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LAND MANAGEMENT

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Relocation and part-to-whole approach in land consolidation: The example of Yeğenli neighbourhood of İzmir province Tire district

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Abstract

Land consolidation projects are one of the most important factors of rural development in our country. In order to support rural development, the application area of land consolidation projects has expanded and as a result, various applications have been implemented in each region.

In this study, the land consolidation project implemented in the rural areas of Yeğenli neighbourhood of Tire district of Izmir was examined in terms of mathematical model and land reallocation method, the total amount of relocation of cadastral parcels after land reallocation was determined as 288.81 metres with the relocation approach, it was determined that there was a 15.90 % decrease in the number of immovable properties with the part-to-whole approach and 36.15 % of the consolidation parcels were obtained with this approach. With the interview conducted in the field, inferences were made on the effect of these approaches on satisfaction.

1. Introduction

The rapid increase in the world's population in recent years and the increase in the rate of consumption of natural resources by the human population cause deterioration in the balance of nature, and this situation brings disasters from time to time. The concept of land management, which has recently entered our lives, is defined as "decision-making processes for basic land management policies such as ensuring the effective use of land resources to support the ever-increasing population; preventing the degradation of the natural environment; creating new, livable settlement areas; protecting watersheds and wetlands; developing social and technical infrastructure areas; providing equal access to the economic returns of the land real estate market; and supporting government services through taxes and fees related to land and structures." [1]. With this concept, the necessity of ensuring the continuity of agricultural lands in order to prevent the deterioration of the natural environment, to meet the needs of the increasing human population and to provide the expected benefit from agricultural lands has been reunderstood. In this context, in order to provide the expected benefit from agricultural lands, the realisation of land consolidation projects has accelerated the planned use of agricultural lands by rearranging them according to soil classes. However, the rapid implementation of consolidation projects has also paved the way for the discussion of the concept of fragmented ownership. Land fragmentation is defined as the reduction of land width by dividing the land owned by an enterprise into separate and numerous parts [2]. In our country, the definition of land consolidation in the Regulation on Land Consolidation and In-Field Development Services prepared on the basis of the Soil Conservation Law No. 5403 is as follows: "To prevent the degradation and fragmentation of agricultural lands by natural and artificial influences, and to ensure the creation of new parcels that are more functional in terms of economic, ecological and social aspects by combining more than one piece of land by considering the natural characteristics, integrity of use and property rights in fragmented lands [3]." as can be understood from the definition, it is legally guaranteed by official institutions that the primary purpose of consolidation projects is to ensure the unification of land pieces.

Relocation or relocation is defined as a change in the position of an object in physics. In land consolidation implementation, it is considered as the change in the position of immovables before and after the implementation. The change in the location of the land is an important variable that directly affects the business owners. For this reason, the desire to stay in the same place is among the most objected topics during the suspension process of land consolidation practices [4].

In Eldelek village of Salihli district of Manisa province, a comparison was made between the consolidated area and the non-consolidated area with the help of geographical information systems. While the average parcel size in the consolidated area was 6.81 da, it was calculated as 14.22 da in the non-aggregated area [5].

In the consolidation practice implemented in Gedikli village of Nurdağı district of Gaziantep province, the consolidation rate was calculated as 47 %. The number of parcels subjected to the implementation decreased by 52 % compared to before the implementation [6].

The land consolidation project in Kuskuncuk village of Ereğli district of Konya province was examined in terms of land fragmentation and its effects at enterprise scale. The number of parcels, which was 1073 before consolidation, was determined as 791 after consolidation. At the end of the consolidation, 863 of the parcels in the project area were converted into 1 share, which corresponds to 80.43 % of the total number of parcels. While the number of parcels with 1 share was 288 before consolidation, it increased to 352 parcels after consolidation [7].

Ertunç and Janus [8] evaluated the impact of land consolidation projects on land fragmentation by considering the spatial land reallocation of parcels before and after land consolidation in Turkey and Poland. Average distance of a hectare index, Grouping index, Structural index, Scattering index, Januszewski index and Simmons's index were used to measure land fragmentation. In addition, the use of land fragmentation indices (Average distance of a hectare index, Grouping index, Structural index, Scattering index) that take into account the distance between parcels in measuring land fragmentation in land consolidation projects is proposed.

Akdeniz and Temizel [9] examined the situation before and after the consolidation according to 17 parameters such as the average number and size of parcels, the average parcel size, and the parcel status of the owners in order to reveal the success of the consolidation projects carried out in a total of 60 project areas in Samsun, Amasya and Sinop provinces. In the study area, while the average parcel size was 8.03 da before the consolidation, it was determined as 12.24 da after the implementation. The total number of parcels in the project area decreased by 35 %.

Tunalı and Dağdelen [10] examined the reallocation phase of the land consolidation project in Aydın Yenipazar region through two different methods. They concluded that the interview-based allocation method has more single parcel areas, while the fuzzy logic method is more advantageous in terms of consolidation rate, number of holdings and average parcel size values. As a result of the comparison of all parameters, he stated that the fuzzy logic method was more successful than the other method.

Alturk [11], in order to determine the degree of shape of agricultural parcels in Tekirdağ province, the parcels were divided into four groups as highly irregular, irregular, regular and near optimum. Accordingly, 53% of the parcels in the study area were highly irregular and irregular, while 47% were regular and near optimum.

Basista [12] evaluated the land consolidation project in the areas of Ilkowice, Rajsko-Niedzieliska-Szczurowa and Łukowa in Poland through geographic information system software. He compared the pre- and post-consolidation situations and presented numerical data on the distribution, number and area of parcels. Accordingly, the average plot area increased by about 25% in Ilkowice and 48% in Łukowa, the number of plots decreased by about 25% in Ilkowice and 48% in Łukowa, and the average distribution of plots in units decreased by about 20% in Ilkowice and 22% in Łukowa.

Davidović et al., [13] In order to analyze the impacts of land consolidation projects, a comparison of the number of parcels, average parcel size, road and canal network surface, before and after consolidation in the Šašinci area of Vojvodina, Serbia was made. According to the quantitative data obtained in the results section, it was found that the benefits of land consolidation were great, the number of parcels decreased by 59% on average per cadastre and the road and canal network surface increased significantly.

In this study, the land consolidation project implemented in Yeğenli neighbourhood of Tire district of Izmir [14] was examined under 4 different headings. In the first examination phase, the cadastral parcels before consolidation and the consolidation parcels were overlapped and coloured with the geographical information systems application. In order to compare the before and after conditions of the coloured cadastral parcels, enterprise numbers were used.

In the second phase of the study, it was aimed to analyse the land reallocation table of the consolidation and to present the mathematical model of the deduction shares. In order to reveal the change in the location of the parcels after the land reallocation, the average change in location value of the consolidation project was determined by calculating how many metres the cadastral parcels before consolidation were displaced after the arrangement. According to this average value, if the location changes of the immovable properties were below or above the average value, the colour green was assigned to those below and red to those above.

In the third phase of the examination of the consolidation project, in the light of the data obtained in the first and second phases, it was tried to determine the satisfaction rate of the landowners about their ownership status before and after consolidation by interviewing with the neighbourhood headman. The satisfaction rate obtained

within the scope of this study was accepted as a criterion for measuring the rate of benefit from the consolidation project.

In the last phase of the analysis, the data obtained in the second and third phases were compared. In this comparison, inferences were made through tables in order to reveal the effect of relocation and the part-to-whole approach on satisfaction. The evaluation of relocation and part-to-whole approach together distinguishes this study from similar studies.

2. Material and Method

In order to examine the project area, the first cadastral map of Yeğenli neighbourhood and the cadastral map after consolidation were obtained. GIS software was used for the evaluation and colouring of these cadastral maps. The land reallocation and deduction share lists, which are the most important part of the consolidation project, were obtained from the mukhtar archive and the mathematical model of land reallocation and deduction shares was studied. An excell table was prepared to determine the mathematical model. In the same excel table, the relocation values of the immovables were also determined.

In order to measure the satisfaction rate of the project, a question and answer interview was held with the headman of Yeğenli neighbourhood about the contributions/disadvantages of the project, which was approved and implemented in 2017, during the implementation phase and after 3 years for the neighbourhood.

Comparison tables were prepared with the help of excel programme in order to determine and compare the reduction in the number of parcels, part-to-whole approach and change of location. published.

3. Application

3.1. Introduction of the Application Area

The cadastral data of Yeğenli neighbourhood of Tire district of Izmir constitute the basic material of the research. According to Article 17 of the "Regulation on the Protection and Use of Agricultural Lands and Land Consolidation" dated 24/07/2009 and numbered 2009/15154, Yeğenli neighbourhood was included in the scope of the study according to the decree dated 19.10.2009 and numbered 2009/15614 by the General Directorate of State Hydraulic Works (DSİ) within the scope of Special Land Consolidation, and Yeğenli neighbourhood was included in the scope of compulsory land consolidation application with the decree dated 14/11/2011 and numbered 2011/2405. The application entered into force on 28/07/2017.

Yeğenli neighbourhood is a typical Aegean village established at the foot of Aydın Mountains in the south of Izmir. The distance to Tire district centre is 18 km, to Ödemiş district centre is 15 km and to İzmir province centre is 113 km. Tire-Ödemiş highway passes through the neighbourhood. To the south of the highway is the built-up area of the neighbourhood. According to TURKSTAT 2019 data, the population of the neighbourhood is 484 people and the total area is 10.78 km^2. There are Kırtepe neighbourhoods to the west, Kızılcahavlu to the north, Çamlıca to the south and Kazanlı to the east.

According to the Land Registry and Cadastre data, there were 1014 immovable property records before the consolidation project. After the consolidation, this number was recorded as 899. The elevation of the neighbourhood decreases from south to north. The agricultural lands in the northern part are also located within the Küçük Menderes Plain. These lands have been taken under protection within the scope of Büyükova Protection Area and are supported by the Ministry of Agriculture and Forestry for crop production [15-16].

3.2. Preparatory Work and Data Collection

The cadastral data of the study area were obtained from Tire Cadastre Unit. The land reallocation and maps of the said Consolidation Project were obtained from the mukhtar archive.

3.2.1. Cadastral Data

At this stage, the first cadastral data (Figure 1) and the consolidation data (Figure 2) were coloured in GIS environment. By overlapping the coloured data (Figure 3), the enterprise number of each owner in the consolidation land reallocation list was determined. Enterprise numbers represent the property owners and all of the cadastral parcels of the property owner were subjected to the application over the enterprise numbers. The total number of properties included in the application is 648 and the number of new properties formed as a result of consolidation is 545.

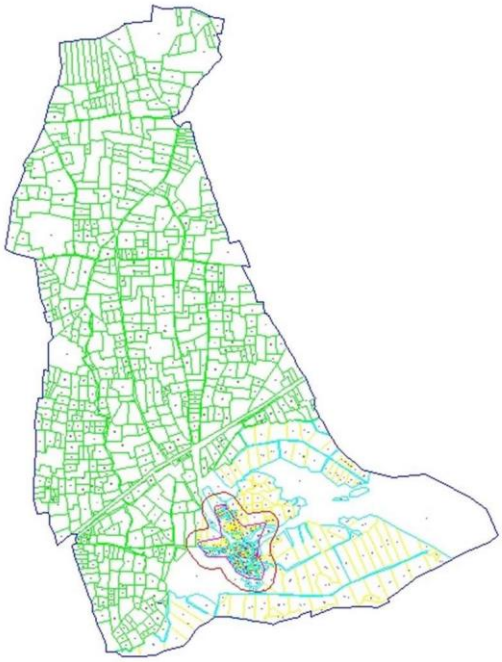

Figure 1. First cadastre

Figure 2. Consolidation

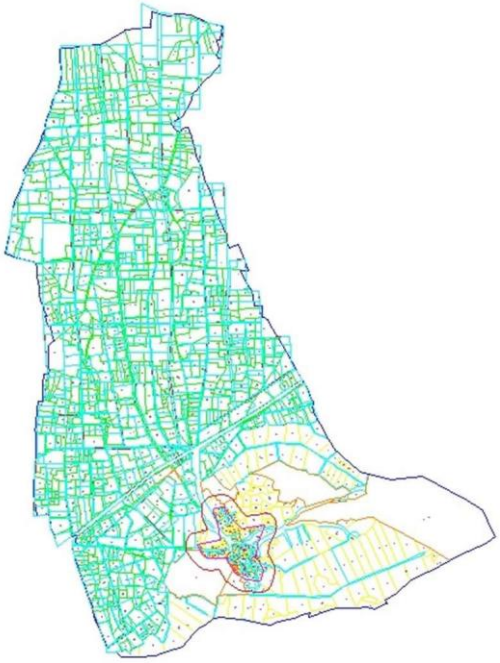

Figure 3. Overlaid view

3.2.2. Mathematical Model and Relocation Calculation

At this stage, the land reallocation tables were analysed in order to present the mathematical model of the aggregation. In order to reveal this model, firstly, the before and after status of the enterprise numbers in the tables were analysed in order to understand the basic principle of land reallocation. During the land reallocation phase, it was observed that the property owners were assigned enterprise numbers and the parcel index and parcel value number of each enterprise were calculated. After deducting the 4.20 % deduction share of each enterprise, it was distributed within the blocks according to the block priority land reallocation model. It was determined that an enterprise with shares in more than one immovable was placed in a single parcel after the land reallocation (Table 1). Thus, it is seen that the mathematical model of the land reallocation is block-priority and the principle of integrating the fragmented lands is applied.

