Assessment of Factors Influencing Urban Development; A Case Study of Niğde Ömer Halisdemir University Campus

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Abstract Our cities have been rapidly developing both vertically and horizontally in recent years due to the increasing urban population, advancing technology, and the desire to utilize urban investment areas. The direction of urban development is determined by many factors such as social, cultural, economic, and transportation, which influence and shape the cities' growth. In addition to these factors, structures with high usage attractiveness such as hospitals, shopping malls, sports complexes, and university campuses play a significant role in directing the development of the city. This study evaluates the impact of Niğde Ömer Halisdemir University Campus on the direction of urban development and determines whether it has the potential to accelerate urban transformation and urban sprawl. In the study, the university's historical process was evaluated, and breakpoints where the number of students, faculties, and departments increased in campus development were determined. Based on these breakpoints, the direction of urban development in Niğde city was evaluated using geographic information systems (GIS) and satellite images from the specified dates to assess the development direction of residential areas.
Keywords: Urban Development Direction, Niğde Ömer Halisdemir University Campus, Urban Transformation, GIS, Historical Process

1. Introduction

In recent years, our cities have been rapidly developing both vertically and horizontally due to the increasing urban population, advancing technology, and the desire to evaluate urban investment areas. **The direction of urban development** is influenced by various factors such as social, cultural, economic, and transportation. In addition to these factors, structures with high utility appeal such as **hospitals, shopping malls, sports complexes, and university campuses** play a significant role in guiding the city's development.

Population density increase has led to a surge in the use of agricultural areas, resulting in unplanned urban development. This has caused the degradation of arable lands and a decline in green spaces in both urban areas and the agricultural lands surrounding cities. Migration from rural to urban areas has influenced the direction of urban development. Hospitals, schools, and workplaces in cities have determined the focal points of urbanization.

According to the United Nations 2018 data, 55% of the world's population resides in urban areas, and it is expected to increase to 68% by the year 2050 [1]. Despite having a relatively low level of urbanization on average and significant internal variations, Asia [1]is home to 54% of the world's population. However, the transition from an agricultural and rural-based lifestyle to a clustered one in urban areas does not occur naturally and equally.

Urban sprawl cannot be explained by population growth [2]. In many regions, the population of urban areas is declining, and the reasons lie in the changes in urban lifestyle [3]. Cities in Turkey, including Niğde, are" affected by the increase in artificial surfaces after 1990, especially in the catchment areas of towns and cities.

It allows us to focus on different aspects of urban expansion and urbanization. Urban sprawl leads to the loss of character of surrounding rural landscapes, causing the degradation of natural and agricultural environments, and fragmentation of natural-urban habitats; furthermore, it has adverse effects on ecology and the natural balance.

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The negative effects brought about by unplanned urbanization, starting in cities, affect both the country and the world. The proposed solutions found by people to ease their daily lives have accelerated the destruction of nature. One of these factors is the expansion of construction areas according to institutions to facilitate transportation, which has reduced the amount of green areas. With the expansion of construction areas, the inadequacy of landscaping efforts on roads has become evident. As institutions like universities grow, the increasing number of users has led to a greater need for residential areas. The purpose of this study is to examine the factors influencing the urban development of Niğde Ömer Halisdemir University in Niğde city and to propose solutions.

In this study, the impact of Niğde Ömer Halisdemir University (NOHU) Campus on the direction of urban development has been evaluated, and its potential to accelerate urban transformation and urban sprawl has been investigated.

The university's historical process was evaluated, and the turning point(s) where an increase in the number of students and on-campus buildings occurred were identified regarding campus development. Using these turning points as a basis, the direction of urban development in Niğde was assessed through geographical information systems (GIS) and satellite images from the specified dates to analyze the development direction of settlement areas.

2. Material and Metod

Material

The primary material of the study is constituted as the research area consisting of the Niğde City Center and the NOHU Campus location, which has a positive impact on the development direction of the city. Other materials include satellite images evaluated within the scope of the research purpose and method, as well as the number of students obtained from YÖK Information System for different years, processed using GIS software. In this context, the research aims to (the rest of the text is not provided, so please complete the sentence as needed).

