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Formation of Zoning Plans with Chaos Theory Approach: Example of Elazığ City Master Plan at 1/5000 Scale

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Abstract

Zoning plans refer to the whole of the vital areas that can meet people's all kinds of housing needs. Zoning plans are gradually created in different ways, from upper to lower scales. As one of the lower scale plans, the master zoning plans are a piece of land whose borders are determined for the relevant region by the ministry in Türkiye. These plans are made on a city basis as an administrative border. It gains significance in the approximate determination of parameters such as density, precedent, or height in the formation of zoning islands such as residential, commercial, and social reinforcements, and the people who will live on the piece of land related to the plan.

This significance is associated with the chaos theory and the correlation of each zoning parameter that seems to be irregular with each other, and planning is made on a 30-40 year basis. Chaos theory is the calculation of planning the abstract event on the land with a deterministic approach for a long time in a way that will respond to all kinds of needs. Zoning plans should respond to the highest need in terms of construction and design. This production, it should be designed like an artistic structure. For this reason, all parameters that seem chaotic should be made with the best possibilities in mind, like a jigsaw puzzle. In our study, the plan parameters of the city of Elazığ, which is one of the 81 administrative cities in Türkiye, were examined with a chaotic approach to the master zoning plan in the determination of the border, which was before the implementation of zoning plan from the 1980s to 2016.

Keywords: Master Zoning Plan, Chaos Theory, Elazığ, 1/5000 scale

Kaos Teorisi Yaklaşımı İle İmar Planlarının Oluşumu: 1/5000 Ölçekte Elazığ Şehri Nazım İmar Planı Örneği

Öz

İmar planları, insanların konuttan her türlü ihtiyacını karşılayabilecek yaşamsal alanların bütününü ifade eder. İmar planları, üst ölçekten alt ölçeğe doğru kademeli olarak farklı şekillerde oluşturulmaktadır. Bu alt ölçekli planlardan biri de nazım imar planlarıdır. Nazım imar planları, Türkiye'de bakanlık tarafından ilgili bölge için sınırları belirlenmiş arazi parçalarıdır. Bu planlar idari sınır olarak il bazında yapılmaktadır. Konut, ticari, sosyal donatı gibi imar adalarının oluşumunda ve plana bağlı olarak arazi parçası üzerinde yaşayacak kişilerin oluşumunda yoğunluk, emsal veya yükseklik gibi parametrelerin yaklaşık olarak belirlenmesinde önem kazanmaktadır. Bu

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önem, kaos teorisi ve düzensiz gibi görünen her bir imar parametresinin birbiriyle korelasyonu ile ilişkilendirilir ve 30-40 yıllık bir planlama yapılır. Kaos teorisi, karadaki soyut olayın belirleyici bir yaklaşımla uzun bir süre içinde her türlü ihtiyaca cevap verecek şekilde planlanmasıdır. İmar planları, yapımı ve tasarımı açısından en yüksek perdeden ihtiyaca cevap vermelidir. Bu yapımda da tam bir sanatsal yapı gibi tasarlanması gerekir. Bu nedenle kaotik olarak gözüken tüm parametreler bir yapboz gibi en iyi ihtimaller düşünülerek yapılmalıdır. Çalışmamızda Türkiye'deki 81 idari ilden biri olan Elazığ ilinin, 1980'lerden 2016'ya, plan parametreleri, imar planı uygulamasından önce olan sınırın belirlenmesinde nazım imar planı üzerinde kaotik bir yaklaşımla incelenmiştir.

Anahtar Kelimeler: Nazım İmar Planı, Kaos Teorisi, Elazığ, 1/5000 ölçek

With the existence of human beings, zoning plans emerged with the idea of using the land more regularly and efficiently with the transition phase from a nomadic lifestyle to settled life. Planning has emerged as a result of the need to create common areas where people can socialize and build a house where they can live comfortably.The first studies were born with the improvement of the streams of the Egyptians, while planning was made in Anatolia, where the constructions of castles, inns, baths, caravanserais, and gullies were formed in the Seljuk and Ottomans, places of worship, moratoriums, and open-air theaters were formed in the Roman Era.

With the proclamation of the Republic, cities, towns and towns were started to be established in terms of administration, the people in Anatolia were tried to be settled in these areas after the war, and the settlement policy was followed. In the 50's and 60's, large-scale plans were drawn up for the expansion of modern cities such as Istanbul, Ankara and Izmir, and for the creation of adobe and masonry houses in reinforced concrete construction. With the developing technology, the cadastral works of the country have accelerated, all the lands of the country have been classified together with the coordinating and mapping systems, and mapping bases have been created in the city centers in local based zoning coordinate systems. Today, zoning plans have been created in the light of laws and regulations in a way to respond to the needs under various headings, especially master and implementation.

The concept of planning the process that includes possible problems to reach the desired goals is considered forward-looking and should be followed to decide on the actions with regular work in line with the determined purpose and to ensure the continuity of these actions (Höçük, 2021). The basis of the zoning activities carried out within the framework of the zoning law is the preparation of the zoning plan and the implementation of this plan within a specific program. Regular urbanization of a region, benefiting from infrastructure and superstructure services healthily, bringing it to livable standards by contemporary needs, first of all, make it necessary to prepare, put into effect, and implement a zoning plan and program for the region (Kulaklı, 2014). Implement the zoning plan, it deals with the foreseen actions, the resources they require, and other necessary aspects together, and organizes them in detail in order of priority for certain periods (Tan, 1976). The implementation of the zoning plan is the adaptation of the property texture, for which new usage decisions have been made, to the zoning plan. It is a set of methods that enable all kinds of urbanization activities to be carried out. However, zoning practices are the basic implementation tools in terms of ensuring the formation of modern and livable healthy cities, and they are processes that are carried out based on the methods whose boundaries are specified by the laws and regulations (Terzioğlu, 2015). Settlement areas, the behavior of the people living there, and the relations of people with these areas should be regulated and controlled. It is like a man settling in a place and owning an immovable one in that

place. The issues expressed here are also human rights (Kalabalık, 2002; Terzioğlu, 2015). The open and dynamic structure of cities, which has become more evident as a result of increasing interaction with the outside world, makes it difficult for planners to prepare plans with a long-term perspective. When the changing social-cultural structures and the resulting increasing and changing expectations are added to this, it becomes impossible to ensure the continuity of the design of urban areas (Yavuz, 2017). As a result of the increasing migration from the village to the city, there has been agglomeration in the cities and the damage to the environment has increased considerably, especially with the increase in unplanned constructions. As a result of unplanned construction, urban sewage wastes have caused environmental pollution, and unregistered and irregular settlements called slums have increased around the city (Aslan, 2019; Özden, 1997). Although zoning law originates from public law, its effects are immediate and directly on private property. The powers given to the administration in the area of zoning planning and implementation impose restrictions on the property right. Public restrictions on property rights are of such a nature as to provoke a pronounced reaction in society. For this reason, the supervision of such regulations and transactions that put pressure on the property right is of special importance due to the sensitivity of society and the individuals who make it up about property (Çolak, 2011; Topal, 2019). Residential areas are dynamic structures that are constantly changing and renewing themselves. While the urbanization movements experienced throughout the world have eliminated some settlements over time, it has also led to the emergence of some new settlements. However, different definitions have been introduced to the settlements with distinct. The most obvious distinction between settlements was in the rural-urban title (Onur, 2020). Implementation tools (laws and regulations) developed in parallel with the planning periods affect the urban form and the formation of urban textures. When Türkiye's urbanization experience is examined, it can be said that the laws are periodically very strict and restrictive or they consist of a series of regulations for the legalization of spontaneously developing textures (Karadeniz, 2020). Zoning plans are the most important tools that organize urbanization. The functions determined by the zoning plans enable the citizens to have a more organized living space. It is an important tool in controlling the city with a certain mechanism so that it can grow and develop in the future (Ebevi, 2021).