Table 1. Block Priority Land Reallocation Model

LIST OF LAND CONSOLIDATION (New Block Parcel Sequence) — Schedule No: LC-8

Neighbourhood Name : Yeğenli — Deduction Rate: 0.042 — Page No: 1/31

Households No	Title Deed Holder				Block No	Parcel No	Area (m^2)	Share	Area per Share (m^2)	Regulation		Parcel Index	Parcel Value Number	Deduction Amount	Block Location	New Block Index	New Parcel Value Number	Block No	New Parcel No	New Parcel Area
	ID No	Name	Surname	Father's Name						Non-entry	Entry									
217		S***T	G***K	M***T	-	1	18560	1/2	9280		9280	0.8318	7719.1	324.2	101	0.8315	7394.9	101	1	36667
217		S***T	G***K	M***T	-	2	18000	1/4	4500		4500	0.8318	3743.1	157.21	101					
217		S***T	G***K	M***T	-	15	22720	Tam	22720		22720	0.8318	18899	793.74	101					
217		S***T	G***K	M***T	-	23	3520	1/2	1760		1760	0.8318	1464	61.49	102					

In the second step of this stage, in order to determine the relocation of the immovables, the geometric midpoints of the first cadastral and consolidation lands were determined with the help of GIS programme and the relocation amounts (Figure 4) were determined in metres and entered into an Excel table. Again, the average of the total relocation of the lands was calculated on the Excell table and the lands above the average were assigned red colour and the lands below the average were assigned green colour (Table 2).

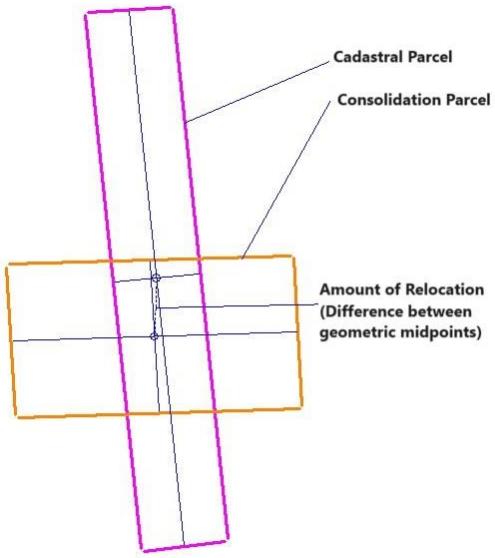

Figure 4. Relocation Calculation

3.2.3. Interview

At this stage of the study, an interview was conducted with Ünal Sayran, the mukhtar of Yeğenli neighbourhood, in the village square in order to reveal the satisfaction rate of the consolidation. During the question and answer interview, he stated that there are 165 households and 540 people living in the village, that he was the headman at the time when the land consolidation project was implemented, that he closely followed the process, and that he continuously informed the immovable owners by obtaining the land reallocation and map documents from DSİ.

As a result of the questions asked to the neighbourhood mukhtar and the answers received in order to determine the satisfaction rate of the consolidation;

- The scattered fields were brought together as a result of the implementation and the work from the part to the whole was welcomed,
- The fact that the lands become road fronted with the consolidation eliminates many disputes,
- With the immovables being connected to the drainage channels, the problems in irrigation have been overcome,
- Keeping the deduction rate between 3 per cent and 5 per cent is acceptable,
- Only two property owners were dissatisfied with the land reallocation, one of whom filed a lawsuit,
- It has been determined that the electricity poles located on the old cadastral roads remained within the properties after the arrangement, and no result has been obtained despite the three years that have passed.

As a result of the interviews, the satisfaction rate of the consolidation was accepted as a high value of 90 %. Due to Covid measures, it was not possible to interview all citizens one by one, so all questions were directed to the neighbourhood mukhtar.

Table 2. Mathematical Model and Relocation

Households No	Block No	Parcel No	Area	Old Parcel No	Area	Deduction Area	Deduction Rate (%)	Relocation (m)
217	101	1	36667.14	1, 2, 15, 23	38260.00	1592.86	4.20	258.19
102	101	2	10421.40	2,378	20780.00	10358.60	4.20	1711.78
153,166	101	3	16079.68	14,18,19	21086.67	5006.99	4.20	225.24
168	101	4	24103.28	1, 2, 16, 17, 23	25160.00	1056.72	4.20	245.15
322	101	5	10291.86	18, 408	14933.00	4641.14	4.20	1623.9
502,174,216,163,51	101	6	14178.38	20	14800.00	621.62	4.20	25.81
429	102	1	32996.01	3,4	37800.00	4803.99	4.20	127.2
299,231	102	2	19945.56	5	20820.00	874.44	4.20	40.02
198	102	3	8478.30	6	8850.00	371.70	4.20	128.48
389,156	102	4	16048.91	7, 34	16752.00	703.09	4.20	259.98
347, 348	102	5	11821.72	14	12340.00	518.28	4.20	29.57
384	102	6	16358.74	11, 12, 13, 22, 24	19095.00	2736.26	4.20	65.65
46	103	1	14791.52	49	15440.00	64848	4.20	80.41
386, 390	103	2	34842.46	6, 30	36370.00	1527.54	4.20	108.26
387, 388, 391	103	3	31479.85	7, 8, 9, 34	33689.50	2209.65	4.20	133.72
373	103	4	11208.60	10, 28	11700.00	491.40	4.20	89.73
381	103	5	3851.15	26	4020.00	168.85	4.20	52.04
519	103	6	8277.12	29	8640.00	362.88	4.20	81.4
382	103	7	9235.12	27	9640.00	404.88	4.20	104.95
138	104	1	46059.14	54, 58, 491	49071.00	3011.86	4.20	1354.07
129	104	2	41227.08	35, 46, 50, 1098	49780.00	8552.92	4.20	254.7
132	104	3	10750.67	54	11222.00	471.33	4.20	426.02
225	104	4	14791.52	49	15440.00	64848	4.20	232.98
507	104	5	13316.21	36	13900.00	583.79	4.20	101,78
286	104	6	12243.24	48	12780.00	536.76	4.20	31.12
490	104	7	10154.80	44	10600.00	445.20	4.20	78.24
357, 355	104	8	40501.80	32, 38, 39, 1098	42420.00	1918.20	4.20	89.75
123	105	1	50105.50	54, 55, 56	52605.00	2499.50	4.20	120.63
136	105	2	30542.76	54	31067.00	524.24	4.20	154.52
302	105	3	29817.79	54	29857.00	39.21	4.20	171
301	105	4	25575.82	54	25258.00	-317.82	4.20	287.74
160, 159	105	5	28356.80	53, 60	29600.00	1243.20	4.20	149.08
368, 372	105	6	32045.34	47, 52	34300.00	2254.66	4.20	159.96
197	105	7	15711.20	45	16400.00	688.80	4.20	81.63
8, 1008	105	8	4057.24	99, 1092	41055.20	36997.96	4.20	1088.5
327	105	9	18015.83	52	20000.00	1984.17	4.20	177.76
458	105	10	16343.75	51	17000.00	656.25	4.20	147.82
							TOTAL	**288.81**

4. Discussion

4.1. Part to Whole Approach

In the study area, 648 immovable properties were regulated and 545 consolidation parcels were created. With the part-to-whole approach, the number of parcels decreased by 15.90 %. Since the reduction rate is not meaningful by itself, the change in the number of parcels based on block priority in the study Comparison of Interview and Block Priority Based Land reallocation Models in Land Consolidation Projects [17] was compared with this study (Table 3).

Table 3. Comparison Table

Consolidation Area	Number of Cadastral Parcels	Number of Consolidation Parcels	Reduction Rate (%)
İzmir-Tire-Yeğenli	648	545	15.90
Konya-Ilgın-Ağalar	1536	718	53.26

According to the evaluation made on the land reallocation tables, it was determined that 197 of 545 consolidation parcels were formed by bringing together the fragmented shares of one or more property owners. It is seen that 36.15 % of the 545 consolidation parcels have been formed following the part-to-whole approach.

4.2. Relocation Approach

In the Table 4, 5 blocks (101, 102, 103, 104, 105) were evaluated. The amount of relocation was determined for the cadastral parcels evaluated and the average of these values was determined as 288.81 metres. According to the average relocation value, 32 of the 37 consolidation parcels were assigned green colour (below the average relocation value) and 5 of them were assigned red colour (above the average relocation value). 86,49 % of the

immovables were below the average change of location and 13,51 % were above the average change of location. According to the relocation table, the smallest relocation was 25.81 metres and the largest relocation was 1711.78 metres (Table 4).

Table 4. Relocation

	Number of Parcels Analysed	Number of Parcels Under Relocation Value	Number of Parcels Above Relocation Value
	37	32	5
Rate (%)	100	86.49	13.51
	Min. Relocation (m)	25.81	
	Max. Relocation (m)	1711.78	

5. Conclusion

In this study, in order to evaluate the consolidation project, the mathematical model, deduction shares, relocation amounts, part-to-whole approach and satisfaction rate were examined.

Block priority mathematical model is the most frequently used method in land consolidation projects in our country. In this project, a deduction of 4.20 % was made from the holdings distributed with the block priority model. In the interview with the neighbourhood headman, it was understood that the deduction rate was accepted as a low rate by the owners, and the importance given to the interview in the land reallocation brought the satisfaction rate of the consolidation to 90 %. Only 2 immovable owners reported dissatisfaction due to the land reallocation, the other dissatisfaction was not due to land reallocation but due to external factors.

The number of parcels decreased by 15.90% after consolidation. This decrease is in accordance with the main logic of consolidation, but it is lower than the rate of another consolidation project sampled (53.26%). The number of parcels decreased in accordance with the part-to-whole approach is directly proportional to the total number of fragmented properties in the consolidation area, and a healthier result can be obtained by comparing the number of fragmented properties in the sampled project with the number in this project. Of the 545 parcels obtained by consolidation, 197 parcels were formed as a result of bringing together fragmented properties. The ratio of part to whole was determined as 36,15 %. Again, in accordance with the main principle of consolidation, fragmented ownerships were brought together to ensure land integrity. In order for the ratio of 36.15 % to become meaningful, more than one consolidation project should be examined with the same method and an average value should be determined by comparison tables.

According to the relocation calculation made over 37 parcels in the consolidation area, it was determined that the lands were mostly located in the same region with their former locations. The most important conclusion obtained from the relocation table is that the partto-whole approach affects the relocation calculation to a great extent. Although the change of location is an undesirable situation for the property owners, it is obvious that this situation is overcome with the part-to-whole approach. In fact, 4 out of 5 immovable properties that are above the value of change of location are examples of the part-to-whole approach.

Considering that the satisfaction rate of the consolidation project is a result of the amount of relocation and the part-to-whole approach, it is important to develop and implement these two concepts, and the most accurate approach is based on the interview basis.

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Conflicts of interest:

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Evaluating Land Use Plans in Line with Climate Change Adaptation Policies in the Semnan Urban Region

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Abstract

Climate change in developing countries are more exposed to the risks of climate change due to a lack of adaptation capacity, an economy dependent on climate-sensitive sectors, gaps in policies caused by central governments, weak institutions and a lack of learning adaptation strategies. This article examines the relationship between land use systems as one of the intervention areas of multi-level climate governance and the policy of adapting to different governance methods in this area. This article also introduces the conceptual model of the compatibility of the land management system and the multi-level climate governance framework, from the documentary research method and the systematic review of texts in the form of documents, laws and programs prepared for urban and suburban development in Semnan urban complex in two decades. Examines the latter. The results showed that Regulating the development process of Semnan City based on climate, and environmental considerations, considering natural hazard management and climate change, improving the level of development sustainability through comprehensive ecological management based on a participatory approach, emphasizing desertification control, water conservation, and protection of Soil, air and vegetation, its optimal use, especially in the northern margin of Iran, The climate change fact is intensive among the Middle Eastern countries and especially Iran.

1. Introduction

The history of development planning in Iran is more than six decades and planning in general and land use planning in particular at this time under the influence of economic, social, and political conditions has always been associated with the changes [1-3]. In this regard, the realization of local governance as a new concept in rural-urban management is very important. Local governance and the formation of new scales over the last few decades have caused local governance to face new challenges [4-5].

The increasing availability of geo-referenced data on subnational entities provides a unique opportunity to link geographical features of local areas in resource-rich countries to administrative, household, and individual data [6].

The literature touches upon urban climate goals indirectly, and mostly by pointing to the gap between intentions and practices in current urban governance [7-8], recent studies have shown that climate change, including changes in precipitation and temperature patterns, has caused hydrological changes in Iran [6, 9, and 10].

The Semnan urban complex is also exposed to the consequences related to vulnerabilities of temperature changes and changes in precipitation in this category and according to the forecast of the Intergovernmental Panel on Climate Change, by 2100 AD, Iran will increase the average temperature above 5 degrees Celsius and Will experience a 10 to 20 per cent decrease in rainfall.

The international level should act as an integrated mechanism to the local level, providing a wide range of possible vertical and horizontal interactions in different parts of the governance framework. In the meantime, what is the basis of this research is to establish the relationship between land use systems as one of the areas of intervention of multilevel climate governance and adaptation policy and different methods of governance in this area. According to the research literature, research has been done in line with this research; for example,

Stehle et al. [11] in the article entitled Urban Climate Politics in Emerging Economies: A Multi-Level Governance Perspective article explores the vertical and horizontal integration of cities' climate actions in the multi-level climate governance landscapes in Brazil, India, Indonesia, and South Africa.

Vedeld et al. [12] drawing upon two strains of climate governance and collaborative governance literature, respectively, this article adopts a polycentric approach to the analysis of Oslo's urban climate governance. It unpacks the relationships between urban leadership, climate goal-setting, and institutional design, and reveals how these variables condition the employment of a combination of integrative and interactive governing instruments that foster both self-governance and co-creation in climate responses.

2. Material and Method

In this study, the method of documentary research and the technique of systematic review of texts in the form of documents, laws, and programs prepared for urban and suburban development in the Semnan urban complex during the last two decades were used. In this regard, after extracting, classifying, and reducing the data in the mentioned projects, the data were analyzed and the compliance of the explained programs with the climate change adaptation policies was investigated. The scale of measurement in the method was the Likert spectrum and the degree of adaptability was done in 5 levels (fully compliant, relatively compliant, partially compliant, relatively non-compliant, and completely non-compliant).