For determining historical turning points:

- NOHU student enrollment data
- Satellite images from Google Earth illustrating campus development

For assessing urban development in Niğde City Center on specified dates:

- Landsat 4-5 Collection 2 Level 1 satellite image dated 14.08.2008
- Landsat 8-9 Collection 2 Level 1 satellite image dated 25.09.2023
- ArcGIS software 10.7

Method

The method has been developed in accordance with the purpose of the research, consisting of three stages as illustrated in Figure 1.

In the first stage of the method, literature on urban development, as well as the development of Niğde Ömer Halisdemir University from its establishment to the present day in terms of both structural and population aspects, has been investigated. A comparison has been made between the period when it experienced significant growth in both structural and population aspects and the present day. The research area selected as the Niğde City Center has also been evaluated in terms of urban development for the same time periods.

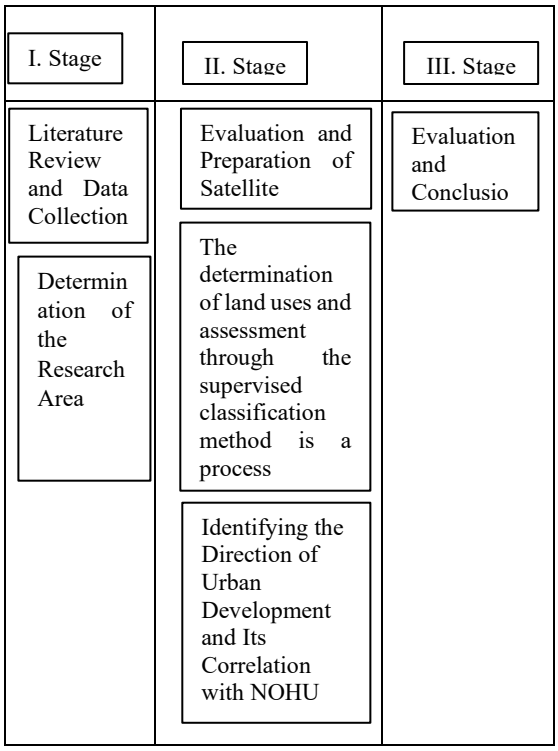

Figure 1. Method flowchart.

To determine urban development and its direction, satellite images from the selected dates were obtained, and these satellite images were processed using controlled classification methods. The created maps and tables indicate that the development is oriented towards the NOHU campus boundaries, and rapid horizontal and vertical urban development has been observed.

In the final stage of the method, it was concluded that focal points are essential in determining urban development and its direction, and university campuses, such as NOHU, also have a significant impact as focal points.

3. Research Findings

Identifying Historical Turning Points

Determination of NOHU campus development and historical breakthrough pointIn the research, an effort was made to identify two different dates for detecting temporal changes. Within this scope, the impact of NOHU, which plays a significant role in urban development, was assessed through the number of students and its structural development. When the number of students obtained from the YÖK Information System was examined, it was observed that as of the year 2008, the decrease in the number of students had stopped and began to increase (Table 1).

Table 1. Student Numbers at Niğde Ömer Halisdemir University According to Years [4].

Educational Period (Year)	Associate's - Bachelor's Degree	Postgraduate- (Master's Degree - Doctorate)	Total	Chance
1992-93	4.286	0	4.286	
1993-94	4.016	0	4.016	+
1994-95	5.679	24	5.703	+
1995-96	8.197	101	8.298	+
1996-97	10.595	152	10.747	+
1997-98	13.829	148	13.977	+
1998-99	15.739	201	15.940	+
1999-00	17.761	319	18.080	+
2000-01	18.817	476	19.293	+
2001-02	19.595	451	20.046	+
2002-03	19.009	420	19.429	-
2003-04	17.449	467	17.916	-
2004-05	15.440	532	15.972	-
2005-06	14.785	510	15.295	-
2006-07	10.775	390	11.165	-
2007-08	10.244	389	10.633	-
2008-09	11.032	614	11.646	+
2009-10	12.120	847	12.967	+
2010-11	13.179	797	13.976	+
2012-13	15.109	1.063	16.172	+
2013-14	17.934	1.850	19.784	+
2014-15	20.160	1.854	22.014	+
2015-16	21.904	2.146	24.050	+
2016-17	24.044	2.383	26.427	+
2017-18	24.914	2.576	27.490	+
2018-19	23.370	2.423	25.793	+
2019-20	23.001	2.080	25.081	-
2020-21	22.121	2.379	24.500	-
2021-22	20.698	2.587	23.285	-
2022-23	22.181	3.046	25.227	+