Theoretical framework and scope

During the preparation of the plans, some ordinary or extraordinary factors such as unpredictable population movements, socio-economic changes, and increasing social needs may require the modification of the zoning plans (Şen, 2000; Yavuz, 2017). These may lead to the urban space's changing density, and the legislation's development regarding the relationship between land use decisions and the transportation network was examined. It is seen that during the preparation of the zoning plan, the necessity of analyzing transportation is stipulated, and the criteria and techniques are not defined. If an increase in building density is envisaged in the case of a zoning plan change, standards for the social and technical infrastructure areas that will serve the increased density for the population to be added to the area are defined. In case of an increase in the number of floors with plan changes, there is a provision regarding the necessity of providing a minimum distance between opposite building facades (Tatlı, 2017). Even after the plans are prepared, approved, and implemented, interventions can be made in the face of unexpected situations related to demographic, economic, socio-cultural, and political structures (Ersoy, 1997). Interventions to zoning plans are made through plan revisions or plan changes. Plan revisions or changes; enable functional, contextual, visual changes, and changes in density decisions to occur (Ünlü, 2006). Sometimes one of these changes can be made at the same time (Tatlı, 2017). The function of the land plots to be used and land use decisions are primarily shown in these plans. Planning is carried out on the plots

determined by following the main decisions given on the land use in these plans (Palamutoğlu, 2019). According to the principle of gradual coexistence of zoning plans, the next level of 1/1.000 scale implementation zoning plans is the 1/5.000 scale master zoning plan. This plan should also be compatible with the 1/25000 scaled plan at an upper scale. With a clearer explanation; each plan is supervised by a higher scale plan. In the transition to 1/1000 scale plans, 1/25000 scale plans are insufficient; A master development plan with a scale of 1/5000 should be prepared (Palamutoğlu, 2019; Yanık, 2015). The sustainable urban development approach emphasizes the participation of local stakeholders in urban policy processes by associating environmental, social, and economic dimensions with each other in urban scale and content to ensure the of cities. The Aalborg Charter, includes social equality, economies, and environmental sustainability objectives (Gedikli, 2017; Kayahan, 2019). Density zoning is related to the population in the zoning area. As in altitude zoning, zoning is done by considering the usage area in density zoning (Kaya, 2020). While the vertical limitation is related to the height zoning, the horizontal limitation is related to the parcel surface area and dimensions, the area occupied by the building within the plot, and its location in the plot (Kaya, 2020). The distribution process can be carried out easily in cases where the cadastral parcels coincide with the zoning parcels. For example, in some cases, there may not be any zoning parcels vacated from the regulatory partnership share (DOP) near the relevant cadastral parcel for the distribution of the owners of any parcel in the project area, which is in the public area or where the cadastral and zoning plans do not overlap. In such cases, the distribution process should be carried out in such a way that the number of shared parcels is minimal, taking into account the values of the share areas of the owners in the parcel to be distributed. In cases where the shares are high, the manual distribution process is technically very difficult. As they move away from the cadastral parcel, the land owners do not accept this situation (Koç, 2020). While the master zoning plan is being prepared, the location of the study area within the region is determined primarily, and the decisions taken in the upper-scale plans regarding this location, which are decisive at the scale of the Master Zoning Plan, are written on the current map. In the second stage, the historical formation process of the planning area is examined. In addition, the elements that make up the aesthetics of the space and define the city image in the planning area today are also determined at this stage (Yıldız, 2021). The zoning plan changes are also a tool that increases the impact of local actors and investors in the urban space. Normally, the development plans prepared for 15-20 years cannot meet the needs in time and conflict with changing conditions in a country like Türkiye, which adopts the plan-based system and has dynamic economic and social fluctuations, as in many developing countries (Kılınç, 2021).

The zoning plans are listed from the upper level to the lower level in the hierarchical order as the country development, environmental order, region, master, implementation plans, revised, location, and additional development plans. Within this hierarchy, land use planning of a country's administrative regions is made. In the study, it was analyzed how the land use planning of a region should be formed as a cross-section and how the master development plans should be formed correctly, and which parameters were taken as the focus and their integration with the method. Master zoning plans are plans that are formed as a universal set that determines the boundaries in the formation of general regional planning, which is formed at a 1/5000 scale as a purpose. That is, it is a form of planning arising from a direct correlation with the population and land living in a region as a parameter. In particular, it sheds light on the plans where the details of the 1/1000 scale, which is the sub-scale, are shown.

The purpose of the master zoning plan, land area surface measurement, and population correlation, the population rate that has increased in the multi-year period are taken as a

basis. The population rate on the existing land as a result of migrations and birth accumulation is carried out by the population-based planning process. As a criterion, at the end of the master plan, in line with the number of floors, precedent values, density type, density value, the size of the household that can be enough per person, the size of the face measurement per flat, the number of households to live in the area, the size of the construction area, area-based parameters. The main points of the direct study have been the correlation between the deterministic and mathematically land-based criteria, which are called chaotic, and the correlation in terms of the population-rate relationship for the formation of perennial residential housing, housing that can be opened for development and other planning equipment by mathematically determining the average increasing population relationship every year. No matter what field chaos is used in, it aims to reach the best solution by evaluating an uncertain situation in light of the main factors.

Material and method

Chaos is complex and disorderly looking, sensitive to initial conditions; It is a phenomenon that occurs in deterministic, nonlinear, time-varying systems (Ablameyko et al., 2003; Fırat, 2006; Williams, 1997). The signs produced by chaotic systems are not like periodic or quasi-periodic signs, their graphics look complex like the graph of noise, and at first glance, it gives the impression that the system does not move in a certain order (Fırat, 2006). The simplest example of chaotic behavior is cigarette smoke. Cigarette smoke has no known differential equation. The movement of smoke takes place at the molecular level. Smoke molecules and air molecules collide, and unpredictable shapes emerge due to the rise of the heated air. Physicists define chaos as *"sensitive dependence on initial conditions".* The concept of the *Butterfly Effect* has emerged depending on this definition. If a butterfly flaps its wings in China, it can be a hurricane in Texas, its motto describes the butterfly effect, and states that very small changes in initial conditions can make a huge difference in the behavior of systems. In summary, the behavior of dynamic systems whose behavior cannot be predicted is described as chaos (Alpar, 2012). The study, emphasizes that the technical definitions of chaos are not easy to understand, first of all, it is necessary to get used to the terms of this subject; briefly includes the first uses and historical definitions of frequently used concepts such as dynamical system, deterministic system, nonlinear systems, fractals, strange attractors, unstable aperiodic behavior, feedback, cyclicity, butterfly effect, turbulence, entropy, self-regulation, dissipative systems, likelihood, and prediction (Egi, 2014).