The validity of the answers is based on the audit method and the expert opinions of experts. Among the documents and plans related to the subject under study and at national, regional, and district levels in the last decade, we obtained 3 documents Table 1, which were reviewed. The general research model is presented in (Figure 1).

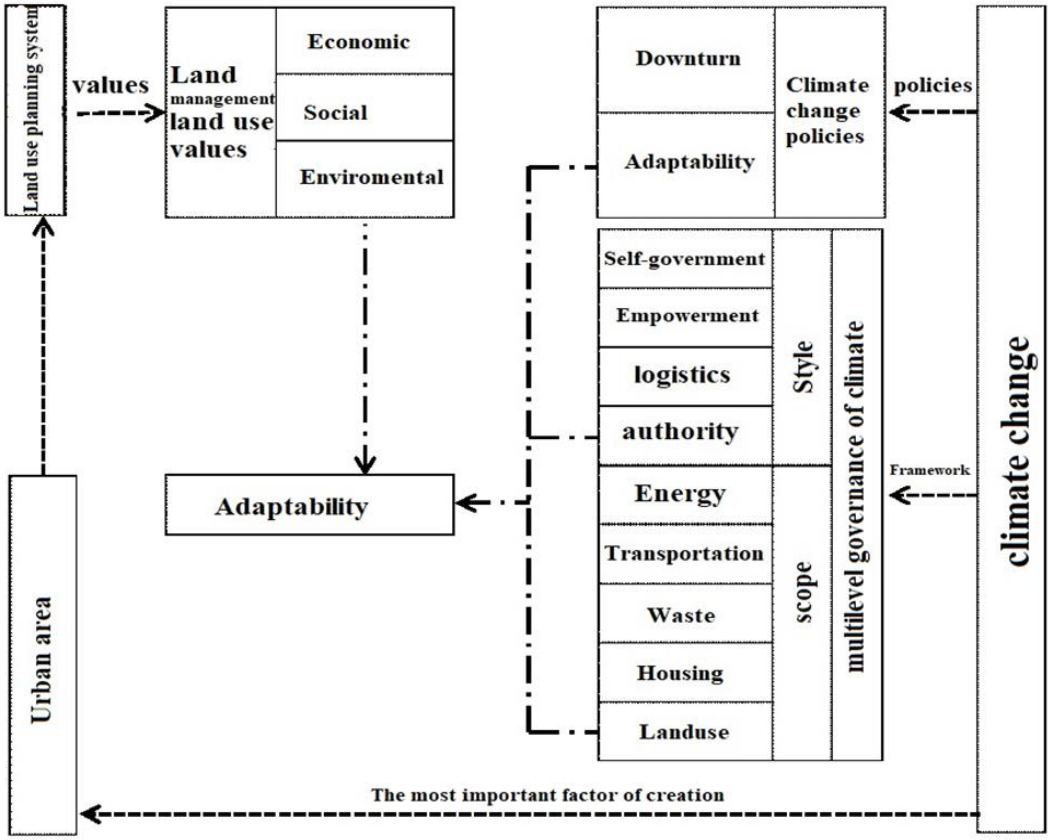

Figure 1. General research model

Table 1. Documents examined in documentary analysis

Approval reference	Operational level	Year of plan approval	Documents reviewed
Supreme Council of Land Management	National	2020	Iran land use document
Iran Program and Budget Organization	Regional	2019	Semnan land use document
Supreme Council of Urban Planning and Architecture of Iran	District	2012	Semnan Urban Complex plan

2.1. Area of Study

Semnan urban area, including the urban complex formed from the links of urban structure between the cities of Sorkheh, Semnan, Darzin, Mahdishahr, and Shahmirzad - the city of Semnan, has provincial, national and transnational functions. Semnan is one of the cities of Iran, the capital of the province, and the city of Semnan (Figure 2). This city is located in the south of the Alborz Mountain range and north of the central desert plain of Iran, at a distance of 216 km from Tehran (the capital of Iran). And is located 34 minutes away. The city is bounded on the north by the cities of Darjazin, Mahdishahr on the west by the city of Sorkheh, and on the east by the city of Dam Ghan.

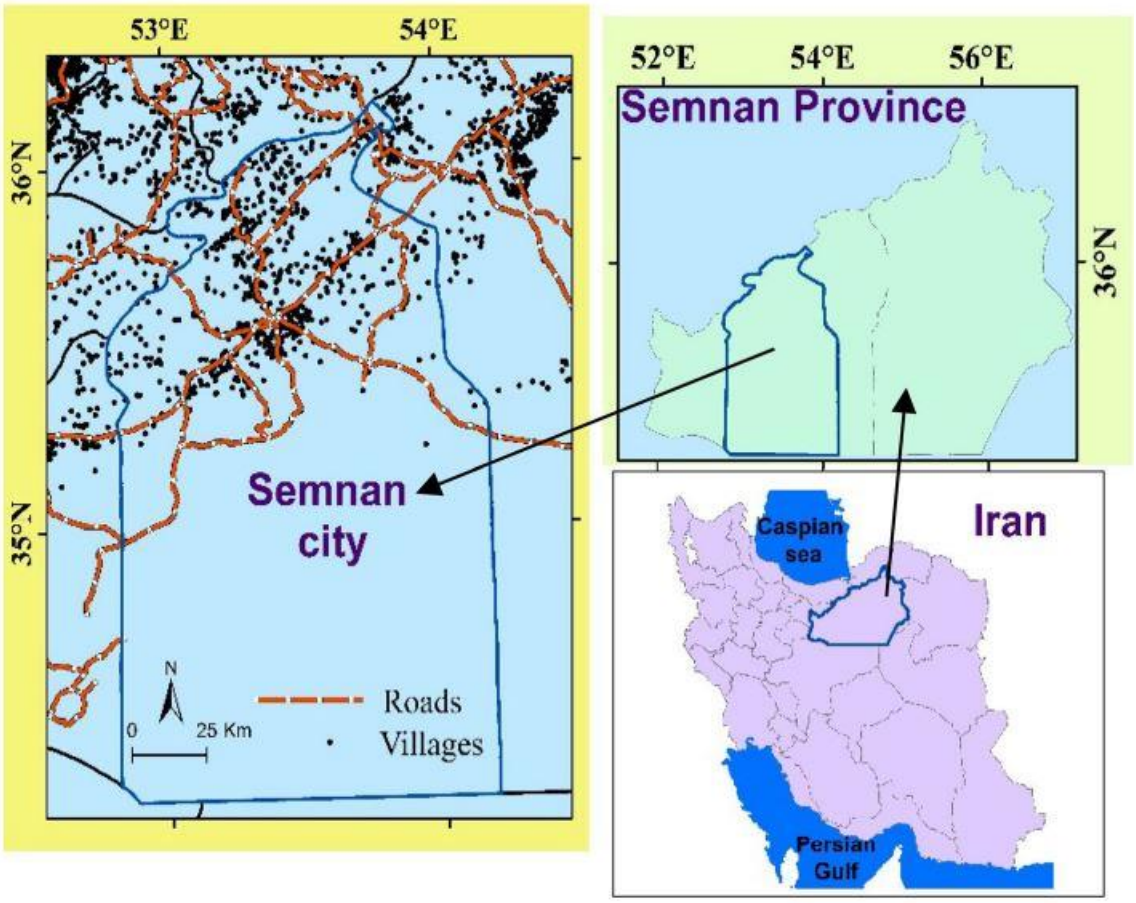

Figure 2. Geographical location of Semnan in Iran

2.2. Land Use Planning in Iran

Iran enjoys the experience of six decades of development planning. During this period, planning in general and land use in particular have gone through many changes and modifications due to the economic, social, and political circumstances of the country (Figure 3). In the land management plan of Iran, Semnan province, the policy of attracting surplus population and overflow of Tehran, Mazandaran and Golestan provinces has been emphasized by undertaking part of the industrial and service activities of these provinces.

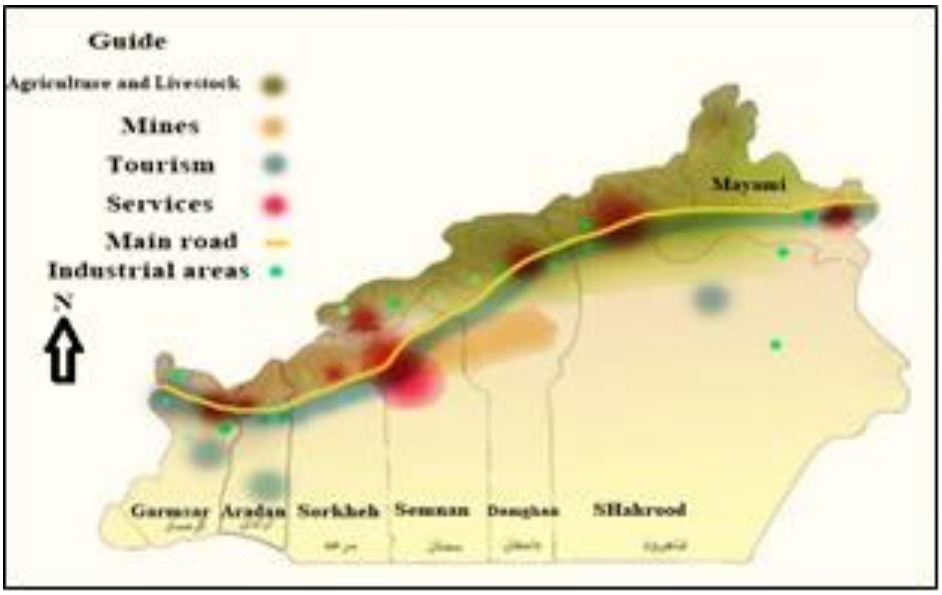

Figure 3. Optimal space organization on the horizon 2045

3. Results

The results showed that the document contains 24 territorial strategies and 254 territorial policies. The territorial strategy determines the main and long-term direction of the spatial development of the territory by considering the capabilities, opportunities and limitations in facing challenges to achieve the desired spatial development goals of the territory, and the territorial policy reflects the policy of implementing the spatial development strategies. It is a land. (Figure 4). Based on the topics studied, this document has considered different roles for this area in the study area (Semnan urban area), which are:

- Logistics center
- The region is prone to producing renewable energy (wind and solar).
- Level one and two level service axis of the city in the residential system Areas prone to special strategic and industrial development.
- Located at 4 communication crossings North-South, East-West, Trisica and Echo.
- Managed areas affected by dust.
- Establishment of industrial activity in the field of production of electronic, computer and optical machines and pharmaceutical products. Also, out of 24 land strategies, 8 strategies were related to environmental issues, land use, and land use-related activities. Below these 8 territorial strategies, 21 territorial policies related to the mentioned topics have been identified and are listed in Table 2. The compatibility of the policies extracted in this document with the policies of adaptation to climate change was examined (Figure 4).

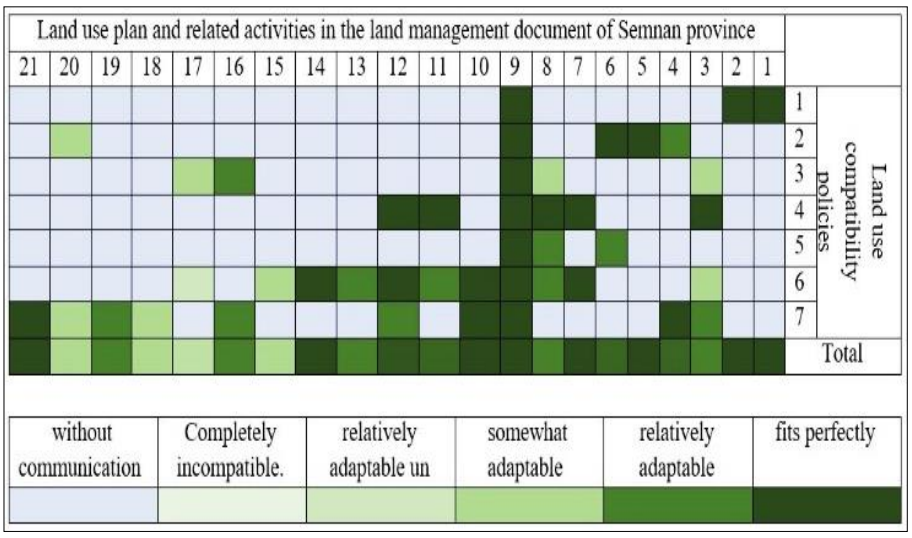

Figure 4. Assessing the Conformity of Compatibility Plans and Policies and Land Use Plan and Related Activities in the National Land Use Document

4. Discussion

Based on the results, the degree of compliance of the program in the field of land use and climate change adaptation policies was estimated to be relatively consistent, indicating the high degree of compliance of this document in the field of land use, environment, and related activities. With climate change adaptation policies. Policy No. 9 in the National Land Use Management Document, which refers to the formulation and implementation of climate change adaptation programs in various fields, including water, agriculture and food security, health, tourism, natural ecosystems, etc., specifically states It focuses on adaptation to climate change, which shows the importance of this issue in legislation.