When satellite images from 2008 and 2023 were evaluated, it was determined that the number of structures, including new faculties and departments, had increased (Figure 2). Consequently, the settlement status and changes in Niğde city center were researched between these years.

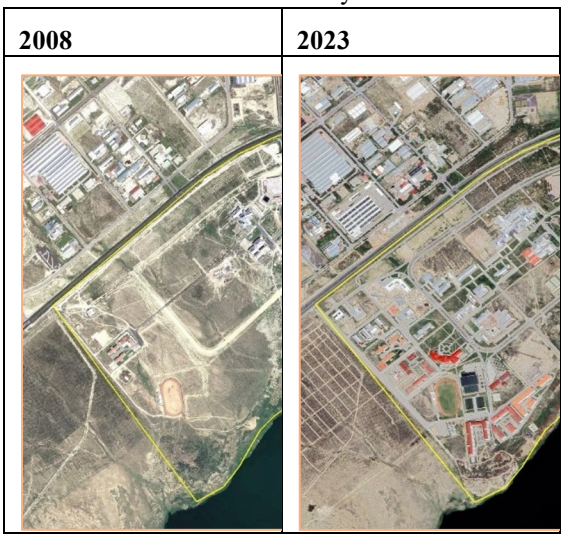

Figure 2. Structural change image of NOHU campus campus [5].

Temporal Change of Land Uses in Niğde City Center

Using Landsat satellite images, changes between land uses based on the years 2008 and 2023 were determined through controlled classification using ArcGIS software. Land uses were classified according to Corine Land Cover Level 2 (Figure 3 and Figure 4).

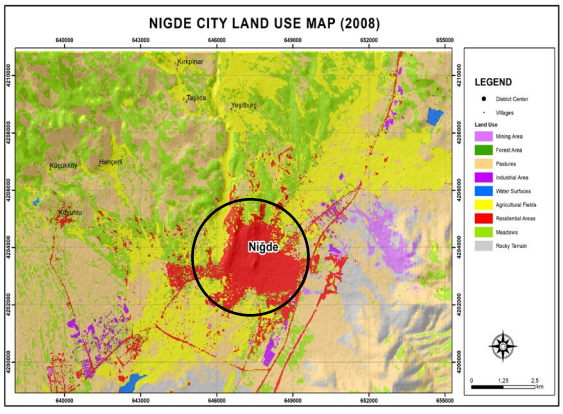

Figure 3. Land Use Map of Niğde City Center for the Year 2008.

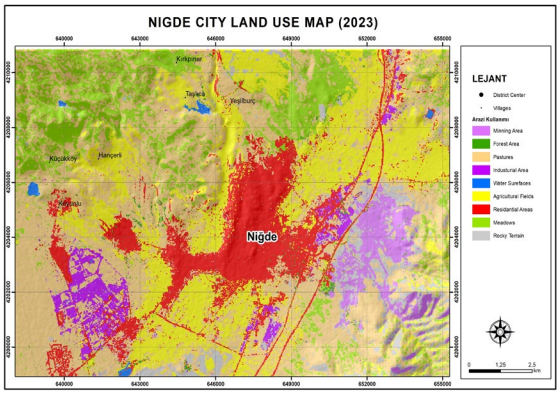

Figure 4. Niğde City Center Land Use Map for the Year 2023.

The land use changes for the respective years are presented in Table 2.