The answer to this question is that any variable (initial condition) of the system cannot be measured with infinite resolution or error-free. This may not be a problem in linear systems (where the input and output of the system are in constant proportion) where the nuances can be neglected. However, under conditions of chaos in nonlinear dynamic systems, this nuance can turn into a huge difference. This situation leads to the conclusion that the long-term behavior of chaotic systems cannot be predicted (Fırat, 2006).

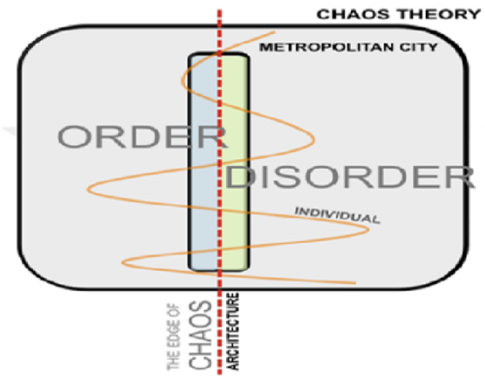

Image 1.
Representation of chaos approach in urbanization with an architectural perspective (Aytekin, 2017).

Image 1 shows the logic of how to take advantage of chaos while making a zoning plan in cities called metropolitan. As an introduction, it is the main scheme of chaotic planning in line with an infinite possibility

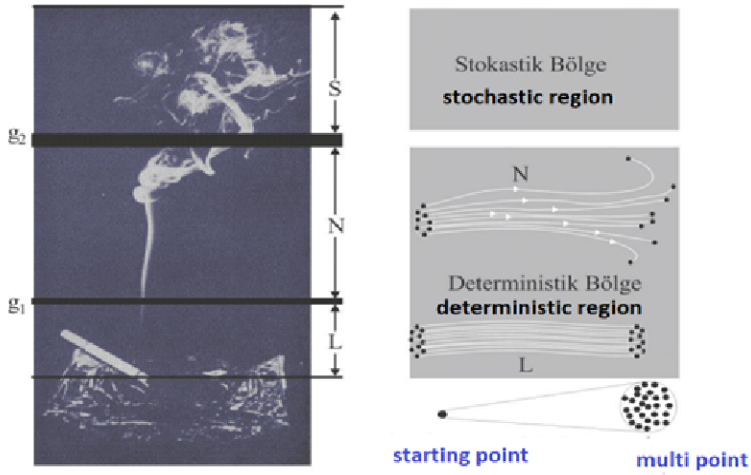

Image 2. Deterministic and stochastic chaos representation (Konkan, 2019) with an architectural perspective (Aytekin, 2017).

according to the number of people and the area ratio of the people in this zoning area. It shows how the basic plan parameters such as housing, commerce, social areas, and green areas can be formed according to the number of people in the input product and the output of the city planning as a result product.

There is a fundamental difference between the concepts of deterministic chaos and stochastic chaos. Deterministic chaos gives the same or similar results of operation within a specified system. It would be more accurate to say that this similarity can be made meaningful. Because the results obtained in the deterministic region constitute a roadmap. In the stochastic region, this roadmap is absent or considered unreadable (Konkan, 2019). As stated earlier, it is considered and interpreted as the state of the universe before ordering and being discussed as the first of things. Thus, it is seen that the productive and creative feature of the concept in dynamic systems is emphasized (Alan, 2019). Therefore, it is not correct to express a chaotic system with complete confusion; some conditions will create order in a chaotic system (Greybe, 2004; Koçel, 2014; Yıldız, 2020).

In Image 2, the stochastic idea emphasizes the construction of the basic parameters of zoning in terms of more distant relations in the chaos approach between the input and the output product as infinity. The deterministic idea shows the planning process by using basic zoning parameters such as houses closer to each other, housing, and trade.

In Image 3, the concept of mutual information was introduced to determine a reasonable value of delay. Contrary to the autocorrelation function, it also takes into account nonlinear relationships (Fırat, 2006; Hegger, Kantz, Schreiber, 1998).

$$I(\mathrm{x};\mathrm{y}) = \sum_{y}\sum_{x} p(x,y)\log\frac{p(x,y)}{p(x)p(y)} \quad (1)$$ (Fırat, 2006).

Here, I(X; Y) is the mutual information function, p(x, y), x, and y are the composite probability distribution functions of the time series, and p(x) and p(y) is the probability distribution functions of x and y, respectively. The first minimum value of the mutual information function is taken as the optimum delay value (Fırat, 2006). That is, if it is called as the definition and value set, from the 1st formula, the amount of land area to

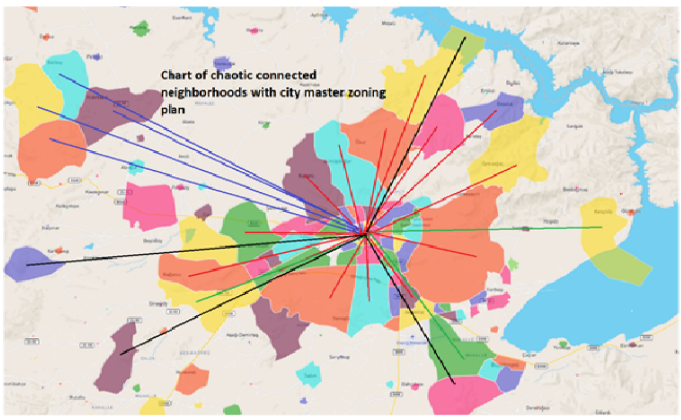

Image 3. The connection between neighborhoods in the city-centered master development plan as chaos (Municipality of Elazığ, 2022).

be selected as the X master development plan with X parameters as the domain set and Y parameters as the value set, and this area selection is the maximum and minimum depending on the annual population growth rate. It is evaluated as an input to the chaos approach, which is a method since it is not expressed in full numbers as the domain, although it is determined by selecting it in a range. On the other hand, in the formula, together with the area limitation in the definition, residential housing, which are the basic planning factors in the area, i.e. zoning islands to protect the existing building stock, development housing area zoning islands to be opened for a new settlement, are distributed chaotically as development input as a result of logarithmic population distribution. As a result of output, the zoning islands are distributed homogeneously within this determined master plan by induction.