Table 2. Adaptation plans, policies, and land use plan and related activities in the National Land Use Document

Territorial policy	Territorial strategy
Creation and development of infrastructure and hardware and software superstructures of logistics centers in the central area of the east-west of the country, with priority given to Semnan, Qom, and Qazvin zones	Strengthening the joint role of the country in the network of regional and international transit corridors
Development, strengthening, equipping and optimal operation of the national transportation mode network by regional and global transit corridors and focusing on providing competitive services.	
Implementing industrial development programs (agricultural industries and related industries) with the advantages and production capacities of agricultural products in each region based on ecological potential and programmable water	Diversify the economy according to the advantages, capabilities and specialties of the land
Establishing proper governance in the agricultural sector with the government's focus on policy-making and facilitation	Agricultural transformation, reform of structure and system of exploitation, and establishment of intelligent and sustainable agriculture by ensuring food security, water and environment
Prohibition of changing the use of agricultural potential lands	
Establishment of conservation agriculture, is accurate, smart, and adaptable to climate change and provides food security	
Strengthening and empowering the National System of Strategic Environmental Assessment (SEA)	Development compatibility with the environment and natural resources
Encouraging investment and supporting the creation, commercialization and use of environmentally friendly technologies	
Develop and implement a program to adapt to climate change in various fields, including water, agriculture and food security, health, tourism, beaches, natural ecosystems, etc.	
Integrated management of environmental critical centers (management of areas affected by land subsidence)	
Reviewing the criteria and criteria for land use change by the ecological characteristics of each territory	
Strengthening and empowering the Environmental Impact Assessment (EIA) system and establishing an audit and monitoring system	
Ambient air quality management in the country, especially in metropolitan areas	
Monitoring and protecting the soil and preventing its erosion, salinization, pollution, and destruction	
Applying the cluster development approach in settlements, industrial, and mining areas	Organizing the establishment of the country's industries and shaping the chain of industrial activities
Strengthening and improving the level of performance and services of cities/cities of Urmia, Ardabil, Zanjan, Sanandaj, Ilam, Khorramabad, Hamedan, Qazvin, Gorgan, Semnan, Arak, Qom, Yazd, Bojnourd, Birjand, Yasuj, Shahrekord, Bushehr Level two	Decentralization and changing the pattern of urban land network from single-center to multi-center and multi-level network
Decentralization and functional refinement of the Tehran metropolitan area by maintaining and developing the function of the capital	
Creating dynamism and strengthening the connection in the multi-level and multi-center network of the residential system by using the ball and bar pattern	
Zanjan, Qazvin, Fars, Kerman, Yazd, Semnan, Qom, Markazi, Hamedan, Chaharmahal and Bakhtiari, Kohgiluyeh and Boyer-Ahmad, Lorestan provinces: as a multi-center cluster urban network with the approach of developing central locations, stabilizing metropolitan areas, Development of small and medium cities, strengthening of medium and large rural centers	Implementing the optimal model for the development of the residential system in different regions of the land
Preventing the uncontrolled conversion of rural areas into cities	Maintaining and absorbing the population in the villages by emphasizing on promoting the dynamism and production nature of the villages
Strengthening the institutional system and continuous decision-making of urban-rural development in the context of the regional network	

The objectives identified in the land management document of Semnan province have been formulated in several sections: the objectives of the upstream documents, the objectives of the problem, and the objectives of the value, the basic objectives of the planning of Semnan province are as follows:

1. Improving connectivity and strengthening the joint role of the province in the trans-regional transport network

2. Upgrading and transitioning from corridor spatial development to spatial spatial development 3. Promoting spatial and inter-territorial justice in the development process of the province

4. Improving the rate, diversity and productivity of productive and sustainable employment

5. Development of institutional capacities Development and planning of the main actors of the province

6. Reducing and refining the intensity and quality of dependence of economic activities on natural and climatic resources

7. Promoting the sustainability of natural resources, especially water, soil, and desert resources 8. Control and reduce the risk of residential, activity and communication areas against natural hazards.

This document contains 11 territorial strategies and 86 territorial policies. Territorial development policies of the province are based on the strategies developed for the development of the province, which focus on redefining the system of population and activity in the province and form the policy framework for the development of service and production infrastructure. Semnan province planning research studies and utilizing the achievements of physical plan research in Semnan province, the zoning of planning areas in Semnan province; including two macro-western planning areas, to the center of the east, to the center of the city, it is located in the center of Shahroud city. The province has two prominent populations this document has considered different roles and specializations for this area in the study area (Semnan urban area) based on the studied subjects (Figure 5).

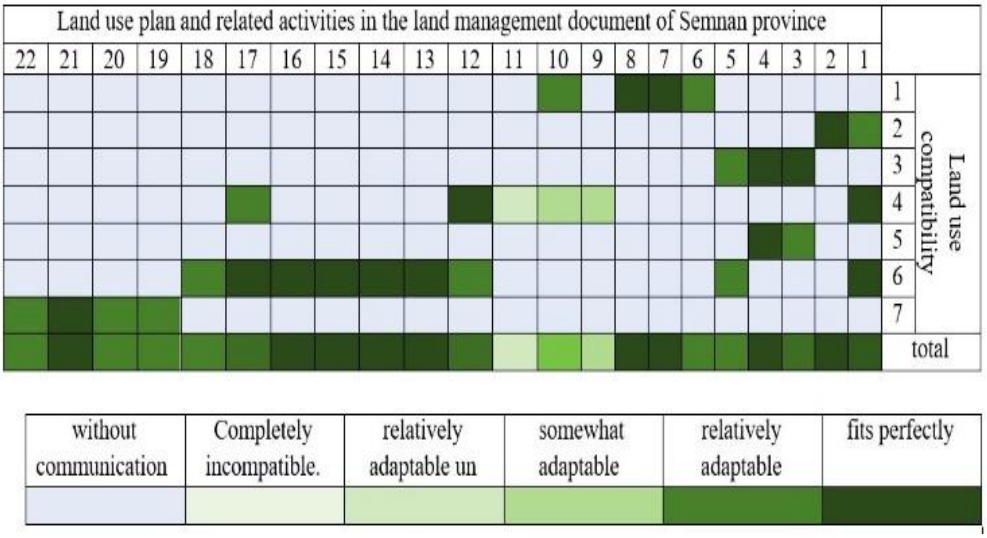

Figure 5. Assessing the compliance of adaptation programs and policies and land use program and related activities in the land management document of Semnan province

5. Conclusion

Regulating the development process of Semnan city based on climatic and environmental considerations with regard to the management of natural hazards and climate changes, improving the level of development sustainability through comprehensive ecological management based on a collaborative approach, emphasizing desertification control, water conservation and soil protection. Air and vegetation, its optimal use, especially in the northern border of Iran, the reality of climate change among the countries of the Middle East and especially Iran is severe. Considering the characteristics of multi-level governance and due to the weakness in the body of the land development system, whether in the field of policy making and performance in the urban area of Semnan in general or the weakness in facing climate changes in the city of Semnan in particular, using New management approaches in this field, such as multi-level climate governance, can be helpful.

The establishment of such a system requires the identification of effective actors and stakeholders and the examination of the capacities and governance methods that can be used in this region and its compatibility with the land development system. Considering the current situation of the Semnan urban area and also because land preparation is considered the most important tool of city managers and policy makers in facing climate changes in the Semnan urban area.

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Author contributions:

Vahid Isazade: Conceptualization, Methodology, Software **Abdul Baser Qasimi:** Data curation, Writing-Original draft preparation, Software, Validation. **Taher Parizadi3:** Visualization, Investigation, **Esmail Isazade:** Writing-Reviewing and Editing.

Conflicts of interest:

The authors declare no conflicts of interest.

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GIS-based land use and land cover change assessment around Assosa district, Upper Blue Nile Basin, Ethiopia

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Abstract

Early researchers have reported the high land use land cover change by using years 2009-2013. We try to detect the land use land cover change from the years 2013-2023 by taking three years 2013, 2018, and 2023 by using Landsat 8 images of each year. We have taken five land cover types. They are forest, farmland, built-up, barren land, and water body. From this land covers farmland and built up areas shows a dramatic increase in this three-year gap. Especially forests show a high decrement, the rest water body, and barren land show some change. We found that the decrement of forests from 2013 up to 2018 is -27% and also from 2018-2023 is -7% additionally the percentage change of increase of farmland between 2013-2018 is 19% and between 2018-2023 is 2%, built- up area increases by 4% between 2013-2018 also in between 2018-2023 it increased by 10%.this change indicates that it can cause a serious problem unless it cannot be resolved.

1. Introduction

1.1. Background of the Study

The land is a complex and dynamic factor that consists of, geology, topography, hydrology, soil and microclimate, and a community of plants and animals that are continually interacting under the influence of climate and people activities [1]. In Ethiopia, farmers mainly use this basic resource in traditional ways without any logical organization of different types of land according to their agricultural potential or their physical configurations [2].This leads to further performance of agricultural sectors in particular and the whole economy in general. Land use / Land cover change plays a vital role in the study of global change [3]. Land use / Land cover and human or natural modification have largely resulted in deforestation, biodiversity loss, global warming, and increasing natural flooding [4]. Thus environmental problems are often related to Land use/ Land cover change. LULC change refers to the conversion of one type of LULC to another [5]. It also refers to human modification of the terrestrial surface of the Earth and reflects the role of human activities on natural resources and the environment [6].

The interaction between nature and humans has transformed the face of the earth for their demands as no other living species ever done [7]. Usually, the development of LU/LCC is relied on the two broader groups of man-made agents, i.e., proximate drivers and underlying causes. The proximate drivers explain the direct action of humans on local land covers and include expansion of agriculture, unsustainable exploitation of forest resources and infrastructure development [8]. Deforestation is an important cause of LULC elsewhere in the world [9]. The major drivers of deforestation in Ethiopia are settlements, agriculture (both small scale and commercial), extraction of construction materials, grazing, and firewood and charcoal collection [10]. Ethiopia is among the countries characterized by diverse vegetation [11]. However, the high demand for agricultural land due to growing human population has contributed to the deterioration and depletion of forest resources of the country [12].

In Ethiopia, forest losses of 140,000 hectares each year are driven by conversion into agricultural lands, and unsustainable forest management, underpinned by poor governance, uncertain land tenure and a rapidly growing population [13]. The average annual deforestation rate is 1% which is high compared to other Sub-Saharan African

countries (0.6%) [14]. Benishangul-Gumuz Regional State (BGRS), which is located in Western Ethiopia, is one of the highly forested regions in the country. The larger portion of the region is covered by the Combretum-Terminalia vegetation type in which lowland bamboo is also the major resource in the region. However, studies from the year 1985 to 2011in some districts of the region reported the decline of forest resources at an alarming rate [15]. In the 1960s, the total area of bamboo in Ethiopia was estimated at less than 2 million hectares. The 1997 Global Forest Resources Assessment, estimated 0.8 million hectares of bamboo resources in the region. The lowland bamboo forest cover in the region has been devastated due to anthropogenic and natural factors. This result implies that if the same trend continues, the available bamboo stock will vanish in a shorter period of time [15].

1.2. Objectives of the Study

The objective of the project is mapping of land use land cover for those three years and detecting the land use land cover change in areas and percent between this five years interval.

1.3. Statement of the Problem

Assosa woreda has faced the difficult challenge of rapid change of land use land cover, especially a dramatic decrease of vegetation due to deforestation for agriculture. [15] as they stated Woodland, bamboo forest and bushlands have declined by 31.7 percent, 53.9 percent, and 39.3 percent, respectively. A rapid decline in woodland which means forest could be due to ever- increasing firewood demand in the study area and also they also deforest for agricultural land. Moreover, increasing the number of human population coupled with climate change may contribute to the problem. Local communities in the study area largely depend on wood and charcoal for cooking meals and heating homes. This problem can lead the area to higher risks .my intention is to detect how the problem has it reduced or still increasing since the early researchers detected it in 2013, and I tried to test from 2013 to 2023 within five years intervals.

2. Material and Method

2.1. Description of the Study Area

The study area, Assosa Woreda, is located in western Ethiopia and it is located Northing of between 90 45′ 00 and100 50′60.00 and Easting of between 34° 00′ and 34° 50′ 00′′. The region has a total area of approximately 50,380 km, ranging from 580 to 2,731 meters above sea level (masl). Asossa is located at a distance of 687 km west of Addis Ababa, the capital city of Ethiopia (Figure 1).

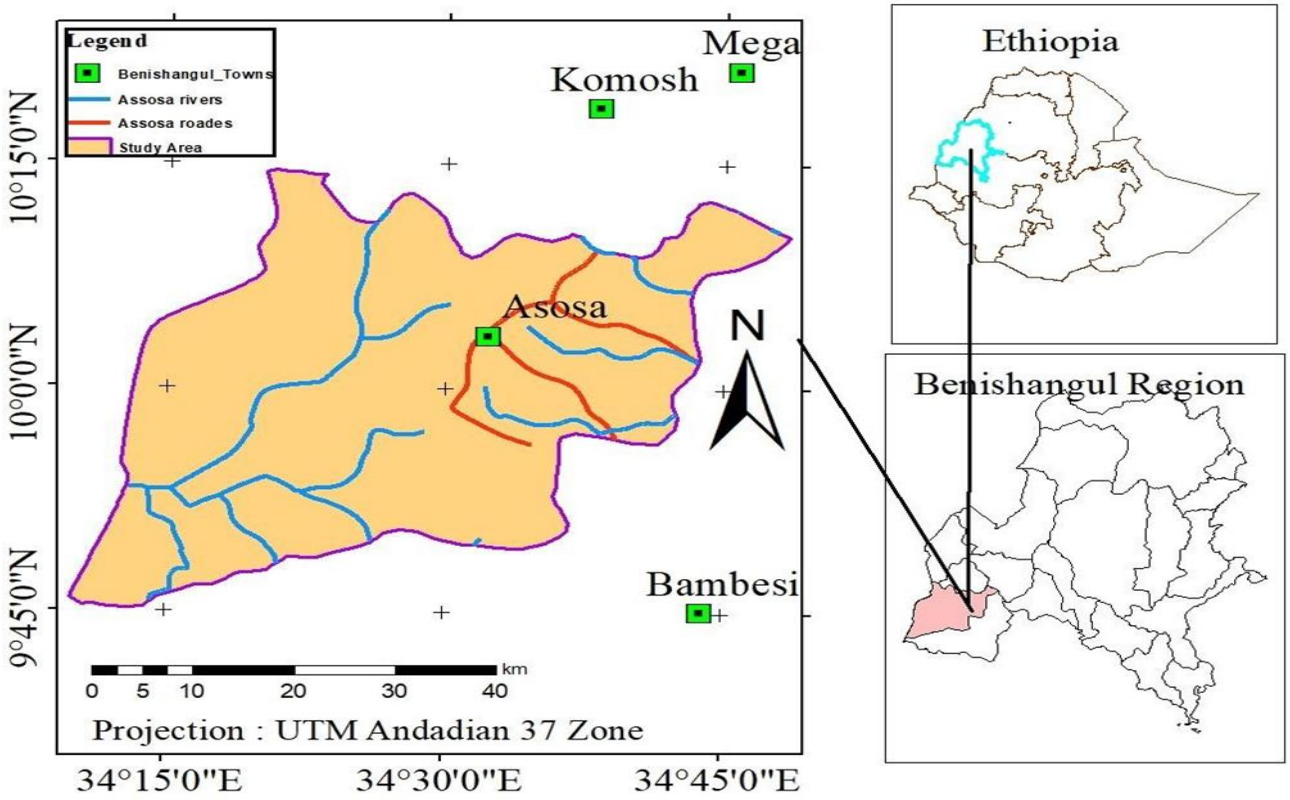

Figure 1. Location map of study area

2.2. Research Design

Firstly, Landsat 8 images were downloaded for the years 2013, 2018, and 2023 from USGS earth explorer. Then by using ArcGIS software bands were composited. Then by using ArcGIS extraction of the area of interest that is Assosa woreda for each year respectively. Then in ArcGIS arc toolbox special analyst tools, iso cluster unsupervised classification was done, the input is those three years respectively.

