale Disasters a Case Study of Urban Area of Ishinomaki City after the Great East Japan Earthquake. Procedia Engineering, 161, 2209-2216. https://doi.org/10.1016/j.proeng.2016.08.817

UNPD. (2024). World population prospects: The 2022 revision. U. Nations. https://population.un.org/wpp/

Uzun, C., & Çakar, E. (2016). 17. YÜZYILDA HARPUT KALESİ. Fırat Üniversitesi Sosyal Bilimler Dergisi, 26(2), 337-350.
Wannous, C., & Velasquez, G. (2017). United Nations Office for Disaster Risk Reduction (UNISDR)—UNISDR's Contribution to Science and Technology for Disaster Risk Reduction and the Role of the International Consortium on Landslides (ICL). In (pp. 109-115). Springer International Publishing. https://doi.org/10.1007/978-3-319-59469-9_6
Witt, E., & Lill, I. (2018). Methodologies of contemporary disaster resilience research. Procedia Engineering, 212, 970-977. https://doi.org/10.1016/j.proeng.2018.01.125
Yıldırım, H. (2021). Neoliberal Bir Politika Olgusu olarak Türkiye'de Gecekondu Mekanı Kamu Yönetimi ve Politikaları Dergisi, 2(2), 257-275.
Yılmaz, E. (2016). Konut sorunu ve toplu konut üretiminde TOKİ'nin ve belediyelerin rolü. Gazi Üniversitesi Sosyal Bilimler Dergisi, 3(7), 31-50.
Yoon, D. K., Kang, J. E., & Brody, S. D. (2016). A measurement of community disaster resilience in Korea. Journal of Environmental Planning and Management, 59(3), 436-460. https://doi.org/10.1080/09640568.2015.1016142
Yüksel, K. U., & Karaçor, E. (2021). Afet Riskleri ile İlgili Kentsel Dayanıklılık Çalışmalarının Yöntemsel Olarak İncelenmesi. İDEALKENT, 12(34), 1531-1558. https://doi.org/10.31198/idealkent.846722
Zengin, B., & Aydin, F. (2023). The Effect of Material Quality on Buildings Moderately and Heavily Damaged by the Kahramanmaraş Earthquakes. Applied Sciences, 13(19), 10668. https://doi.org/10.3390/app131910668
URL 1: https://yurtsever.org.tr/2020/elazig-depreminde-14-yurttasin-can-verdigi-dilek-apartmani-13-yil-once-agir-hasar-almis-sadece-guclendirme-yapilmis-397397/
URL 2: Kahramanmaraş merkezli depremlerde hayatını kaybedenlerin sayısı 50 bin 96 oldu, 20.03.2023. https://www.aa.com.tr/tr/asrin-felaketi/kahramanmaras-merkezli-depremlerde-hayatini-kaybedenlerin-sayisi-50-bin-96-oldu/2850716. Accessed 02.04.2024.
URL 3: https://www.yenisafak.com/ekonomi/elazigda-yikilan-aykent-apartmani-ile-ilgili-sok-iddia-kolonlari-kesildi-3523321
URL: https://www.elazig.bel.tr/foto-galeri/sehirden-gorunumler