In Image 4, a time series can sometimes contain repeating patterns, or its previous values may be related to later values. An autocorrelation function is a statistical tool that measures this relationship is given with (Fırat, 2006; Williams, 1997).

$$C(r) = \lim_{N \to 00} \frac{1}{N^2} \sum_{i,j,=1}^{N} \theta = \theta^{\left(r - |\overline{x_i} - \overline{x_j}|\right)} \equiv \int_0^{\sigma} d^d \sigma' \, C(\vec{r}') \quad (2) \text{ (Fırat, 2006).}$$

For a chaotic attractor, at a certain interval of r, v is C(r)00 rv. Here represents the radius of the circle used to calculate the relation integral. If v, it is called the relation dimension of the attractor. The relation size is equal to one for a periodic system. Conversely, for a chaotic system, the relationship size can be a fractional number. In theory, the relation size of a random system is infinite. Therefore, the relationship dimension can be used to distinguish between random systems and chaotic systems (Fırat, 2006; Van Zyl, 2001).

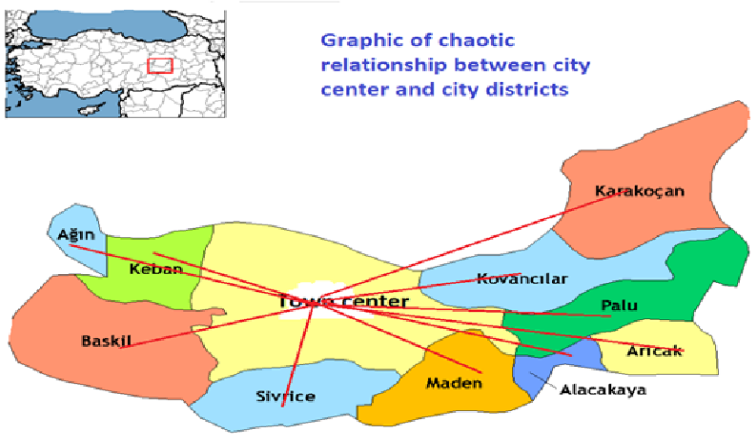

Image 4. Examination of the regional layout of the planning, the holistic city relation before the poem (Elazığ Wikipedia, 2022).

Afterward, as a result of the chaotic land and population relationship of the master plan, the homogeneous distribution of the parcellation part of the zoning islands is evaluated with the logic of infinite range from zero with limit expansion, and the construction precedent values corresponding to the population of the zoning islands without showing the details on the master plan scale, the size per household, the parcel façade and the depths are chaos. A systematic plan is executed by approximating the.

In Image 5, while making a zoning plan, housing, commerce, official institution, hospital, school area, playgrounds, parks, and other social reinforcement islands are created. In these islands, in light of basic factors such as precedent values, the number of floors, height coefficients, and density amount corresponding to the human population, planning is made based on the population that will increase in a long time, and the final product is created.

With induction, the homogeneous zoning island distribution of the master plan is roughly

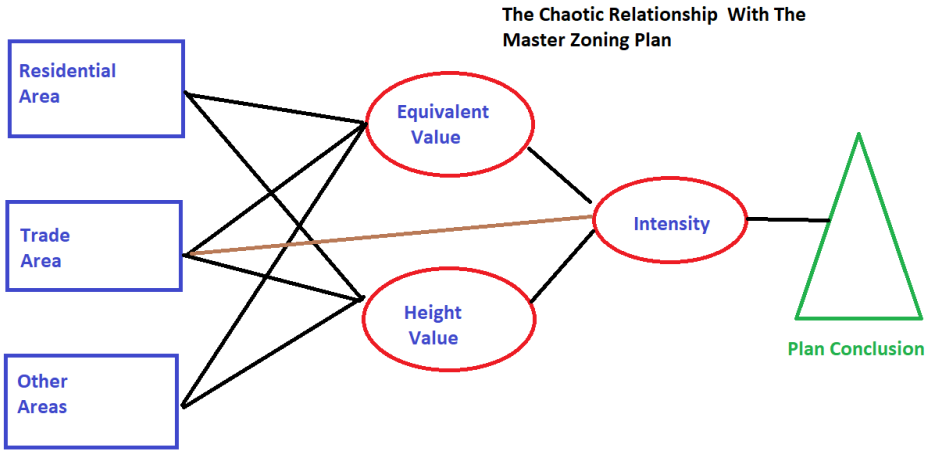

Image 5. The relationship between the parameters in the master development plan

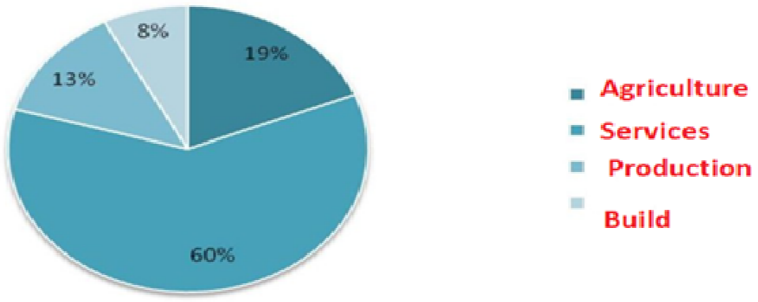

Image 6. Sectoral distribution of employees (Municipality of Elazığ, 2016).

deterministic, that is, in proportion to the area where the population lives, and the details of the islands such as housing, trade, social equipment, and green space are finished as the last criteria to be determined between the development and the final product, and the final product, the master urbanization plan, is formed. The advantages and disadvantages of chaos theory are being able to make an approximate calculation of an event in the mind by thinking abstractly as an advantage. It is done within the limits of being able to do the work. It can be replaced when its convenience is quickly disrupted. The resulting product has not materialized. However, it can be partially subjective at first.

Findings and discussion

In the old zoning plans, an area of approximately seven hundred hectares was arranged in an adjacent order throughout the settlement. In 2016, the adjoining order application was abolished. One of the biggest problems of the settlement is the small/fragmented property structure. The properties in the area are very small. The fact that the old zoning plans allowed independent structures to be built for each property brought about unhealthy housing in the area. Regulations regarding minimum parcel sizes have been made. There is no gradation regarding density and/or floor heights in the old zoning plans. Namely, in some zoning islands, there were three different building orders and the number of floors on the same island. With the arrangement made, the settlement was divided into regions, and the building order, heights, and densities of each region were balanced. In the zoning plans, it has been made compulsory to apply on an island basis in certain regions. In these regions, the properties are small and they are the center of the city. Transportation connections were strengthened in these areas and rearrangements were made. Again, according to the old plan decisions, arrangements were made to eliminate the problems

arising from the implementation, taking into account the regulatory partnership share (DOP) rates. Arrangements have been made for the implementation of court decisions regarding the areas that were allocated to regulation and public partnership share use in the old zoning plan, but which have not been zoned and expropriated in the intervening 25-30 years, and to eliminate the issues that may be subject to a new lawsuit. The east-west connection in the settlement is weak. Arrangements have been made to strengthen this connection (Municipality of Elazığ, 2016).