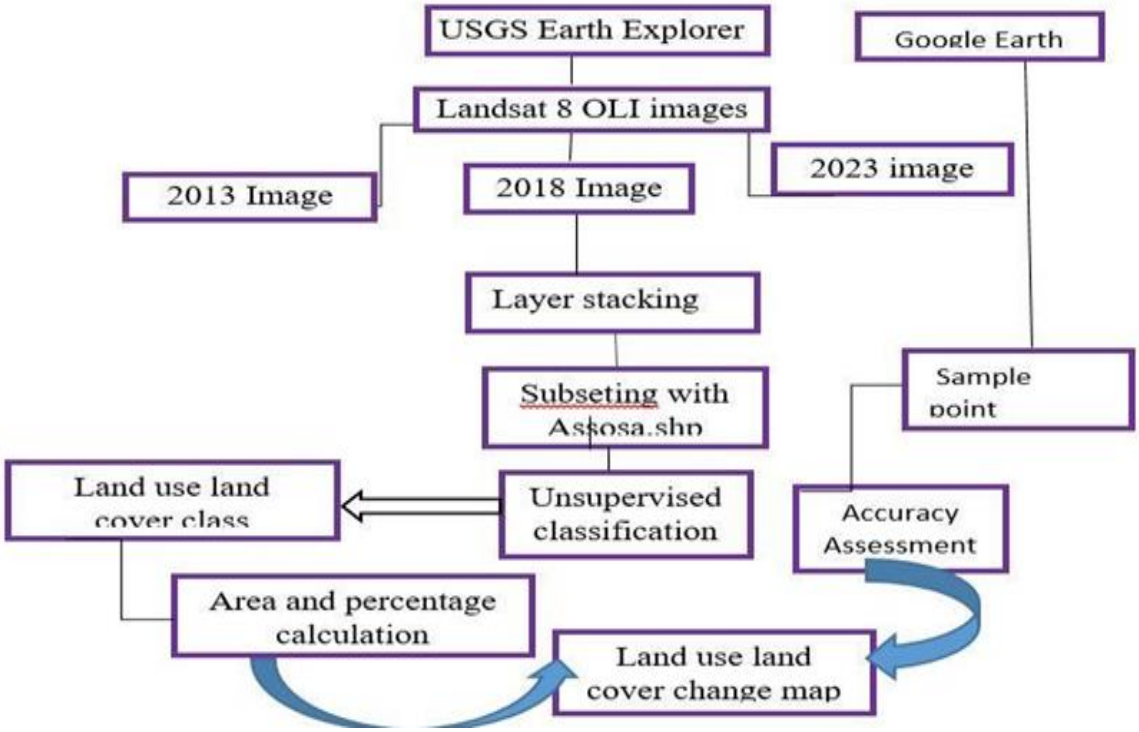

Figure 2. The methodology chart of the project

A number of classes that were taken were initially, six class were taken for each by overlaying on a base map and it is difficult to identify one feature class from another therefore the number were increased to ten, which was best for the identification of one class from another when a class of ten were used, there were two or more colors indicating one feature, for this reason, those features were grouped as one since it is on a base map. By this method, the features were classified into five main classes, Forest, Bare land, Farmland, built-up, and water body lastly the area was calculated for all those features for each year respectively (Figure 2).

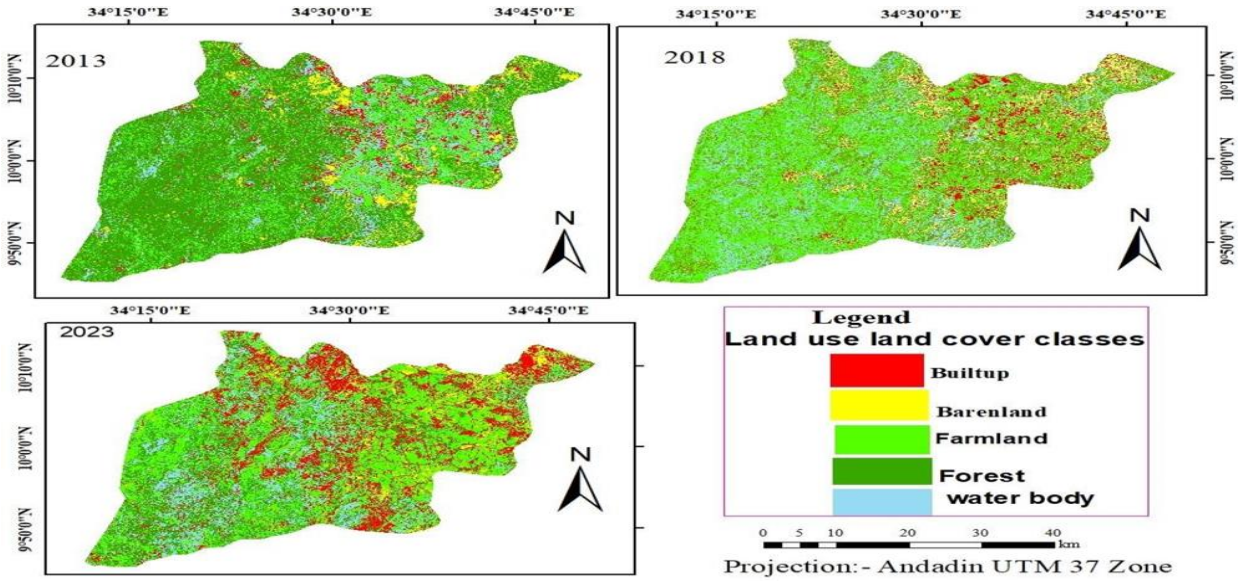

Figure 3. The land use and land cover change map for 2013, 2018, and 2023

3. Results and Discussion

The findings of the project demonstrated five major land-cover types on the basis of 2013, 2018, and 2023 Landsat images taken for Assosa woreda. These classifications were forest, farmland, bare land, built, and water body. From those classes, forest shows the highest decrement, and also built and farmland shows a high increase from 2013 up to 2023. This change could be due to the increase in population since when the population increases the need for agricultural land and built- up areas increases which led to the decrease of forest since both increases the rate of deforestation (Figure 3).

Table 1. The area and percent cover for each year interval

LULC type	2013 Area(hectare)	2013 Area (%)	2018 Area(hectare)	2018 Area (%)	2023 Area(hectare)	2023 Area(%)
Forest	116129.7	57%	64182.4	30%	47829.2	23%
Barren land	8790.07	6%	17003.5	8%	8790	4%
waterbody	28439.2	14%	35849.2	17%	29785.2	15%
farmland	35950.9	18%	77698.6	36%	79016.5	38%
Built-up	12383.3	6%	20604.8	10%	39906.87	19%

The land use and land cover (LULC) dynamics between 2013, 2018, and 2023 reveal significant changes in the landscape. This analysis focuses on the alterations in different land cover types and their implications (Table 1 and Figure 4).

Forest Cover: The forest cover has shown a noticeable decline from 2013 to 2023, with a reduction of approximately 57,347.5 hectares, representing a decrease of 34%.

Barren Land: The area of barren land has experienced fluctuations over the years, with a slight increase between 2013 and 2018 followed by a decrease in 2023. While the decrease in barren land from 2018 to 2023 is a positive sign, further analysis is needed to understand the underlying reasons behind these changes.

Water Bodies: Water bodies have exhibited a gradual increase in area from 2013 to 2023, indicating potential improvements in water resource management and conservation efforts. However, it is essential to monitor the quality and health of these water bodies to ensure sustainable water availability for various human and ecological needs. Strategies to mitigate pollution, habitat degradation, and over-extraction should be implemented to safeguard these vital ecosystems.

Farmland: The expansion of farmland is evident in the data, with a significant increase in area from 2013 to 2023. This expansion suggests intensification of agricultural activities to meet growing food demands. While agricultural development is essential for food security and economic growth, it may also lead to adverse environmental consequences such as habitat loss, soil degradation, and water pollution. Therefore, sustainable agricultural practices and land management strategies must be adopted to balance agricultural productivity with environmental conservation goals.

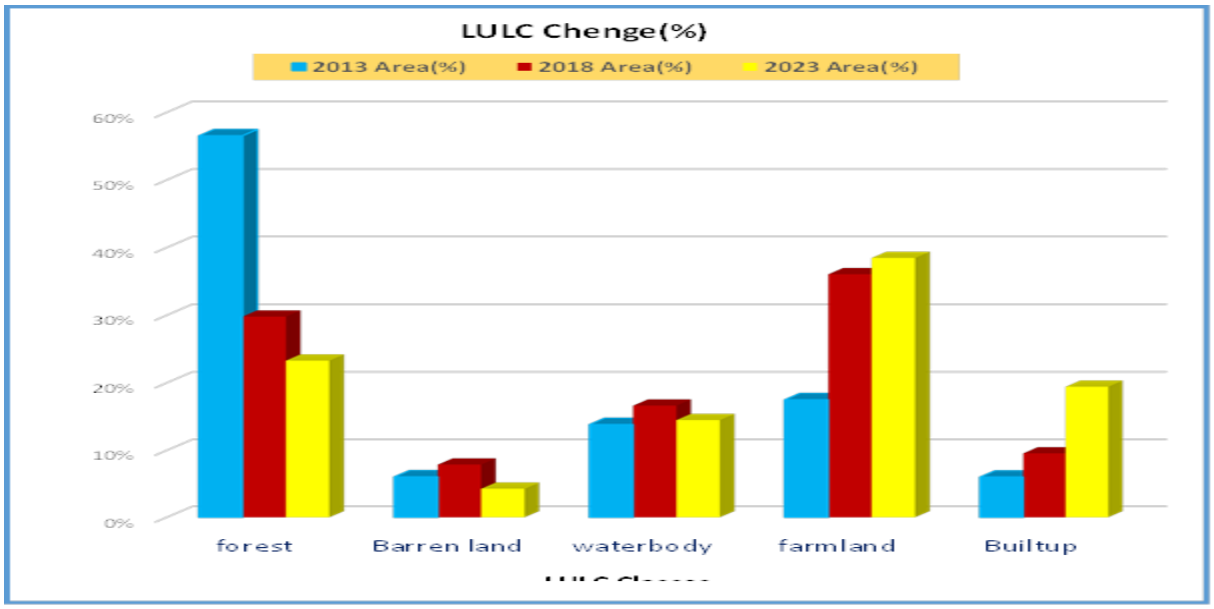

Figure 4. The Land use and land cover change in percent for each year

Built-up Area: The built-up area has experienced rapid expansion over the years, nearly tripling in size from 2013 to 2023. This expansion is indicative of urbanization and infrastructure development driven by population growth and economic activities. While urbanization brings socio-economic benefits, it also poses significant challenges such as habitat fragmentation, air and water pollution, and increased vulnerability to natural hazards. Urban planning policies focused on promoting compact, efficient, and sustainable urban development are essential to mitigate these negative impacts and ensure the livability and resilience of urban areas.

To achieve sustainable development and environmental conservation goals, integrated land use planning, informed policy interventions, and community engagement are imperative. Continued monitoring and assessment of land cover changes are necessary to inform evidence-based decision-making and promote the long-term health and resilience of ecosystems and societies.

Table 2. The change in percentage between the years

Land use	per(%)change 2013-2018	per(%)change 2018 -2023
Forest	-27%	-7%
Barren land	2%	-4%
Waterbody	3%	-2%
Farmland	19%	30%
Built-up	4%	15%

The land use dynamics between 2013 and 2023 exhibit significant changes across various categories (Table 2).

Forest: Between 2013 and 2018, there was a substantial decrease (-27%) in forest cover, indicating significant deforestation during this period. However, from 2018 to 2023, the rate of deforestation slowed down, with a smaller decrease of -7%. This could be attributed to conservation efforts, stricter regulations, or natural forest regeneration processes. The continued loss of forest cover remains concerning, emphasizing the need for continued conservation measures to protect biodiversity and ecosystem services.

Barren Land: Barren land witnessed a slight increase of 2% between 2013 and 2018, indicating land degradation or abandonment. However, from 2018 to 2023, there was a reversal in this trend, with barren land decreasing by -4%. This could be due to reclamation efforts or changes in land use practices. Efforts to rehabilitate barren land should be encouraged to restore ecosystems and prevent further degradation.

