Implementation of Urban Planning Parameters for the Needs of the Spatial Planning Process in Kosovo

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Abstract: - This paper consists of finding a way to implement some norms of urban planning in the process of drafting the urban development plan, that in are ignored in many cases. The plan is considered a development process to be carried out in several phases, such as the analysis of the existing situation, the vision provisions, and its implementation for the specified period. Based on the development program, the future functions of the city are determined, its increase at the end of the foreseen planning period, and the completion of new material elements of the city. All these predictions in the urban development plan should be realized in the foreseen period. For this reason, the program must rely on preliminary testing, analysis, and budgeting.

Key-Words: - Planning, city, land use, sustainable urban, parameters, building.

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1 Introduction

These last two decades, after the 1999 war, Kosovo has experienced significant changes in social, economic, and political life. These changes affect the field of planning has a direct or indirect impact. The changes directly or indirectly affect the field of planning, especially in the development of cities. “Cities need more than ever to be sustainable and should offer the kind of quality of life and opportunity that make people want to live in them”. (European Union, 2010). The urban development plan relies on three main planning components: basic spatial organization, nature conservation, and historical cultural values of a particular territory. This, in the first place, means the assessment of the territory and the method of use of land within the settlement, ranging from the country's capital to the smallest habitations with functional characteristics. The Urban Development Plan as a document is drafted by the projection office registered for drafting of spatial plans, whereas the municipal assembly approves that document for at least 5 years and at most 20 years. The document consists of a graphical part that is derived from the basic state map of large scale, and today the latest orthophotos are used based on which the digitalization of the objects and all the spaces needed for evaluation is done, as well as the textual part that contains: entry, plan objectives and implementing provisions.

The main purpose of this paper is to present a model for the application of urban parameters in the spatial planning requirements of a certain territory. The basic framework of general orientations for socio-economic development and the assessment of environmental impacts is achieved with general orientations with spatial planning plans For this case study, the treatment of the city of Kaçanik was used as a model, the analysis of this study was based on the demographic movement, the way and manner of land use, the way and form of city construction, etc. The implementation of control parameters in urban and regional development plans is a necessary action, with the sole purpose of having a rational use of urban land. This is in full harmony with the concepts of sustainable development, [1]. Sustainable cities are developed based on several important criteria, such as integrated land use, and high density, [2]. Variety of activities, [3], mixed land use, built environment and compactness [4], Sustainable transportation [5], the density of construction and the 'greening' of the city, and the integration of society with nature, [6]. Building

density is one of the most important parameters of urban planning. The building density must be fully compliant with the road, technical, social, educational, road, technical, social, educational, etc. infrastructure parameters. In addition, the density of the building must also ensure the fulfillment of other conditions such as; natural lighting, ventilation, fire extinguishing, etc.

Plans can be considered assets of agendas, policies, designs, and strategies for physical development, summarized in a 'two-dimensional layout of the physical form of the city'; urban development regulations are binding rules concerning 'what is built, where it is built, and when and how it is built', [7]. Generally, these take the form of land use regulations, zoning ordinances, and building codes. Such regulations generally have the force of law, unlike master plans, which city councils consult, [8]. Well, there is a strong need for an integrated national policy, a strong need for special development control mechanisms, a moderately strong need for a separate format for preparing the Development Proposal Report, a moderate need for special planning standards, and some support for revising the present town and country planning to satisfy the town development, [9]. The elements needed to formulate measures adapted to the needs of society are being designed to ensure the consolidation of the urban morphology. This can be seen in the historic centers, [10].

In Kosovo, spatial planning control is also carried out through the building permit. This permit is required for any construction work inside or outside the settlement. It is a combined planning and building control system, that regulates the construction and demolition of buildings, as well as the change of land use. However, in most cases, these rules on the ground are overlooked, avoiding standards. Consequently, most of our cities have been caught by chaos, especially after the last war in Kosovo in 1999.

2 Literature Review

Decision-making in the spatial planning process is focused on spatial planning theories, laws, and systems, but they do not dealing with concrete issues regarding urban development. Cities are complex organizational systems, where for sustainable development and efficient use of urban areas, the interconnection of theories, planning laws, and spatial planning parameters is required. For sustainable urban planning, it is required to have: efficient land management, adequate infrastructure, protection and services, [11].

In the process of drawing up urban development plans, and other development plans, the parameters of urban planning are important, such as population density calculations, calculation of the population size at the end of the forecasted period, the way of land use, the coefficient of construction, etc. Many authors have addressed all these problems.