The settlement is within the scope of the Elazığ, Malatya, Bingöl, Tunceli planning region 1/100.000 scale environmental plan approved by the ministry of environment and urbanization general directorate of spatial planning. The contradictions between this environmental plan and the zoning plans have been resolved. Regions that do not have a sub-scale zoning plan and are arranged as urban settlement and development areas in the environmental plan are included in the zoning plans in line with the opinions of public institutions and other data (Municipality of Elazığ, 2016).

Elazığ center implementation zoning plan revision, by targeting the year 2040, aims to create a sustainable and livable environment in the whole of planning, to protect touristic, natural, and historical values, and to develop a planned development in line with the principles determined in accordance with the sectoral development goals within the scope of our country's development policies. For this, the social, demographic, physical, and economic structure of the region was examined in detail and it was aimed to distribute the investments to the physical space in a balanced way according to the economic and social structure. Alongside this main objective, the aim of obtaining a plan that is feasible and can be developed according to requirements will be considered. In addition to these basic objectives, reaching the data that will create input to the planning and producing plan decisions are among the sub-objectives. This plan covers an area of 12.000 hectares, excluding areas subject to special laws such as conservation areas, protected areas, culture tourism conservation, and development zones, and urban transformation and development areas within the scope of approved master development plans in Elazığ center settlement (Municipality of Elazığ, 2016).

The province of Elazığ is located in the southwest of the Eastern Anatolia Region, in the upper euphrates section, between 400 21' and 380 30' east longitudes and 380 17' and 390 11' north latitudes. Bingöl to the east of the province, Tunceli to the north via Keban Dam Lake, Malatya to the west and southwest via Karakaya Dam Lake, and Diyarbakır to the south. Its surface area is 9,281 km^2, of which 8,455 km^2 is land, 826 km^2 is dam and natural lake areas. Elazığ, which is 1,067 meters above sea level, covers 0.12% of the country's land. 50.69% of the provincial lands are meadows and pastures, 26.95% are agricultural lands, 13.45% are forest-heath lands, 6.88% are Dam and Lake areas, and 2.03% are other lands.

The 2015 urban population of Elazığ central district is 351,504 people. The working population is 82,245 and these are the people residing in Elazığ and working in the settlement. It will be given in the sections where the sectors related to the number and distribution of the workforce area examined (Municipality of Elazığ, 2016).

In Image 6, considering the working population in terms of sub-sectors and number of employees, 24.78% of the employees are in commerce, 18.12% in agriculture and livestock, 14.82% in administrative and official institutions, 10.90% in the education sector, 7.36% in the construction sector, 7.30% u work in small and medium sized industry, 5.32% in transportation, 5.09% in industry, 5.61% in the health sector and

0.70% in the tourism sector.

In the central district of Elazığ, residential areas are located in the middle of a bowl-shaped topography as a result of the increase in heights from the center to other directions. The highest areas in the central district are the areas to the east of the settlement, and the contour of these areas is located at 1515, 1470 in the southern parts, 1345 in the northern parts and 1135 in the western parts. The lowest places of the province are the areas where Kesrik, Aksaray, Olgunlar and Sürsürü districts are located. The lowest contour is 1005 in Aksaray district, 1040 in Olgunlar district and 1060 in Sürsürü district.

There are 37 neighborhoods that make up the central district of Elazığ. These neighborhoods are: Abdullah Paşa, Akpınar, Aksaray, Ataşehir, Bizmişen village, Cumhuriyet, Çarşı, Çatal Çeşme, Çaydaçıra, Eastern City, Esentepe, Fevzi Çakmak, Gümüşkavak, Harput, Hicret, Hilalkent, İcadiye, İzzetpaşa, Karşıyaka, Kırklar, Kızılay, Culture, Mustafapaşa, Nailbey, Olgunlar, Rızaiye, Rüstempaşa, Tuesday Baba, Industry, Sarayatik, Sürsürü, Ulukent, University, Yemişlik village, Yenimahalle, Yıldızbağlar and Zafran. In these neighborhoods that make up the settlement, 351.504 people live in 93,294 households.

Table 1. Land use table in the scope of the current map

Uses	Available Area (Ha)	Area Ratio (%)	Person/ m^2 (351.504 People)
Total Housing Areas	1385.07	6.35	39.40
Preschool Education Areas - Kindergartens	4.46	0.02	0.13
Primary School Area	31.23	0.14	0.89
Middle School Area	13.02	0.06	0.37
High School Area	27.52	0.13	0.78
Vocational Training Area	8.63	0.04	0.24
Non-Formal Education Area- Special Education Area	3.95	0.02	0.11
Private School Area	1.23	0.01	0.03
Higher Education Area	126.55	0.58	3.60
Official and Administrative Institution Areas	143.78	0.66	4.09
Municipal Service Areas	5.56	0.03	0.16
Health Facility Area	64.73	0.30	1.84
Social Facility Area	17.08	0.08	0.49
Cultural Facility Area	3.07	0.01	0.09
Religious Facility Area	16.44	0.08	0.47
Military Fields	216.13	0.99	6.15
Trade Areas	105.16	0.48	2.99
Wholesale Trade Areas	6.43	0.03	0.18
Market Area	0.51	0.01	0.01
Industrial Area	44.94	0.21	1.28
Small Industrial Site	41.99	0.20	1.19
Storage Space	19.84	0.09	0.56
Gas Station	5.15	0.02	0.15
Auto Terminal	2.75	0.01	0.08

Station	2.95	0.01	0.08
Urban Green Spaces	59.48	0.27	1.69
Entertainment and Recreation Areas	1.80	0.01	0.01
Protected Areas-Historical Areas and Ruins	2.79	0.01	0.01
Sports Fields	33.95	0.16	0.97
Cemetery	118.34	0.54	3.37
Wooded Areas	34.19	0.16	0.97
Vineyard-Garden Areas	1026.84	4.70	29.21
Farming Areas	6611.42	30.30	188.09
Barren Land	9996.66	45.82	284.40
Empty Building Plots	33.79	0.15	0.96
Urban Empty Spaces	325.86	1.49	9.27
Technical Infrastructure Areas	10.10	0.05	0.29
Stream - Channel and Stream Beds	74.70	0.34	2.13
Within The Urban Area Boundary	5.20	0.02	0.15
Parking and Passenger Stops	6.77	0.03	0.19
Railway	44.51	0.20	1.27
Highway-Urban Access Roads	1132.44	5.19	32.22
Total	21817.01	100.00	620.68

It is the land use table created by bringing together the land use values created from the information obtained from the on-site land use studies within the scope of Elazığ Revision-Additional Zoning Plan studies. The values in the land use table given above reveal the current land use values and settlement pattern of Elazığ province. When the values in this table are examined, it is seen that the uses with the highest area within the scope of the land use study are barren land, agricultural areas, existing residential areas and roads. The total usage area determined for the Elazığ central district settlement is 21,817.01 ha. The land use within the urban area border is 4407.92 ha, and the land use area outside the urban area border is 17409.09 ha.