Water body: Water bodies experienced a modest increase of 3% between 2013 and 2018, which could be attributed to natural factors such as precipitation patterns or human interventions such as reservoir construction. However, from 2018 to 2023, there was a slight decline of -2% in water body coverage. This could be a result of anthropogenic activities like land reclamation or climate-induced changes. Maintaining and preserving water bodies is crucial for biodiversity conservation, freshwater supply, and flood regulation.

Farmland: Farmland saw a substantial increase of 19% between 2013 and 2018, indicating expansion of agricultural activities, possibly driven by population growth and food demand. This trend continued from 2018 to 2023, with an even higher increase of 30%, highlighting the ongoing conversion of natural landscapes into agricultural land. While agricultural expansion is essential for food security, it also raises concerns about habitat loss, soil degradation, and water resource depletion.

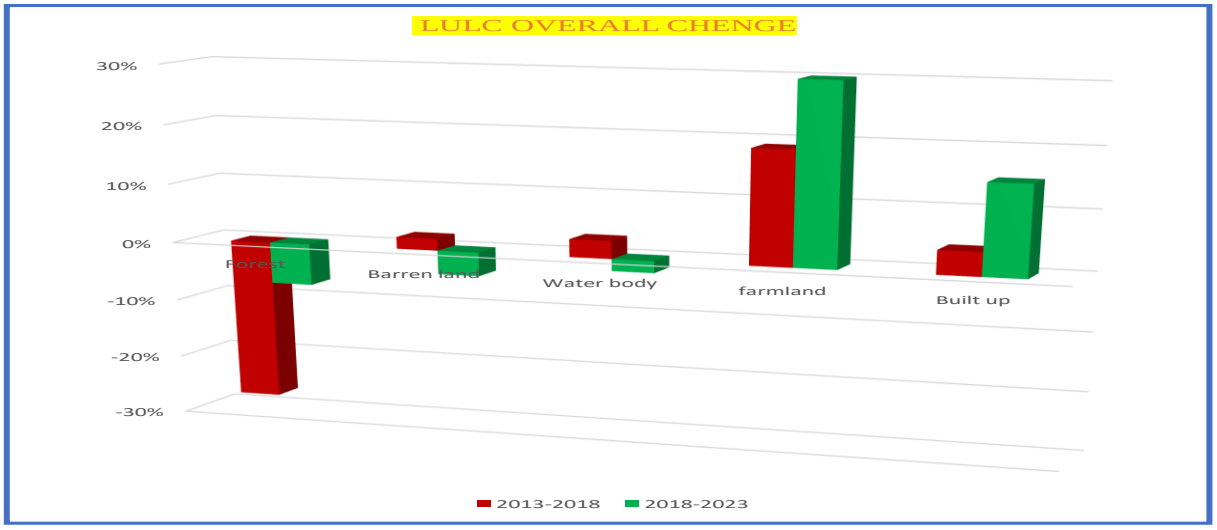

Figure 5. The overall change indicator in percent

Built-Up Areas: Built-up areas experienced moderate growth, with a 4% increase between 2013 and 2018, likely driven by urbanization and infrastructure development. From 2018 to 2023, this growth accelerated, with a 15% increase in built-up areas. Rapid urbanization can lead to various environmental challenges, including habitat fragmentation, pollution, and resource depletion. Sustainable urban planning strategies are essential to mitigate the adverse impacts of urban expansion on ecosystems and human well-being.

Overall, the data reveals complex dynamics in land use changes over the study period. Effective land management policies and conservation initiatives are imperative to balance the competing demands of development, agriculture, and environmental protection. Long-term monitoring and adaptive management strategies are crucial for maintaining ecosystem resilience and ensuring sustainable land use practices in the face of evolving socio-economic and environmental pressures (Figure 5).

3.1. Accuracy Assessment

The accuracy assessment for this project is done by taking samples from the classified LULC and dragging those points to google earth to detect their accuracy. I have taken twelve sample points in each land cover class the result that I found is almost eight up to ten is accurate. Since it is an unsupervised classification it could have some limitations. Even though almost the samples are indicators of the land use land cover classes.

4. Conclusion

Environmental and natural resource degradation is a major concern in Ethiopia. This project shows the major decrease in land use land covers around Assosa Woreda. (Bessie et al., 2016) as they described a large number of immigrants were resettled around Assosa woreda. In case of famine encountered due to severe droughts in 1984/85. If this problem continued as this, it has the probability to lead to vulnerable climate change as well as famine in order to mitigate this problem appropriate policy should be designed.

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Genet Amsalu: Conceptualization, Methodology, Software **Yimam Mekonen:** Data curation, Software, Validation.

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The authors declare no conflicts of interest.

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The feasibility of developing bicycle based urban transportation as a means to reach the goal of sustainable transportation: The case study; zone 2 of Tabriz municipality

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Abstract

As a result of the expansion of automobiles and motor vehicles after the Industrial Revolution, the expansion of roads, and passages outside the city and inside the city without considering the conditions and standards. Over time, complex problems have taken place. It created a new trend in the urban transportation network, especially in big cities and urban centers. One of the solutions of developed countries is encouraging people to use non-motorized travel models (such as walking and cycling) along with motorized types (public and personal transportation) through the building of necessary infrastructures and public awareness. The expansion or non-expansion of cycling is influenced by various factors including natural and artificial obstacles, social and economic structure and factors, legal framework, traffic policy, safety, and safety of cyclists. The present research is practical and descriptive-analytical due to the description and analysis of the features governing the range. In this research, various library tools, interviews, observation and field observations, statistics and documents of relevant organizations, and scientific sources have been used to collect quantitative and qualitative data, and to analyze the gathered data, the chi-square test, and Kruskal-Wallis were used. According to the participants in the interview, the aspects of sports and recreation, reducing environmental pollution and traffic, and the reasonable price of bicycles compared to other vehicles are the most important incentives, and the absence of an exclusive bicycle path, the social view of people towards cyclists, harassment of some drivers towards cyclists, lack of safety, and security are among the most important obstacles for citizens to use bicycles as a means of travel.

1. Introduction

The industrialization process caused the separation of areas such as housing, work, health and education, and cities began to grow and spread. The distance between these areas has led to longer travel distances and brought about transportation problems [1].

During many years in the past, our cities were transformed to facilitate the use of the private vehicle. As a result of this massive use and the rising motorization rate, which reached its maximum value in 2007 with 481 vehicles per 1000 inhabitants, our cities suffer nowadays problems of congestion, saturation of public areas, contamination and noise. The changes for increasing the capacity of the roadways used by private vehicles are more expensive to build and carry greater sacrifices [2]. Movement in urban space is one of numerous challenges of the modern world. Problems with transport result from both endogenous and exogenous functions performed by cities, which has a critical impact on the number of people interested in commuting and the need to meet their transport requirements [3].

The following are the overall consideration of transportation:

1- Climate change aspects: Some of the most significant impacts of climate change on transportation infrastructure and operations arise from severe adverse weather conditions. As these weather incidents increase in frequency and severity, their related damages also increase [4]. This means that careful and effective governance of transportation operations and infrastructure is crucial to limiting disruptions and accidents caused adverse weather conditions [5].

2- Social and health aspects: Different cities differ in how they provide public transportation services, facilities for pedestrians and cyclists, and car usage. Similarly, there are significant differences between reality and the application of policies for speed limits and blood alcohol control. These observations show that the impact of transportation policies on public health and social equity among different groups is diverse [6]. In addition, economic development has led to increased demand for passenger and freight transportation. Increased car use, pollutant emissions, and traffic congestion have given rise to multiple health problems, including traffic-related injuries and respiratory disease risks caused by harmful emissions and noise [7].

3- Economic aspects: Transportation is a fundamental part of the global economy, making it possible for people and goods to move across borders. It drives economic growth and development by supporting trade, investment, tourism, global supply chains, and employment. Its economic impact can be measured in a number of ways, including the value of transportation, such as passenger and freight fares, and the value of goods transported [8]. In turn, the economic benefits of transportation are reflected in other sectors of the economy. These include increased economic productivity, investment and trade, and the attraction of new businesses and activities to areas with efficient transportation infrastructure. In addition, transportation can improve cost efficiency by facilitating access to resources and markets around the world. It can also improve people's lives by providing access to jobs, education, health care, and other essential services [9].

4- Energy use aspects: Energy consumption in transportation has become a major concern for researchers. Accordingly, assessing the relationship between economic development, the transportation industry, and energy consumption in this sector is one of the key issues for investigation. This relationship involves the possibility of improved transportation quality and consequently, a decrease in energy consumption [10]. Other factors have an impact on energy consumption, i.e., passenger-kilometers, fuel efficiency, distance, and emissions from the transportation sector, which all depend on vehicle type, combustion engine, and fuel type [11].

Sustainable transportation system is one of the most important elements of a sustainable and livable city. Approaches to developing sustainable urban transportation systems will assist the achievement of a sustainable city [12]. A move towards sustainable mobility necessitates a reduction in the inefficient use of private vehicles and an increase in access to environmentally-friend and sustainable transport [13]. Cycling offers part of a solution as an active mode of transport that is inexpensive, healthy, free from local emissions, and consumes very little space compared to motorized traffic [14]. It is known that the majority of inhabitants tend to move in areas where journeys require less than a quarter of an hour via walking, cycling or unmotorized transport [15].

In Iran, population growth, rapid urban development, an unbalanced spatial structure, changes in the way of living, and job patterns and have led to increase in travel demand in big cities. The increase in travel demand, need to move and the dynamic of citizens has led to an expansion in the number of cars, an increase in traffic congestion in the main roads, and then environmental pollution and disruption of traditional social relationships and the mental health of residents [16].

Despite the costs are allocated for the construction of bicycle paths in the streets of Tabriz, it has not been effective in promoting the culture of using bicycles, and the public's willingness to use bicycle paths in Tabriz is much lower than international standards [17].

1.1. Theoretical Foundations

Sustainable Urban Transportation: Although there is no standard definition of a sustainable transport system, the widely accepted definition recognizes that sustainable transport is a set of policies and guidelines that are integrated, dynamic, continuous, and include economic, social, and environmental objectives.

It is a background that brings fair distribution and effective use of resources to meet the transportation needs of society and future generations [18]. Sustainable transportation systems can reduce the pollutants related to transportation and greenhouse gases, and improving the sustainability and vitality of communities through investment in transportation facilities, from priority systems, especially green transportation supporting system and environmentally friendly non-motorized traffic [19].

Principles of Sustainable Transportation: In the book "Our cities belong to us" which was published by Walter Hook from researchers of ITDP Institute in 2010; 10 principles that are necessary for sustainable transportation in urban life are stated, which include [20] (Figure 1).

1	•Creating suitable places for walking
2	•Creating suitable plices for cycling and other non-motorized vehicles
3	•Low-cost and comperhensive public transportation
4	•Managing trips by increasing walking, reduced number of vehicles and safe speed
5	•Transportation goods in cleanest and safest way
6	•Mixing landuses or consolidating people with activities, buildings, and spaces
7	• Increasing density of buildings, creating pedestrian-oriennted and public transportation-oriented zones
8	•Adding natural, cultural, social, and historical attractions
9	•Straighten walking paths by decreasing size of blocks
10	•Making them durable and sustainable

Figure 1. Principles of sustainable transportation

Types of Cycle Routes

1- Exclusive Paths: These routes are independent and separated from the routes of other motor vehicles. They are created only for bicycle traffic. These routes are created for parks, recreation areas, out of town areas, and new cities, where there is no space limitation and the traffic separation is possible.

2- Semi-Exclusive Paths: If the volume of bicycle traffic is low, and the creation of exclusive routes is limited by space, semi-exclusive routes are used. These paths are built near and parallel to the automobile lane and are separated by physical obstacles such as the difference in height, tabulation, fence, or border.

3- Mixed-Used Paths: This type of route is used in a mixed manner for the traffic of bicycles and motor vehicles, and the direction of movement is determined by symbols on the pavement and signs.

4- Shared Pedestrian and Bicycle Paths: Mix use by pedestrians and cyclists will be possible when the traffic volume of both is sufficient compared to the allocated place. In cases where the volume of vehicular traffic is high compared to the capacity of the street, the width of the street is not efficient to be built a separated cycle path next to it, if it is impossible to reduce the width of the vehicular lanes, or if the speed of motor vehicles endangers the safety of bicycle traffic, the use of shared pedestrian and bicycle paths is allowed.

Designing Cycle Route Tips: For designing cycling networks, not only the necessities of current situation, but also the future terms should be considered.

1- Continuous Network: For designing cycling network, one should try to create continuous and direct paths. The network should be started from the center of urban activities to its outside. In other words, residential, work, shopping, and leisure areas should be connected by cycle lanes in the whole city.

2- Observing the longitudinal slope: the longitudinal slope and its length determine the quality of bicycle traffic. For network designing, each part of the road must be divided into parts with the same slope, the length of the slope and the amount of the slope should be determined.

3- Route safety: It should be avoided as much as possible from Interference and collision between bicycle paths and motor vehicles, and the speed of motor vehicles should be kept as low as possible in the areas where the volume of bicycle traffic is high.

4- Route clarity: Bicycle paths should have enough clarity and legibility to inform cyclists about the facilities around the path, and try to make the route continuous and direct in the shortest way, connect the distance of origin and destination and avoid routes that increase the travel distance.

5- Route Beauty: Due to the low speed of bicycle traffic, it is important to consider the surroundings compared to traffic with motor vehicles; therefore, it is necessary to observe the beauty of the route and its diversity. At the same time, the routes should be equipped with urban furniture, green places, bicycle parking and signs [21].

Effective factors in using a bicycle: There are various factors that influence the use of a bicycle in different time and place conditions [22].

Effective factors in using a bicycle: There are various factors that influence the use of a bicycle in different time and place conditions [22] (Figure 2).