The application of urban parameters and development control mechanisms helps in the realization of urban centers with sustainable development. To improve the living environment, such as transport system, public safety, minimization of negative externalities, efficiency of land use, equal access to urban land, social welfare, etc.

Population projection techniques can be simple and straightforward or exotic and complex, [12]. A very important indicator is the population density that can be predicted from population projections. Many demographers developed an innovative approach and described a model of population density. It concludes that past growth rates, and population density, measured in people/ ha, affect population changes, affect population changes. At different stages of the community life cycle, maximum population density changes and growth decline results. Under this model, communities progress through the initial stages. Maturity and decline are each represented by mathematically derived critical density ceilings. Because its output is expressed in persons per hectare, and population is established by multiplying that figure with the current area of the community, the model can account for annexations or their boundary changes. It also allows what-if analysis that produces different results depending on where the community is in its life cycle and how the analyst categorizes the community with calculated projected parameters, [13]. A low level of economic development, which leads to emigration of the young members of society, is among the major factors causing population decrease. Development controls such as growth control lower the urban population growth path and thus create smaller cities; this eliminates congestion and overcrowding and thus has a welfare-enhancing effect on the residents of the city, [14]. This happens also in Kosovo in general and in the Municipality of Kaçanik in particular.

Many authors have described the application of density measures in urban planning and regulation. "Accommodation density", or the number of habitable rooms/acre, is problematic because the number of persons per room is not taken into account, and the definition of "habitable" rooms is

vague. Similar problems damage the habitable floor space/ha index. Population density fails to reflect concentrations of people (as in high-rise structures) but divided by accumulation density it can produce an occupancy rate (persons per habitable room). Stein notes that a common characteristic of all density measures is their inflexibility, both in reflecting spatial differences (concentration of dispersion) and temporal ones (differences between daytime and nighttime use).

3 Data and Methods

The number of the population should be calculated in the process of drawing urban or even regional plans. The time of this calculation can be 20 years. The drafting of spatial plans can be for long periods, as well as for short periods of time. Urban plans are drawn up for short periods, which enable long-term development of the city. The number of populations should be calculate for the data of the planned period. The calculation will done according to this equation:

$$Pn = Pe \times (NGr + Gm) \times Y/100] + 1$$

where **Pn** represents population forecast for n years; **Pe** represents the current number of the population; **NGr** represents the annual rate of natural growth;
Gm represents annual growth by migration and
Y represents a number of years of the design period.

In our study, the population in the city of Kaçanik was calculated for the period 2010-2020. In the drafting of the urban plan, which is required for planning the needs for new housing, infrastructure, social facilities, and green areas, we must know the exact forecast of population growth. To achieve this, standardized urban parameters must be applied. For this, the terms are used: FSR, FSI, FAR (FSR = Floor Space Ratio, FSI= Floor Space Index, FAR = Floor Area Ratio). According to this case, the construction of buildings up to 5 (five) floors is allowed, according to the defined coefficients ISD max= 2.8, IUP= 40%, max= 50% (based on the area allowed for construction).

For high-rise buildings, businesses, accompanying spaces for residents, such as greenery, parking, internal roads, pedestrian paths, recreation, children's activity corner, etc., and objective construction up to two floors, the coefficients are determined ISD max= 1.3, IUP= 40%, max= 50%.

In the process of spatial planning, a great importance to discuss is the population density of the city, such as gross density (Db) and net density (Dn). Gross density is expressed by the number of inhabitants per 1 hectare of the city's territory. The density of the city is determined by the size and character of the city, its functional structure, and natural conditions. These affect the number of buildings, such as social and commercial ones, and the way the city is populated. Gross density increases with city size. Thus, the gross housing density is 100-120 inhabitants per hectare for small cities, 120-140 inhabitants/ha for medium-sized cities, and 140-150 inhabitants/ha for large cities, [15].

Whereas, for settlements with health functions that require large green areas, as in the case of bathrooms, the density of housing is low, reaching around 50-60 inhabitants per hectare. These parameters can be used as a guide when calculating the area required for the population. However, as a real measure of residential density, it is taken only based on final forecasts, such as the type of residential buildings, the degree of living space per inhabitant, the size of households, differ in the number of members. Net density, which deals with the residential areas or neighborhoods, is called net density. In the calculation of the net density, the residential complexes are taken into account together with social and traffic ones within the residential area, [16].
According to the number of floors, and the construction method, the net density is estimated. Increasing the number of floors increases the distance between buildings and thus increases the net density. Thus, for example, the net density for the family ground floor building complex in parcels of 400 m2, with an average of five residents per building unit, will provide this result:

$$D_n = \frac{25\ x\ 5}{1.0} = 125\ inhab/ha$$

On the same surface (of 1 ha), in case of elevation of 50 m long multi-storey buildings, at a distance of 20 meters between them, which is the sufficient distance for light, can be obtained the total floor area of 7.000 m^2. If the average gross surface area of 20 m^2 is approved per capita then the result will be:

$$D_n = \frac{7000}{20} = 350\ inhab/ha$$

Also, other factors, such as: the number of buildings, green areas, road infrastructure, social

facilities, etc., determine the net density. As an orientation in the projection phase, in function of sustainable urban development, this percentage can be: 40-50% for a residential complex, 15-20% for social facilities, 15-25% for green spaces, 15-20% for infrastructure. Numbers for population and density of population represent space utilization, which may look like this:

Dn - indicates the number of residents in the built area.

Db - indicates the number of residents with built-up areas and accompanying infrastructure.

To determine the number of floors, you need to know the population density, from this, you can determine the type of housing construction (Figure 1), such as Low-rise buildings with 0-3 floors for 100-200 inhabitants per hectare, tall buildings up to 6 floors are for 300-350 inhabitants per hectare.

In spatial planning, the arrangement of the space and the way of use is indicated by numerical indicators: ***Cc*** - construction coefficient, ***Luc*** - land use coefficient, and ***Dc*** - density of construction (Dc). The construction coefficient is present in this form:

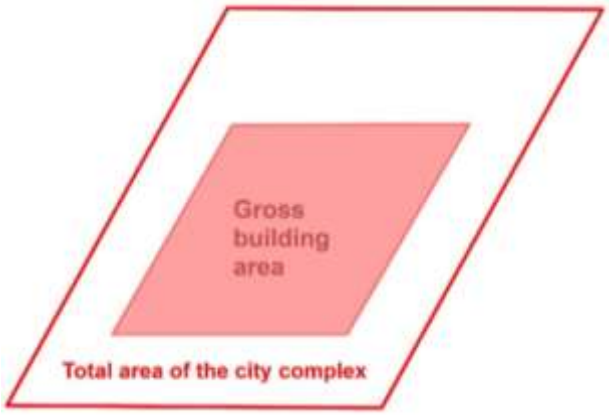


Fig. 1: Zooning parameters (Construction Coefficient)

The construction coefficient is determined by the ratio of the total built area (residential and public buildings) and the total area of the city. Whereas, the construction coefficient can only be calculated for residential buildings or public buildings, gross (total residential area), or net (residential or working area).

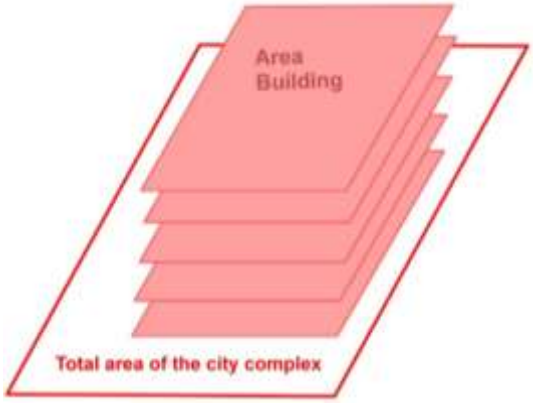
$$Ccb = \frac{Gba}{Ta}$$

Ccb represents the coefficient of city building, ***Gba*** represents gross build-up area (housing, public, economic facilities) and ***Ta*** represents the total area of the city complex. Other authors have also presented ways to calculate the coefficient of city building. Among them is the Weaver-Tomas composite coefficient (WT), which helps us to calculate urban built-up land composite structure quantitatively.

Thus, the percentage of built-up area (apartments and all accompanying buildings) can be calculated in relation to the total area of the city (Figure 2), as follows:

$$Pb = \frac{Sb}{Sq}\ 100$$

Pb represents the percentage of built-up area,
Sb represents the surface of buildings per hectare and
Sq represents the area of the city complex in hectares.



$$Luc = \frac{Sb \times No.\ floors}{P\ (parcele)}$$

Fig. 2: Parameters of land use and construction

The land use coefficient is the reciprocal value of the construction coefficient and shows how much net land area is needed for 1 m^2 of gross built area, [17].

$$Luc = \frac{1}{Ccb} = \frac{Sq}{Gba}$$

In addition, in the spatial planning process, there is also a presentation of the development program, as an important part of the preliminary drafting of the spatial plan, [18], [19].