Table 2. 2008 and 2023 Land Uses and Changes Between the Years

Land Use	2008 Area (Ha)	2023 Area (Ha)
Meadows	5.414	3.012
Barren Rocky	1.295	1.109
Mining Area	283	745
Forest/Reforestation	0	114
Patures	8.345	8.679
Industrial Area	192	606
Water Bodies	65	70
Agricultural Area	4.370	4.466
Residential Area	1.508	2.673
Total	**21.474**	**21.474**

Accordingly, in Niğde City, grasslands and rocky areas decreased, while afforestation, grasslands, industrial areas, water bodies, and agricultural lands increased. Mining and settlement areas, on the other hand, showed an approximate two-fold increase.

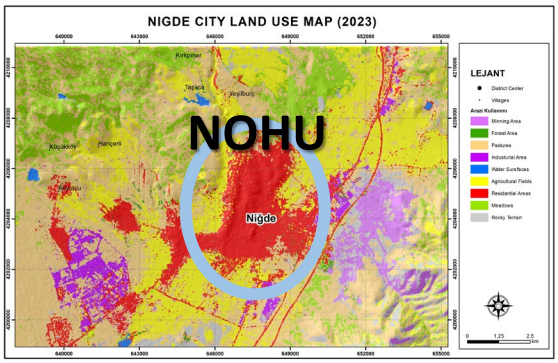

Figure 5. Areas of Increased Urban Development

When evaluating Figure 5, it can be observed that urban development has occurred predominantly to the north and most significantly to the southwest. The development to the north of the city consists mainly of detached houses, with only a portion resulting from urban transformation. On the other hand, the development in the southwest of the city is attributed to the positive influence of the NOHU campus. This urban development in the southwest has shown its intensity both horizontally and vertically. In this densely developed area, there is the neighborhood of Aşağı Kayabaşı, and the population changes in this neighborhood over the years are provided in Table 3.

Table 3. Population Numbers of Aşağı Kayabaşı Neighborhood in Niğde Province by Year [6].

Year	Total Population	Year	Total Population
2022	**37.777**	**2014**	24.984
2021	36.761	**2013**	22.972
2020	34.999	**2012**	20.832
2019	33.066	**2011**	19.211
2018	30.813	**2010**	18.418
2017	30.802	**2009**	16.790
2016	29.090	**2008**	**14.335**
2015	26.745	**2007**	14.589

When reviewing Table 3, it can be observed that the population has increased by approximately 2.5 times between 2008 and 2023. Despite the urban transformation in the north, the reason for this increase in the southwest of the city and the change in the focal point of urban development can be attributed to factors such as the increase in social amenities along with the university in this region and improved accessibility to the campus, which have had an impact.

4.Results and Recommendations

When evaluating the NOHU campus settlement, as of 2008, the structural and green areas have been developed through regulation and renovations up to the campus boundaries. The opening of new institutes, faculties, and departments, as well as admitting more students, has led to an increase in the declining student population starting from 2008.

The increase in structural areas in the student and campus areas, along with the opening of new institutes and departments, has resulted in a growth in the student population. This growth has increased access to social (congresses, conferences, concerts, and other events) and health-related (dentistry, health center, etc.) facilities within the University campus.

Moreover, the positive attraction effect brought by the campus to the city, coupled with the need to provide easy access to the social and health facilities within the university campus, has led to rapid development in the urban settlement of the Aşağı Kayabaşı neighborhood, which extends its boundaries to the university, both horizontally and vertically.

In this study, this development has also been highlighted through temporal change analysis. Other development areas of the city have generally remained as horizontal development. The population has rapidly increased in a narrow area along with vertical development.

In urban planning, analyses and evaluations should be carried out to avoid causing urban problems in the selection of areas that will create positive attraction points such as campuses and other facilities (stadiums, shopping malls, health complexes, etc.).

Changes in areas brought about by urban development should be taken into account. The loss of areas that will affect the food sector such as agriculture, pasture, and meadow should be minimized or prevented.

In the preparation of urban plans, landscape planners must be included and their opinions must be taken into account within the scope of urban planners

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