According to the research of Adam and Urtar, the dominance of motor vehicles was revealed from the time of their inception until the late 1960s. Despite the small number of motor vehicles, city streets were mainly converted into throughways and city squares into car parking lots. Following such dilemmas, the youth movements of the 1960s and the events of 1968 redefined and visualized cities as vibrant places, which is seen in the analysis of Lefebvre (1968). The right to the city focuses on returning the city to its residents, creating an excellent quality of life for people, and building the city as a starting point for collective life [23].

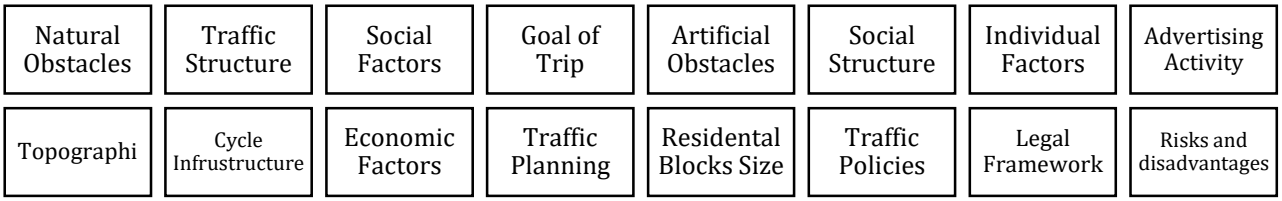

Figure 2. Effective factors in using bicycle

1.2. Literature Review

Hatami nejad (2006) in his article entitled Bicycle and its role in sustainable urban transportation (case example: Bonab city), has concluded that the bicycle is the most sustainable urban transportation system next to walking. In addition, to travel short distances in cities (up to 6 km), the average speed of a bicycle is higher than the average speed of other vehicles [24].

Gharib (2012) in his article on the feasibility of creating pedestrian and bicycle paths in the area of old Tehran, has put forward some essential points for bicycle and pedestrian traffic. These points include improving the current public transportation system, reducing the volume of driving traffic and banning motorcycle traffic in the central core, the safety of bicycle traffic, predicting bicycle parking, and compliance with slopes [21].

Kashani jou (2008) has described various theories in his studies on the evolution of theories related to inter-city transportation. In the meantime, according to the Economic Corporation and Development Organization, sustainable transportation does not endanger public health or biological systems and uses fewer renewable and non-renewable resources. The most important criterion proposed by the organization is sustainable mobility, including public transportation, walking, cycling, electric vehicle technology, and other types of green transportation [25].

Eftekhari (2009) in the article titled, analyzed the travel demand pattern in the city of Isfahan and based on the analytical knowledge of the subject, the potential and actual features of this metropolis intended to develop and create cycling transportation system infrastructures as a main mode of transportation and an option for public transportation [26].

Wesley and Norman (2011) in the article evidence on why bike-friendly cities are safer for all road users, investigated the number of fatal accidents. According to the studies, the risk of fatal or severe accidents for all users is much fewer in bicycle-oriented cities, which is caused by the low traffic speed on the roads. At first look, these observations seem to be due to the design of the road network suitable for bicycle movement, But the bicycle infrastructure itself helps to calm the traffic, the presence of a large number of cyclists changes the dynamics of the street and effective to reduce the speed of the car. This study, unlike its peers, investigated the behavior of vehicle drivers and concluded that reaching a threshold of the number of cyclists forces drivers to move more slowly [27].

Ghaffari Gilandeh (2014) in the article has concluded that the citizens consider cultural factors (such as lack of sufficient advertising, lack of cycling culture, lack of use by community managers, etc.) as the most important factors of unwillingness to use bicycles and even the weather factor that is considered as an important deterrent, is placed in the next ranks. In addition, people with less education than people with higher education and people with lower income than people with higher income use bicycles more. It shows that either education or high income cannot be a factor for more acceptance of cycling in city trips. It can be due to the cost-effectiveness of cycling and demonstrates the need for enhancing culture among all classes of society. Furthermore, the purpose of most bicycle users is sport and pastime, which requires planning to encourage them to cycle to do daily tasks [28].

Kwiatkowski [2018] in his article on urban cycling as an indicator of socio-economic innovation and sustainable transport, investigated the citizens' perception of the bicycle as a means of transportation in the city and concluded that Commuting by bicycle due to the existence of various obstacles and incentives (on the one hand, the advantages of the cycling include its positive effects on the budget and health of the residents, the environment, and the urban economy, and on the other hand, the problems and restrictions imposed on cyclists) has become a considerable challenge for urban residents. One of the solutions to overcome some of the applied limitations related to system performance in spatial, socio-economic, and technology is the use of the bicycle-sharing system as an innovative element in the urban transportation system [3].

Fistola, Gallo, LaRocca, and Russo (2020) in an article entitled the effectiveness of urban cycle lanes; From dyscrasias to potential solutions, is devoted to analyzing urban bicycle lanes as an infrastructure that can be improved. According to the sustainable methods of moving in cities and the framework of European policies, cycling is adjudged an environment-friendly transportation model; Because it is related to the stability and health of people. The promotion of cycling in the urban context should be accompanied by safe movement and a feeling of satisfaction with the urban space, which requires the planning of mobility infrastructure and land use to ensure the high effectiveness of urban infrastructure for sustainable mobility [29].

Achieving bicycle-oriented sustainable transportation requires some important modeling and applications in various technical, engineering, social, economic, media, and similar fields at different regional, urban, national, and international levels, because this is in the interaction of factors with Each other and mobilization can be achieved together. The conceptual framework of this major goal can be seen below [30] (Figure 3).

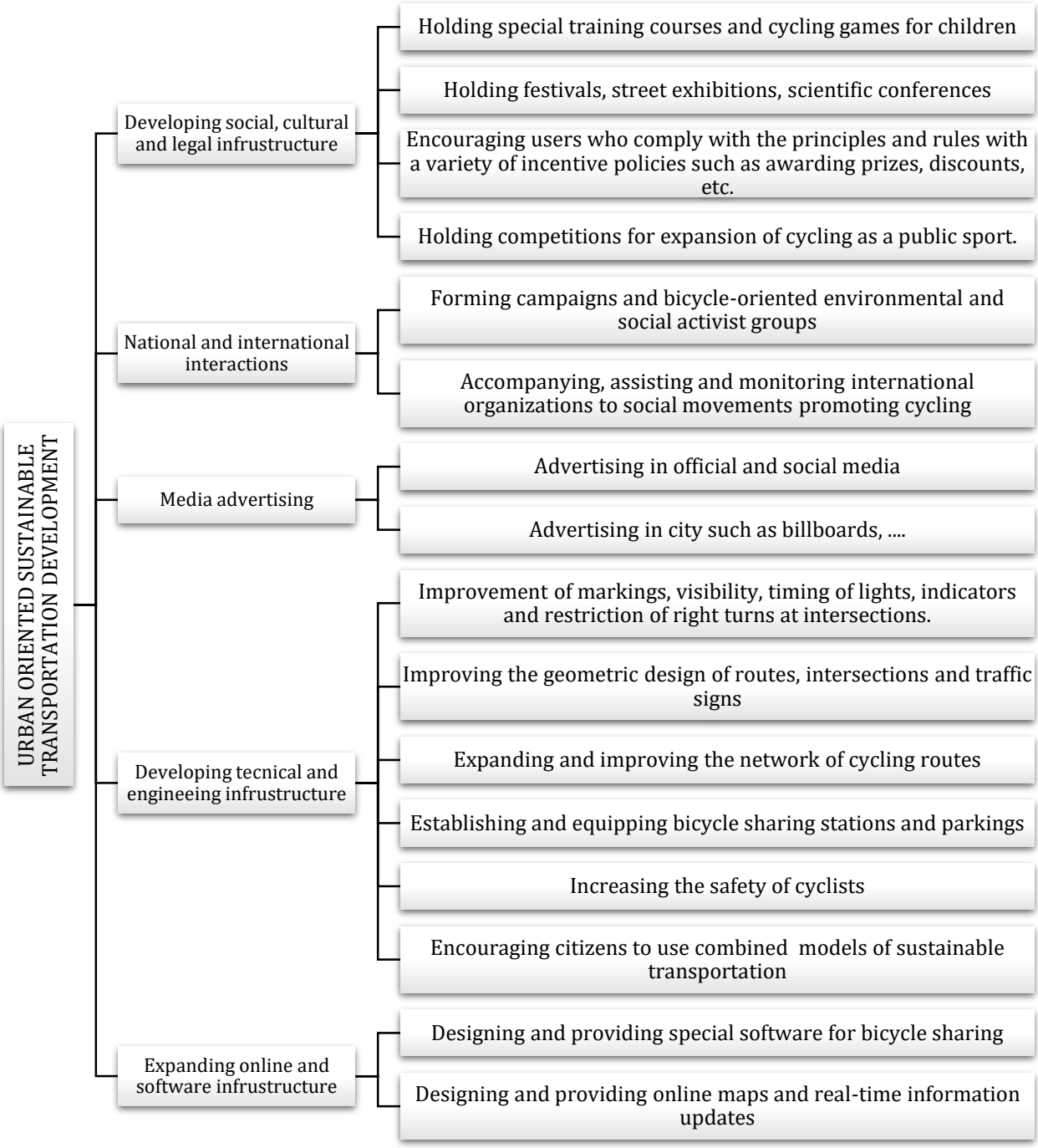

Figure 3. Bicycle-oriented sustainable transportation development framework

2. Material and Method

2.1. Study Area

District 2, one of the ten districts within the Tabriz metropolis, is situated in the southwestern part of the city, bordered by districts 9, 5, 1, 8, and 3. To the east, north, and west, it is encircled by Shahid Kasaei Highway, Basij and 29 Bahman Boulevards, Imam Khomeini Street, Jodeiri Street, Montazeri Street, and Azadi and Molla Sadra Boulevards, respectively.

According to data provided by the Statistical Center of Iran in 2016, the population of Tabriz was 1,558,693, with 12.6% of the residents located in District 2. Notably, the district exhibits a higher population of women

compared to men, resulting in a sex ratio of 96.6, a significant deviation from the city's average. The socio-economic distribution in District 2, as well as throughout Tabriz, indicates that the affluent and privileged segment of society predominantly resides in a few districts, including the one under study. Moreover, in comparison to other districts, this stratum has a relatively higher representation among other socio-economic groups.

Within various social groups, there is a notable allocation of resources to middle social groups, a factor that significantly influences the region's development and its ability to address demands, interests, and claims effectively.

2.2. Field Data or Spatial Datasets

Travel and population absorption centers encompass a variety of facilities at both metropolitan and regional levels, such as higher education institutions (Tabriz University), recreational and leisure facilities (El Goli Complex, Shamim-e-Paydari, and Abbas Mirza Parks), administrative buildings (East Azerbaijan Broadcasting Center), medical institutions (Shohada Hospital), commercial centers, and more. These centers serve as daily destinations for thousands of Tabriz residents, particularly in the studied area, and play a pivotal role in the daily travels of these individuals. The significance of these centers, effective planning and design of various transportation models, including infrastructure for public and private transportation systems, bicycles, and pedestrian pathways, become imperative. The objective of the mentioned research is to qualitatively enhance and encourage users' willingness to incorporate bicycles into their daily travel routines, encompassing trips to workplaces, educational institutions, shopping areas, entertainment centers, and more. As can be seen in the following map, most of these centers are located on the northern border of the district (29 Bahman Blvd., and Basij Blvd.) and in the middle of it (Shahid Bakri Blvd.), and they require special attention from officials, planners, and urban designers (Figure 4).

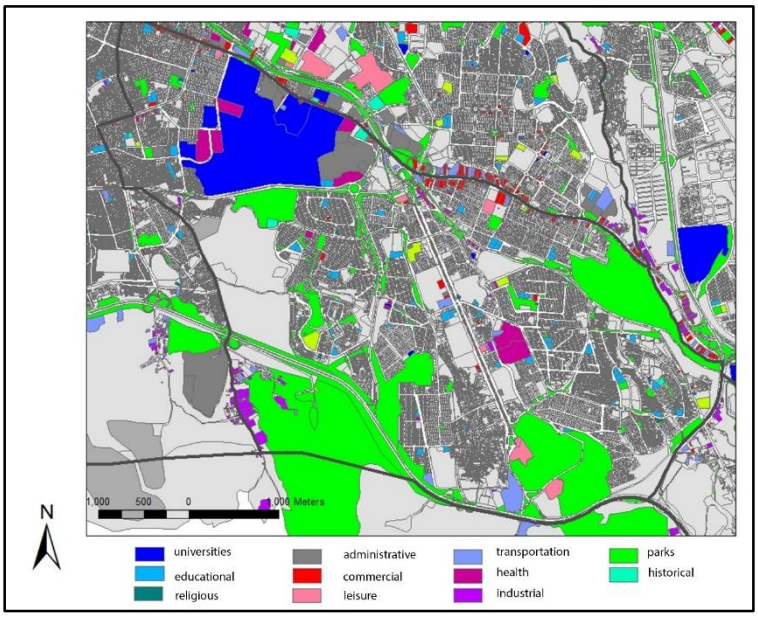

Figure 4. Travel Attractive Centers

The transportation structure and road network of this region, which was the focus of the present study, are poorly described (Figure 5);

[1] Peripheral roads are part of the highway, the central roads inside the part are often arterial, and a limited number are collectors.