4 Study Area

Kosovo has an area of 10,905 square km with about 1.8 million inhabitants, located in the central part of the Balkan peninsula. Kosovo is bordered with Serbia in the north and northeast, North Macedonia in the southeast, Albania in the southwest, and Montenegro in the west (Figure 5). It is surrounded

by the mountains, in the east and southeast such with Sharr Mountains, in the west with Albanian Alps, and north with Kopaonik. Kosovo stretches on two plateaus: in the east part is Kosovo at 600 m above sea height and in the western part at 300-500 above sea level is Dukagjini.

We took the city of Kaçanik as a case study. It is located in the south part of Kosova (Figure 3).

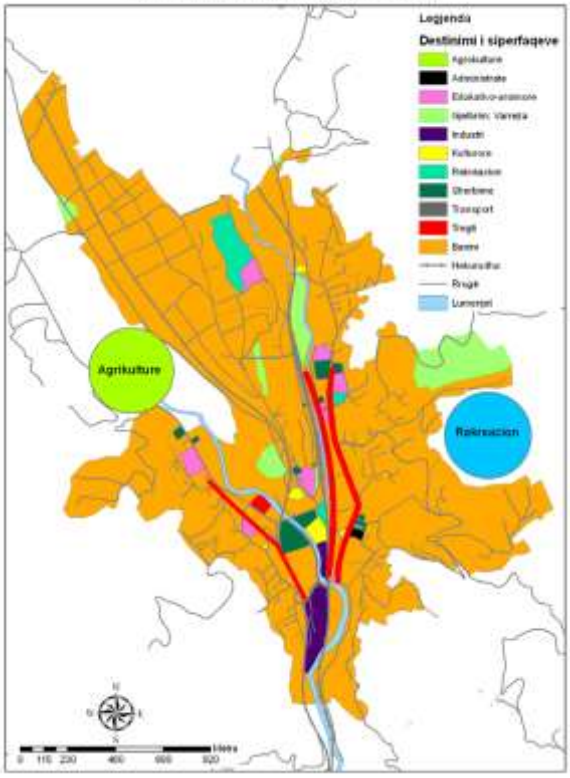


Fig. 3: The Urban Development Structure of Kaçanik Authors' elaboration

It is a small town, the urban area of the city has an area of about 200 ha (Figure 4), with about 13 thousand inhabitants.

Fig. 4: The view of the city of Kaçanik, 2018 (Urban Development Plan of Kaçanik).

Kacanik as a city has been attractive for habitation since prehistoric times, this has been made possible by the convenient position that lies between the mountain systems of Sharri and Karadak [20]. The topography of the relief has influenced this settlement to develop longitudinally along the banks of the Nerodime River.

Fig. 5: The geographical position of Kaçanik in the Republic of Kosovo
Source: Authors' elaboration

To minimize errors in land use, in this paper we have analyzed the implementation of zoning parameters for spatial plans. The data were collected from urban plans, from the field, and supporting literature. Using aerial views and GIS techniques, an analysis of the existing situation, such as the density of the buildings, social facilities, unbuilt surfaces, and land use, have been made. The results are presented in maps, tables, and further recommendations.

5 Results and Discussion

In the process of drawing up spatial plans, the preparation of a sustainable urban program is important. This plan contains elements, such as an analysis of natural conditions and an analysis of social conditions.

Kaçanik urban development plan consists of the general part, vision, and complementary graphical schemes that explain the progress of problem-solving The urban development plan contains all the main current elements and those that will be realized during the projection period. Through the

development plan these basic elements are presented: residential zones with different services, surfaces dedicated to the industry, surfaces designed for rail traffic, with all appropriate stations - passengers, goods, etc., existing and planned areas for the establishment of municipal facilities, existing and planned green areas, the city's main street network, with all types and levels, traffic line network (existing and planned), hydrotechnic network, energy network and reserved area for city expansion for the following projection period.

Spatial planning legislation varies from country to country. The American Planning Association has developed model state planning legislation in its Growing Smart SM Legislative Guidebook (2002). The American Planning Association has developed a legislative guide that suggests required and optional elements such as land use, community facilities, infrastructure, economic development, natural hazards, and agricultural lands. Whereas, in Kosovo, the planning parameters in most urban plans are not practiced properly (Law on Spatial Planning 2009, Kosovo).