According to the population projection calculation made for the central district of Elazığ in the Malatya, Elazığ, Bingöl, Tunceli environmental plan with a scale of 1/100,000, the population of the central district was determined as 1.00,000 for the projection year 2040. The revision and addition of the master zoning plan prepared for the whole of Elazığ center was needed in line with the following issues.

In 2001, 1/5,000 scaled master development plans for the whole city were approved. After this date, regional plan revisions and additions were approved in regions such as Şahinkaya, Baskil road, Hilalkent, Abdullahpaşa, Güney Ring Road, and Doğukent. These plans are independent of each other, and contain different decisions and plan notes. Except this; In Şahinkaya region; The development plans have been approved by the Housing Development Administration for the sole purpose of profit, without considering the city's plan integrity, development direction, and trends. In addition, after 1989, plan changes were approved in almost every region, which increased the population density by increasing the floor on the basis of parcels or did not change the population density by increasing the building density. All these changes, additions, and regional revisions have eliminated the integrity of the plan.

The changes and developments that have occurred in our country and therefore in the settlement of Elazığ over time have revealed new needs in terms of urban, social and

technical infrastructure.

The 1/100,000 Scale Environmental Plan for the Elazığ, Malatya, Bingöl, Tunceli planning region, covering the center of Elazığ, was approved by the ministry of environment and urbanization general directorate of spatial planning on 02.04.2012. Later, revisions were made in these plans on various dates. These changes should include fundamental changes for Elazığ and the sub-scale plans should be made compatible with these plans.

Primarily, research and evaluation reports were prepared during the preparation phase of the zoning plan. In these reports data obtained from institutions, on-site field studies and inventory studies were used. In this context, the boundaries of the settled area where the existing settlement is determined have been established. This settled area boundary has been prepared based on land use and inventory studies. The residential uses in the master zoning plan are also classified based on these settled area boundaries. Namely, the residential areas within the boundaries of the settled area are marked as residential housing areas, and the residential areas outside the boundaries of the residential area are marked as development housing areas. After this study, the residential blocks were divided into groups according to the density grading determined in the spatial plans construction regulation. The center where the traditional texture is located in the planning area is marked as commercial area. The construction conditions for these areas will be determined in the sub-scale zoning plans. However, it should be essential not to disturb the existing building order. At the beginning of the problems in the Elazığ settlement is the compression of the trade in a narrow area. A traditional center phenomenon was formed in the settlement. Gazi Avenue and Vali Fahribey Avenue and its close region are adjacent to this traditional center and are the development axes of commerce. However, these areas are insufficient. The commercial axes developing around the street are limited to two main streets. It cannot assume a regional trade function. The university and public institution areas located in the west of the center also caused the commerce that developed along the street to be interrupted at one point. For this reason, in the master development plan, in addition to the traditional center, it is foreseen that the old ring road (Old Elazığ-Malatya Road) and Kıbrıs Şehidi Mehmet Güçlü Street in the north and Namık Çiftçi streets will develop in mixed use as commercial and residential. In addition, in the western regions where the new texture of the settlement is formed, it is foreseen that trade and housing will develop along the Malatya road and Keban road. The plan decisions regarding these areas should be determined in the implementation of zoning plans, taking into account the characteristics of the area and the existing texture.

In residential areas, the transportation axes in the existing densely populated areas have been rearranged. The streets, which are 8-10 meters in these areas, have been rearranged to 15 meters. These regions are marked as high-density residential areas in the master development plans. The plans were constructed in such a way that the densities decrease as one moves toward the city periphery. The regions marked as vineyard-garden areas in the approved plans are marked as sparsely populated residential areas in the master development plans. Again, the areas of public institutions and organizations are marked on the master development plans. Especially the Fırat University campus and the public institution areas to the south are a threshold that separates the old settlement from the new settlement. The military areas in the northeast of the settlement are also marked on the master development plans. The logistics center, which is marked close to the airport in the environmental plan, is marked on the master development plans. Again, the cemetery area in the east of the settlement was processed on the development plans. To the west of the settlement, a university campus area has been reserved for a new university, which is still being established. To the east of this university area, official institution areas are

reserved. In the master zoning plan, three different regions were opened as housing development areas according to the old zoning plans. These are the low-density residential development areas located in the north of Zafran, the north of the Keban road in the west of the settlement, and the residential development areas located between the Baskil road and the Malatya road. Except for these three regions, no additional zoning plans for large-scale housing were made in the approved master zoning plan. However, within the scope of the environmental plan, additions were made in order to ensure the integrity of the island/plot or region in terms of plan integrity.

That is, in table 1, the number of people who will fall on the area on the ground of the zoning planning is based on the total number of people, and the area-based ratios of the main parameters that will meet the current need, such as housing, trade, green space, official institution areas, and the intermediate parameters such as cemeteries, tourism, culture. Since these ratios are approximated chaotically, the best accuracy based precision ratio may vary.

Table 2. Spatial distribution of uses included in the master zoning plan

Land Use Distribution of ELAZIĞ Master Zoning Plan		
Domain Name	Area (Ha)	Ratio (%)
Housing Areas		
Residential Low Density Residential Area (51-150 Person/Ha)	153.35	1.28
Residential Medium Density Residential Area (151-300 Person/Ha)	1270.82	10.59
Residential High Density Residential Area (301-600 Person/Ha)	192.96	1.61
Development Sparse L. Housing Area (Under 50 Person/Ha)	546.68	4.56
Low Development Housing Area (51-120 Person/Ha)	201.97	1.68
Development Central Housing Area (121-250 Person/Ha)	883.94	7.37
Development High Housing Area (251-400 Person/Ha)	351.82	2.93
Urban Work Areas		
Tick Area	464.37	3.87
Trading Area	162.05	1.35
Collective Workplaces	13.23	0.11
Municipal Service Area	31.16	0.26
Public Service Area	341.54	2.85
Fuel and Service Station Area	15.15	0.13
Logistics Facility Area	77.59	0.65
Industrial Facility Area	14.41	0.12
Storage Area	15.51	0.13
Small Industrial Area	65.97	0.55
Marketplace	13.48	0.11
Military Area	305.74	2.55
Conserved Areas That Will Continue to Continue Today's Land Use		
Forest Area	436.90	3.64
Agricultural Areas	834.39	6.95
Tourism Areas		
Hotel Area	11.61	0.10
Educational Facilities Areas		

Educational Fields	263.74	2.20
Higher Education Facility Area	941.49	7.85
Health Facilities Area		
Health Facility Area	95.7	0.80
Social and Cultural Facilities Areas		
Sports Area	63.33	0.53
Socio-Cultural Facility Area	68.62	0.57
Worship Areas		
Worship Area	58.51	0.49
Open and Green Areas		
Park	1033.66	8.61
Fairground	3.80	0.03
Recreation Area	74.29	0.62
Areas to be Forested	1183.23	9.86
Property Place	30.98	0.26
Cemetery Area	76.61	0.64
Technical Infrastructure Areas		
Technical Infrastructure Area	3.06	0.03
Water, Wastewater and Waste Systems		
Water Surface	50.21	0.42
Waste Water Plant	8.38	0.07
Transportation		
Roads	1549.69	12.91
Car Park	11.98	0.10
Intermediate Station	55.60	0.46
Terminal	22.48	0.19
Total	12.000.00	100

In Table 2, some assumptions were made while calculating the precedent values or the number of floors to which the density values specified in the master zoning plans would correspond in the implementation of zoning plans. These assumptions and explanations regarding the acceptances and the calculation method are as follows. The projection year of this plan is based on 2040.