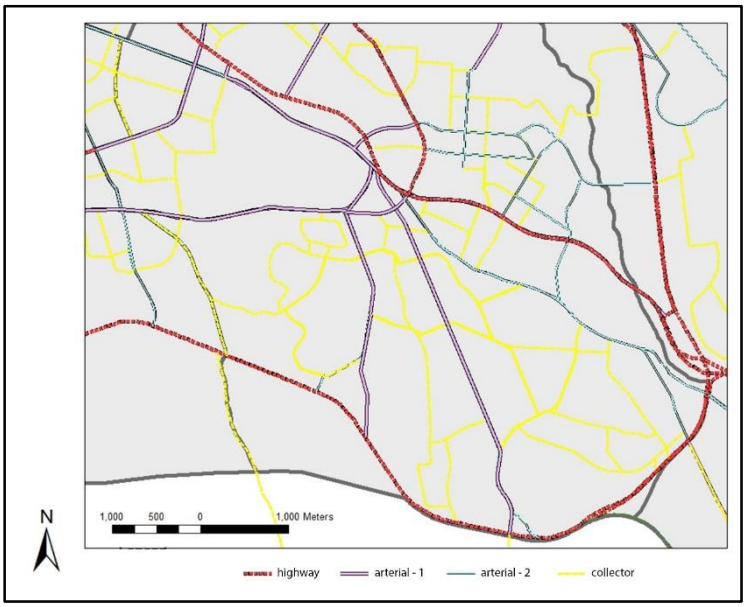

Figure 5. Communication Network

[2] Most of the intersections are in the coplanar subcategory, which was the self-facilitating factor of crossing with bicycles.

[3] The public transportation system focused on the northern area, and the subway system only passes through Bakri Blvd (Figure 6).

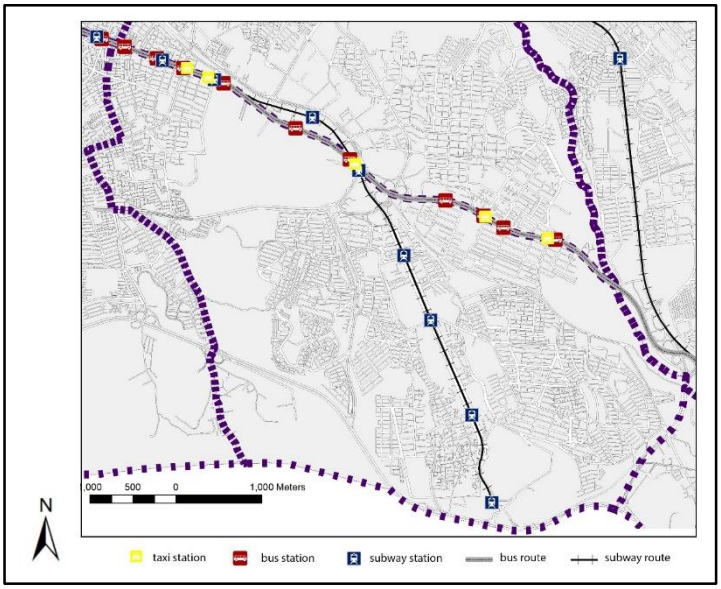

Figure 6. Public Transportation System

[4] The zone is in an acceptable state in terms of travel time and level of service, and people don't suffer from roadblocks and wasted time during the trip.

[5] The slope of the roads is also below 5% in general, which is an obstacle for cycling. In addition, by installing electronic mechanisms, one can ride a bicycle in long and steep passages (Figure 7).

[6] According to the field observations, the specific bicycle paths in the area are in a state of disarray, and at some points, they are interrupted and discontinuous, infrastructure is inadequate and depreciating and has various obstacles and needs to be revised.

2.3. Used Methods

Analyze the features prevailing in the area, and the factors affecting the use and non-use of sustainable transportation approaches to decrease the obstacles, and to increase and develop the relevant incentives. In this type of research, besides illustration, the researcher will describe and explain the reasons for how and why the problem is and its dimensions. One of the attributes of this type of research is that the researcher will not intervene

in the situation, conditions, and the role of the variables, and he/she will not manipulate or control them; simply, the researcher will study what is available, describe, illustrate, and analyze it [31].

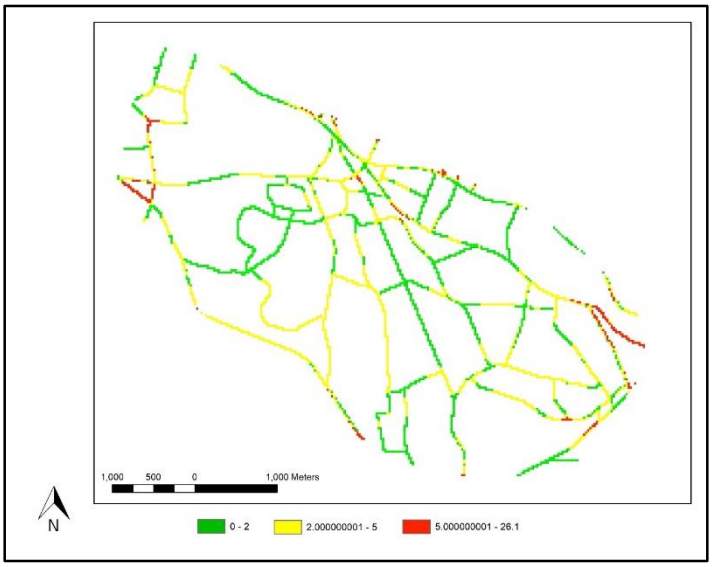

Figure 7. Slope

In the present study, the relevant data were collected based on library methods, interviews, observation, field perception, and questionnaires. Thus, quantitative and qualitative data were extracted from [1] the documents of various organizations, including the Statistical Center of Iran, the Meteorological Organization of East Azerbaijan Province, Tabriz Municipality and City Council, and the like, [2] the studies and researches available in various scientific articles and references, and urban development plans, [3] various and reliable websites. Then, an interview was made with the officials of the transportation department of the district municipality. Finally, the views of civilians and users were investigated through closed questionnaires.

In this survey, some individual information, including gender, age, education, and income, was requested (Table 1). Then, the people were asked if they had or did not have a child in their home. The purpose of this question was to examine whether adults prefer to utilize bicycle as a full or partial substitute for leisure sports and a joint activity with their children or not. Then, the people's weekly cycling, and their preference to use travelling models were investigated; their intentions and purposes to use bicycle, including recreation and leisure, sports, going to the workplace and educational centers, daily shopping, etc., the influence of material and financial issues on bicycle buying and utilization, and their willingness to utilize shared bicycles were studied. Next, people's cycling skills, intentions, and interest in this travelling method were discussed. The purpose of this discussion is to describe skilled and regular cyclists, beginner cyclists (having sufficient skills in cycling, but not having the required self-confidence in urban traffic), false beginners (tending to be useful cyclists), and real beginners (having no skills in this field); so, to train people and make them eager and interested, many training courses and seminars can be held, based on their interest and skills. Then, individual attitudes towards travelling models, obstacles, and incentives were asked by some questions with text answers [24].

Table 1. Crosstabulation [age * cycle path design]

Age	Exclusive Path	Semi-Exclusive Path	Mixed Path	Bicycle and pedestrian path	Total
Less than 20 years old	22	0	0	0	22
20-30 years old	72	68	0	0	140
30-40 years old	0	0	0	0	0
40-50 years old	18	0	0	0	0
total	112	68	0	0	180

Table 2. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.96	2	0.03
Likelihood Ratio	9.98	2	0.007

a. 4 cells [66.7%] have expected count less than 5. The minimum expected count is 1.5.

Table 3. Symmetric Measures

	Value	Approximate Significance
Phi	0.41	0.03
Cramer's V	0.41	0.03

Accordingly, based on the Chi-Square test, about two-thirds of people preferred exclusive cycle tracks and the rest chose semi-exclusive tracks. No one chose mixed tracks or ones shared with pedestrians. The value of Pearson's chi-square was less than the threshold [0.05], implying the correlation between the variables of age group and cycle track choice (Table 2). The coefficients of Phi and Cramer's V were used to check out their correlation; accordingly, their correlation is relatively strong (Table 3-4).

Table 4. Ranks

Age	N	Mean Rank
Less than 20 years old	23	59.8
20-30 years old	140	102.42
30-40 years old	0	0
40-50 years old	17	55.25
total	180	

Table 5. Test Statistics [a,b]

Kruskal-Wallis H	df	Asymp. sig.
6.79	2	0.33

a. Kruskal Wallis Test
b. Grouping Variable: age

Based on the Kruskal-Wallis Test, its significance value is less than the threshold (0.05), implying the verification of correlation among variables (Table 5).

According to the participants in the interview, sports, recreation, environmental pollution reduction, and traffic reduction are the most significant incentives; the lack of a cycle track, individual social views, and the price of the bicycle are the major obstacles to cycling.

3. Results

Research shows that countries, having made significant progress in the field of transportation, have taken some measures to increase bicycle utilization, as a mode of travelling, and improve civilians' experiences in this field. To understand this issue better, some of the major actions, taken in these countries, are as follows:

- ✓ Training and informing civilians: teaching cycling rules, advantages, and benefits to civilians, as well as promoting the use of sustainable transportation, such as cycling and walking, from childhood and adolescence, can be effective.
- ✓ Creating appropriate infrastructures: building and developing special tracks for cycling and walking, creating public cycling stations and related facilities, establishing traffic restrictions, and speed reduction in urban areas can encourage civilians to utilize this model of sustainable transportation.
- ✓ Encouraging people to utilize shared bicycles: providing shared cycling services and creating various facilities may encourage civilians to utilize bicycle and facilitate the option of this sustainable transportation.
- ✓ Rules and regulations supporting cyclists and pedestrians: developing rules and regulations supporting cyclists and pedestrians to increase their safety and convenience, as well as facilitating some dedicated tracks and areas for them, can be an incentive to choose this sustainable mode of transportation.

4. Discussion

In general, experts advocate for returning the city to its residents and enhancing their quality of life through sustainable urban transportation, with a particular emphasis on promoting cycling. This mode of travel is well-suited for short distances and necessitates thoughtful planning of both mobility infrastructure and land use. Beyond the individual benefits for cyclists, such as improved health and reduced environmental impact, cycling contributes to the overall safety of the community. Cycling alters the dynamics of the streetscape and helps mitigate risks by reducing the speed of motor vehicles. This not only enhances the safety of cyclists but also reduces the likelihood of fatal or severe accidents for all road users. The integration of cycling into urban transportation systems aligns with the broader goal of creating safer, healthier, and more livable cities for residents.

In many Iranian cities, the utilization of bicycles by citizens faces numerous obstacles, with the most significant hurdles stemming from social factors such as inadequate advertising and the absence of a cycling culture. The present research, focusing specifically on the 2nd region of Tabriz, reveals that environmental factors do not pose significant obstacles to promoting cycling in this area. However, according to the perspective of citizens, the most critical obstacles are cultural and social in nature. These include the overall societal perception of cycling, highlighting the need for public education and cultural development through various initiatives and plans. Overcoming these cultural and social barriers is crucial for fostering a positive attitude toward cycling and encouraging its widespread adoption among the residents of the 2nd region of Tabriz.

Indeed, the sources, in conjunction with the mentioned research, collectively underscore the importance of establishing the requisite infrastructure for cycling to guarantee the security and safety of cyclists. Simultaneously, there is a consensus on the necessity of public education initiatives aimed at altering the relatively negative societal perception of cycling.

For cycling promotion plans to succeed, it is so significant to ensure cyclists' security and safety. Allocating dedicated and safe cycling tracks, developing and enforcing rules and regulations supporting cyclists' rights, and providing safety training to drivers and civilians can lead to a significant safety improvement, and encourage people to utilize bicycle.

Also, it is so important to consider the local economic and social requirements. To study people's views and attitudes towards cycling, to understand the problems, that may arise for them, and to find solutions to manage these problems can help the increase of participation and public acceptance of cycling.

In addition, financing required for cycling projects, as well as intelligent planning to use these resources, play a fundamental role in the success of cycling promotion plans. Economic and intelligent utilization of available resources and sustainable financing will provide the possibility of further development.

Finally, the success of a cycling promotion plan will require population attention and cooperation between all different strata. Understanding the society's requirements, the population's awareness of the benefits of sustainable transportation, the interaction between associated organizations and local communities, and research and careful planning are among the factors, affecting the success of a cycling promotion plan.

To be more successful in cycling promotion, collaboration between the government, associated organizations, urban planners, and local communities is so critical. Additionally, the effectiveness of local rules and regulations, providing the required infrastructure, public culture, and training; applying appropriate technology to create a proper cycling infrastructure should be of primary concern.

5. Conclusion

Generally speaking, cycling promotion and building a sustainable infrastructure for it are a gradual process that requires collaboration and interaction between different population strata. Through improving public awareness, economic and intelligent utilization of financial resources, and using the best methods and experiences of other countries, a sustainable and eco-friendly transportation system can be achieved.

Nonetheless, today, bicycle, as a travelling mode, is not prevailing in the cities of Iran for the following reasons:

- The lack of coherence and integration in plans;
- Relatively high intervals between various plans, and plan development and implementation;
- Inadequate attention of the city officials and managers to increasing public awareness and providing the required infrastructure, due to the budget limitations and the high costs of the associated projects;
- Civilians' social view towards the cyclists;
- Not to provide the safety and security for the cyclists;
- The harassment of some drivers, and . . .

Among the approaches for increasing people's willingness to cycle and utilize bicycle in the city, there are the following cases:

1. Providing the cycling infrastructures, including building cycle tracks, modifying the geometry of roads and crossroads appropriate to cycle tracks, providing bike parking lots;
2. Social training and culture creation through training courses for different age groups, using the capacity of various media, institutions, and groups;
3. Providing shared bicycles, creating software infrastructures, and the associated stations and parking lots;
4. Holding continuous seminars and programs appropriate to cycling;
5. Developing various policies, supporting cyclists and restricting the utilization of private automobiles;
6. Integrating different applications and compressing the city blocks to facilitate active trips;
7. Integrating public and active travelling models, and locating parking lots and stations for personal and shared bicycles;
8. Providing financial facilities to supply, maintain, and repair bicycles.

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Conflicts of interest:

The authors declare no conflicts of interest.

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