Based on the demographic development, the results of the population of the city of Kaçanik are extracted. During the estimation of the number of population the city of Kaçanik by 2020, two basic components have been calculated that directly affect demographic growth such as natural growth and migration:

Thus, for the city of Kaçanik, the population for 2020 was calculated according to the above formula (in the methodology):

$$P_n = P_e \text{ x } (NG_r + G_m) \text{ x } Y/100] + 1$$
$$P_f = 13.450 \text{ x } (1.7 + 0.45) \text{ x } 12/100] + 1 =$$
$$= 13.450 \text{ x } 1.25 = 16.812$$

From this calculation for the year 2020, the number is 16,812 inhabitants, or 20% more than 10 years ago. According to the analysis, the net density is 92 inhabitants/ha, while the gross density is 74 inhabitants/ha (Table 1).

Table 1. Population in the city of Kaçanik in the period 1948-2009

Year	Population	Period	Population index
1948	2,094	1953/48	108,6
1953	2,275	1961/53	128,5
1961	2,923	1971/61	154,4
1971	4,513	1981/71	146,9
1981	6,629	1991/81	147,8
1991	9,800	2009/91	137,2
2009	13,450	2009/48	642,3

Source: [21]

According to the table, it can be seen that Kaçanik has had a continuous increase in population over the years, although not a large increase compared to other urban centers. As we can see in the table, the density is small with about 74 inhabitants/ha. The parameter <100 inhabitants per hectare is not economically reasonable from the point of view of creation and maintenance. The results show us a change in construction, from individual buildings to tall buildings from 4 to 6 floors. This comes out according to the forecast of the city's population with 16,800 inhabitants or 3,360 more inhabitants by 2020, that is, with an increase in the living area of about 68,000 square meters. This will also affect the increase in density in the city center with about 115 inhabitants per hectare. This also affects the increase in the intensity of urban land use with a coefficient of 0.24, which is several degrees higher than in the previous period.

Based on the digitization of all buildings in the city of Kaçanik, it appears that the total area of the built buildings is 36 ha, while the total area of the city is 182 ha. From this calculation, the gross construction coefficient was obtained, which is 0.198.

$$Ccb = \frac{36}{182} = 0.198$$

Based on this methodology and parameters obtained on the ground, the percentage of built space (residential facilities and associated facilities) can be calculated about the area of urban territory, as follows.

$$Pb = \frac{36}{182}\ 100 = 20$$

From the calculation obtained for the construction coefficient, which is 5.0, the area of the building land is very low.

$$Luc = \frac{1}{0.198} = \frac{182}{36} = 5.0$$

The study shows us that the density of buildings is low. This is like the rules that the city develops more horizontally and consists of private houses and gardens. This is a modern planning process and by a sustainable urban development The urban expansion in the horizontal form, in addition to the loss of agricultural land, also affects the increase in the cost of infrastructure investments.

6 Conclusion

The city of Kaçanik is characterized by an urban development that has not implemented urban criteria and parameters, such as coefficient of land utilization, population density, and population forecast.

The urban territory is covered with buildings by about 20%, mainly individual residential buildings with 2-3 floors, collective residential buildings with 8 floors,

The facilities in the city area are covered with 70% of the built surface, this indicates insufficient development of urban functions, and the average size of the space is about 650 square meters. The living area per member is 15.2. m^2/inhabitants, this shows that it is very low by contemporary standards. The city is characterized by a low residential density, the average density is 74 inhabitants/ha, the central area is 93 inhabitants/ha, and the peripheral area is 50 inhabitants/ha. Population growth has increased from 2,094 in 1948 to 13,450 in 2009, or in the period of 6 decades (1948-2009), it increased by 6.4 times.

This can be determined by the small lack of investments, and uncontrolled professional activities, has influenced the city of Kacaniku has have a slow development and irrational land use. Well, the future developments promise changes in urban functions, an increase in the density of housing, the standard of living, and a more rational transformation of plots with urban norms.

Based on the brief overview of the literature and the process of drafting the urban plan of the city of Kaçanik. Through this study, it can be seen that the objective of harmonizing some standard parameters and formulating a model regarding the application of urban control, from the fact that spatial plans represent the basic framework of general socio-economic development orientations, as well as the assessment of environmental impacts.

In this case, the way of implementing the parameters of area control and development, in the process of drawing up municipal spatial plans, and urban and regional plans, has been addressed. The main focus of the analysis is demographic potential, intensity, and manner of land use, form and type of construction. The municipality should focus on sustainable urban development through strategies and the implementation of technical norms of urban planning.

Avoiding mistakes in the design of urban plans is achieved by taking into account the correct projections of the population for the planned period, it helps to derive the needs for new housing, social objects, infrastructures, and infrastructures and by the implementation of the technical nomes of planning. This would help in sustainable urban development with a very efficient management in the protection of urban land, agricultural land, environmental protection, and socio-economic development.

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The authors have no conflicts of interest to declare.