Household size, according to Turkish Statistical Institute (TUIK) 2016 data, while the household size was 4 people/household in 2012 in Elazığ, this ratio was 3.7 persons/household in 2014. While this rate was 3.7 in 2012 in Turkey, it was 3.6 in 2014. Based on these data, it can be said that the difference between Elazığ province and Turkey average in terms of average household size is gradually closing. In addition, considering the fact that the rural population of the province is included in the analysis of household size, the area subject to the planning covers the city center and the rural households are more crowded than the ones in the center, it can be assumed that this difference is even less in terms of planning area. Assuming that this downward trend will continue with a decreasing momentum both in Türkiye and in Elazığ, it is predicted that the household size will be 3 people/ household in 2040.

Housing size, with the industrialization that started in the 1950s in our country and the

effect of migration from the village to the city, people preferred to live in small houses with insufficient infrastructure, and low comfort. Because according to the conditions of the period, the priority was only to have a place to live and to earn a living. However, after the 1990s, with the increase in the standard of living, harmony with the world countries and the increase in the level of education, preferences began to change. Accordingly, expectations and needs in urban spaces have also changed. People have started to prefer healthier, more comfortable, infrastructure and bigger houses. Currently, the preferred housing size is 140-150 m^2 on average, while it is predicted that this ratio will be 160 m^2 at the end of the plan period (Municipality of Elazığ, 2016).

Spatial plans construction regulation, according to the spatial plans construction regulation, the densities specified in the master development plan express the gross densities.

Spatial plans are in the construction regulation**:** It is the number of population per hectare of gross building area. The gross building zoning area is the sum of all the zoning parcels and the green areas required by them for their own use, urban social technical infrastructure areas and the areas of interior roads. In this context, it is necessary to make a precedent calculation by making regulatory partnership share (DOP) and public partnership share (KOP) deductions in the transition to the implementation zoning plan in the master zoning plan. Calculations should be made with the assumption that the DOP and KOP ratios cuts will be at least 50%.

Interruption rate, according to the spatial plans construction regulation, although it is mentioned that calculations should be made as if the DOP and KOP rates will be taken into account in the application development plans, due to the reasons such as the preparation of the plans in the digital environment and the separation of almost all of the equipment in the master development plans, today's master development plans and application development plans There are small differences in the area between the plans. Large-scale differences emerge only when master development plans are made at a 1/25,000 scale. In this scale, it is not possible to show all kinds of functions or usages as a requirement of the scale. Most uses can only be shown symbolically and cannot give a clear area. Since the Elazığ center, Revision-Additional Master Plan was prepared at a scale of 1/5,000, it is possible to show the uses spatially. In other words, functions can be represented not schematically, but in a way to express clear areas to a large extent. For this reason, the calculation was made by assuming that there would be a maximum 15-20 percent cut in the transition from the master zoning plan to the implementation zoning plan.

According to the previous table available, the display of the zoning plan parameters between the land and the person at the 1/5000 level is as in Table 2.

Calculations, in this context, the equivalent value or the number of floors that the density ranges specified in the spatial plans construction regulation will correspond to in the implementation development plans of the 10,000 m^2 housing area included in the master development plan has been calculated as follows:

Table 3. For residential housing area

Density Type	Density Value(Person/Ha)	Household Size (Person)	Interruption Rate	Gross Area (m^2)	Clear Zone (m^2)	Flat Size(m^2)	Number of Houses to Live In The Area	Total Construction Area (m^2)	Equal Value Number of Implementation Zoning Plan	Number of Floors Corrected In The Implementation Zoning Plan
Very High	601 Over	3.0	17	10000	8300	160	200.3	32053	3.8	11
High School	600	3.0	17	10.000	8300	160	200.0	32000	3.7	10
	301	3.0	17	10.000	8300	160	100.3	16053	1.9	6
Middle	300	3.0	17	10.000	8300	160	100.0	16000	1.8	5
	151	3.0	17	10.000	8300	160	50.3	8053	1.0	3
Low	150	3.0	17	10.000	8300	160	50.0	8000	0.9	2
	51	3.0	17	10.000	8300	160	17.0	2720	0.4	1
Rare	50 Six	3.0	17	10.000	8300	160	16.7	2666	-	1

In Table 3, in residential areas, the density values in the master zoning plan will correspond to the number of floors or the equivalent value in the implementation zoning plan. While calculating the values corresponding to the number of floors, the average floor area coefficient Ground Space Index (GSI), (TAKS/Turkish) in residential areas was accepted as 0.35.

On the other hand, in table 3, master zoning plans are plans showing less detail at 1/5000 scale, while implementation zoning plans are plans with 1000 scale and showing more detail. However, it cannot be said that the application development plan is correct without a proper 5000 plan. Therefore, the plan area per person is shown in a density range in the table. The parcels that were previously unsuitable for the construction area (Floor Space Index/- FSI) were transformed into normal construction parcels, and it was ensured that the transaction took place upon the increase in the unit price of the land with a certain deduction over the old parcel. The total precedent corresponds to the construction area to be built on the title deed area on a maximum square meter basis on a parcel. That is, towing distances are drawn on the ground of the plot. The remaining precedent ratio after withdrawal is divided into multiples.

Table 4. Intensity chaos relationship

Density Type	Master Zoning Plan Density Value	Application Zoning Price Value In Its Plan	Application Zoning Number of Floors In The Plan
Very High	Over 601 People/Ha	Above 3.8	11 Floor and Over

High School	Between 600-301 People/Ha	Between 1.9-3.7	6-7-8-9-10 Layers
Middle	Between 300-151 People/Ha	Between 1.0-1.8	3-4-5 Floors
Low	Between 150-51 People/Ha	Between 0.4-0.9	1-2 Floors
Rare	Under 50 People/Ha	0.3 Under	1-2 Floors

In Table 4, the relationship between the density and chaos approach according to the number of floors in a certain density range of the maximum used total construction area on the plot, which we call a precedent, is given.

Table 5. For development housing areas

Density Type	Density Value (Person/Ha)	Household Size (Person)	Interruption Rate	Gross Area (m^2)	Clear Zone (m^2)	Flat Size (m^2)	Number of Houses to Live In The Area	Construction Area(m^2)	Equal Value Number of Implementation Zoning Plan Number of Floors Corrected	In The Implementation Zoning Plan
Very High	401 Person/ Ha	3.0	20	10.000	8000	160	133.7	21387	2.5	9
High School	400 Person/ Ha	3.0	20	10.000	8000	160	133.3	21333	2.4	8
	251 Person/ Ha	3.0	20	10.000	8000	160	83.7	13387	1.4	5
Middle	250 Person/ Ha	3.0	20	10.000	8000	160	83.3	13333	1.3	4
	121 Person/ Ha	3.0	20	10.000	8000	160	40.3	6453	0.7	3
Low	120 Person/ Ha	3.0	20	10.000	8000	160	40.0	6400	0.6	2
	51 Person/ Ha	3.0	20	10.000	8000	160	17.0	2720	0.3	1
Rare	50 Person/ Ha	3.0	20	10.000	8000	160	16.7	2667	0.3	1

In Table 5, this context, the density values in the master zoning plan in the development housing areas will correspond to the number of floors or the equivalent value in the implementation zoning plan will be as follows. While calculating the values corresponding to the number of floors, GSI coefficient (TAKS) in the residential areas of development was accepted as 0.30.

The total construction area range of the development area is given with the expansion of the new zoning border, except for the existing area in the center.

In Table 6, it is understood that in the previous table, the density in the old, that is, the current city center, is 600, and the valuation based on person area will give correct results. It seems that the new places to be opened for development are kept in the range of 400 person-based areas with less density. In line with this person area ratio, GSI which is called the usage rate of the land area on the ground, shows how many floors the total construction area will be allowed according to the islands, in this way, with a chaotic approach, in line with the earthquake resistance and durability parameters on the ground.

The zoning plan, which will consist of all the equipment to be considered as a subset made in line with the 5000 master plan, is the last image form.

Table 6. Number of density floors chaos approach

Density Type	Master Zoning Plan Density Value	Price In Implementation Zoning Plan Value	Floor In Implementation Zoning Plan
Very High	Over 401 People/Ha	Over 2.5	9 Floors and Over
High School	Between 400-251 People/Ha	Between 2.4-1.4	5-6-7-8 Floors
Middle	Between 250-121 People/Ha	Between 1.3-0.7	3-4 Floors
Low	Between 120-51 People/Ha	Between 0.6-0.3	1-2 Floors
Rare	Under50 People/Ha	0.3 Under	1 Floor

Conclusion[2]

In the light of the master plan results, the following data has been reached in the planning as a result of a chaotic taxonomy in line with the amount of area that will correspond to the population of the zoning islands to be created within the determined zoning boundary, which appears as chaos.

- A total of 1.28 low, 10.59 medium, 1.61 high residential areas in low, medium and high residential areas, on a hectare basis, have been left within the 100 ratio of the plan determined to protect the old areas of the existing area, corresponding to this ratio.
- In the areas to be opened for new settlements, the rates in the determined region were determined as 4.56 sparse, 1.68 low, 7.37 medium and 2.93 high development residential areas, taking into account the displacement of four different types of population. On the other hand, the amount of space sufficient for the needs of the population in the region was met with a ratio of 12 percent.
- Out of a hundred percent, especially 8 and 12 percent planning was left to parks and roads.
- In the planning that will coincide with the year 2040, a portion of approximately 52 percent is left to areas such as all social facilities, education, official institutions, places of worship, soup kitchens, tourism areas, cultural areas, waste, drinking water, etc. adopted approach.
- In addition, residential and development housing areas were made more concrete, and the criteria were taken as less than 0 infrequently, 50 to 150 low, 150 to 300 medium, 300 to 600 high residential areas in terms of number of people, and this criterion is less than 50 rare in developing housing areas. Between 50 and 120 people are classified as low, between 120 and 250 as medium, between 250 and 400 as high when there are numbers of people to accommodate, and over 400 as very high. Thus, the final product part has

[2] The authors declare that there is no conflict of interest regardingthe publication of this paper and the availability of data and material is not applicable.

passed from deterministic to concretization. In addition, the number of people, the equivalent value and the number of floors were determined on the basis of area.

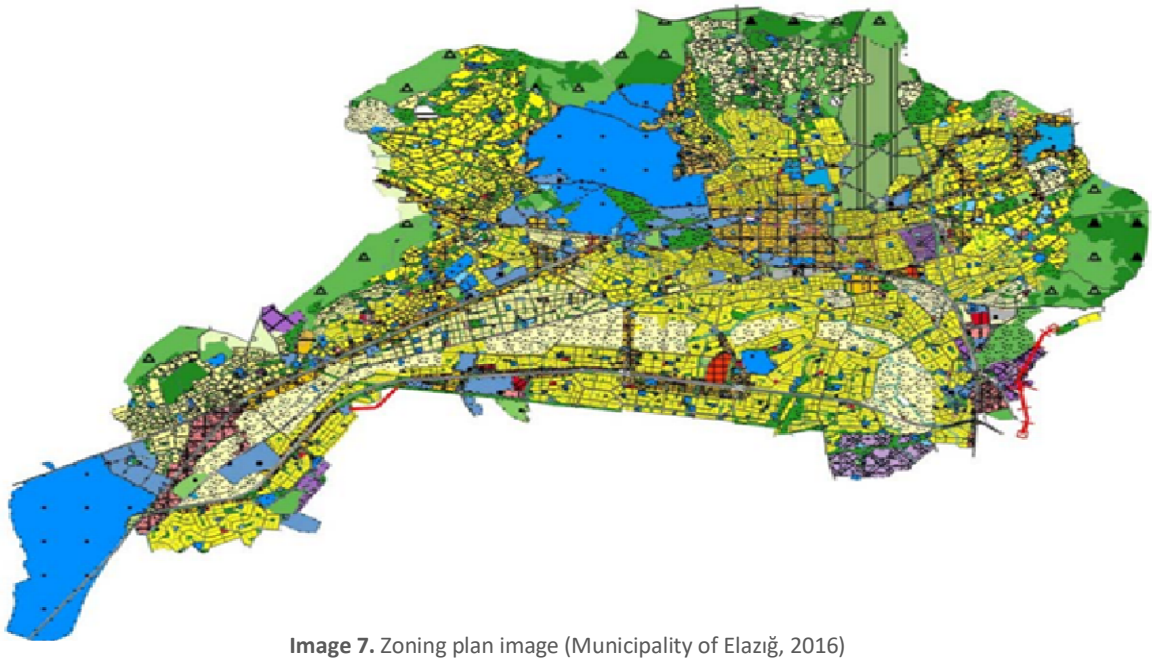

Image 7. Zoning plan image (Municipality of Elazığ, 2016)

In a planning about the use of an area in Turkey, first of all, events that seem irregular are explained with the help of verse, area density, precedent, and number of floors parameters on a local basis. These functions, which seem complicated at the beginning, are made meaningful and the residential, commercial and other areas that may correspond to the population amount that may occur in the 30-40 year period are determined. In the study, how to make a master development plan until 2040 on a medium scale basis and its justification were examined.

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