International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2020): 7.803

GIS Techniques Applied in the Administrative and Territorial Reform

Genc Salja[1], Marpol Koço[1]

Department of Geodesy, Faculty of Civil Engineering, Polytechnic University of Tirana, Rr. Muhamet Gjollesha, Tirana, ALBANIA
E-mail: *salja.genc[at]gmail.com*

Department of Applied Geology, Environment and Geoinformatic, Faculty of Geology and Mine, Polytechnic University of Tirana, Rr.Elbasanit, Tirana, Albania
E-mail: *marjo_peko87[at]hotmail.com*

Abstract: ***In 2015, the government of Albania implemented the New Administrative Territorial Division one of the most important reforms of the Albanian Government. This reform has empowered local government and it has created new opportunities for social-economic development of the country. The main purpose of this study is to show the methodological framework used for the evaluation and determination of local administrative units, with the use of spatial data. The approach mainly focuses on the application of GIS, the database creation and the function used. An evaluation of the existing LGU was done through the examination of a set of scenarios. This approach was applied separately for every region, in order to maintain them. The result of scenarios showed as different spatial possibilities. Based on the criteria set for the New Administrative Territorial Division, the scenario were: the distance to the new center of Municipalities, population, density analysis, time to reach the public service, roads connectivity between the Village and the Cities. The final product were the New Map with 61 municipality.***

Keywords: Digital map, Geographical information Systems, Database, Municipality, Administrative Boundary, Boundary Units

1. Introduction

In each country, the structure of the public sector and the overall design of the various levels of governance is a key factor in the creation of a strong and effective state, with high rates of economic and social development (Vickrey, 1961). For this purpose, the appropriate spatial and administrative regionalization is necessary, through which robust, self-sufficient, and financially independent regions will be created, providing equal opportunities as well as the best possible quality of life for the citizens (Bozkaya et al, 2003). This regionalization should be based on scientific and specialized criteria, and moreover, it should also be equal, so that all created, independent units will receive equal benefits; and the phenomena of a unit's development against the others will be avoided (Armstrong et al, 1991).[3]

Until 2014 the Local Government Units in Albania were: (1) town and rural municipalities, and (2) regions. Albania was divided into 373 LGUs, including 64 town municipalities and 309 rural commune. They were too many LGU and some of them did not fulfill the need of their citizens.

On July 31 2014, the Albanian Parliament approved Law 115/2014, "On the administrative and territorial division of local government units in the Republic of Albania" and the new map with 61 municipalities, reversing the second level Region as it was. The new administrative and territorial division was preceded by a complex consultation process with the engagement of different stakeholders as well as detailed analysis and studies on the situation of the local government in Albania.

The administrative and territorial reform was identified as one of the key priorities of the Government program 2013-2017 and aims to improve the quality of local public services by increasing their efficiency and also the access of citizens to local public services.

This paper shows the methods used, the functions, the classification and the analysis made for the New Administrative territorial division of Albania in accordance with the methodology developed according to the criteria adopted by the Parliamentary Commission on Territorial Reform based on a scientific research. [5] Using scientific tools and technical methods of analysis

We analyzed from the spatial point of view every criterion required.

The main purpose of the GIS was to:

- Create and Update GIS spatial database, based on historical data, field data collected or obtained from Public Institution.
- Define Strategic scenarios of territory intervention based on predefined priorities.
- Create new GIS spatial data, based on strategic scenarios.
- Create digital GIS maps of the New Administrative division
- Create topological process for historical and new spatial data.

The principle of new administrative division has been the creation of functional areas that served as a basis for the preparation of the 5 new administrative-territorial division alternative.

Design the new local units under the concept of functional areas are assumed as large administrative areas from the point of view of the territory and the population that includes urban areas as well as rural areas, allowing a harmonization of development policies and decreasing inequalities between urban and rural areas. Typical

interactions are more intense between the urban center and suburban areas and weaken in the suburbs.

It was the project "STAR" that handled all ADMINISTRATIVE AND TERRITORIAL REFORM, a group of experts were involved in this phase, and the GIS part was cover by me.

Meanwhile the governments of the United States of America, Sweden, Switzerland, Italy and UNDP financially supported this project. [5]

2. Methods and Materials

In order to have a sustainable GIS system, special attention is paid to the design of the database, which is the foundation of the entire system.

In the Framework of the New Administrative Division, a database including a large variety of datasets was needed in order to allow as for diversified queries, selecting and joining data.

A georeferenced database and topologically structured data were the priorities at the beginning. [1]

During the Creation of the database, we used UTM-WGS 84 as the Coordinate reference system we transformed all the layers in this projection.

The interaction between layers was the essential part.

In addition, certain consultations with relevant Experts were carried out to determine the required layers. After collection of the data from the Institution and the expert involved in the project, a database was created. The database contains the vector layers shown in the table below-

Table 1: Database Layers

Layers	Feature Type
Albania Administrative Border	Polyline
Albania Neighbors Country Border	Polygon
Albania Administrative Division	Polygon
Albania Region Division	Polygon
Albania District Division	Polygon
Albania LGU Division	Polygon
Albania Residential Centers	Point
Albania Residential Areas	Polygon
Albania Transport Network	Polyline
Albania Hydrographic Network	Polyline
Albania Hydrographic Areas	Polygon
Albania Social and Public services	Point
Albania 3D Digital Terrain Model	TIN
Population data	Text

The data source came from different institutions:

Ministry of Local Issue ,Municipality office, Ministry of Transport and Infrastructure, Ministry of Justice, Ministry of Education, INSTAT. Immovable Property Registration Office (IPRO), ALUIZNI, Military Geographical Institute of Albania.
Conversion in Esri shape file from dwg file was need in several cases, transformation, and harmonization. Conversion of tabular data into spatial data. To keep a clean database of errors, duplicates with a high integrity, topology was needed.

- Topology is all about rules that you set between different layers.
- Topology allows us to do checks and fix if there are errors.
- Declare and limit how features share geometry.
- Topology helps in editing shared features between different spatial layers

The Layer that we were interested was the Albanian LGU Division in this way we created the rules for this layer, and others could be created derived from it. [4]

The Rules were

- Must not overlap
- Must not have gaps
- Contains One point

For the creation of the borders, we started from the smallest spatial unit, villages and city with the help of the coordinators in the field we added some new villages created in the last years and removed some that were neighbors not village.

Checks were made to the Communes and Municipalities borders if the tabular data villages corresponds to the commune spatial data.

The software used for Database creation and Topologies was ArcGIS.

Each of the maps reflects the current state of the regions, paying particular attention to the economy, type and level of infrastructure and services existing in each of the regions and their extent.[7]

Albania consists of only 61 Municipalities, after the completion of the New Administrative division, recalculation of the attributes by the new extent's municipality was done.

3. GIS Analysis and Maps

To support the Experts in the Optional Variant Findings, the Maps were created by returning the required criterion to the spatial pattern as below:[5]

- Population Map
- Infrastructure Map
- Economic Interaction Map
- Business Distribution Map
- Time Distance Map
- Water and Wastewater Coverage Map
- Physical Map

There were made scenarios maps for every Region. Below we are showing some scenarios done for Tirana Region.

3.1 Population scenario

The maps below show the population of the LGU's in Tirana Region that is an important criterion for the creation of the functional area.

Tirana Region consists of 29 units of local. County population of Tirana was 749 395 inhabitants in 2011, whom almost 56% (418 495 inhabitants) live in the city of Tirana. [6] Looking at the map, we notice that there are municipalities with a population of less than 2000 inhabitants; this is an important indicator since the average number per functional area should be 30,000 inhabitants.

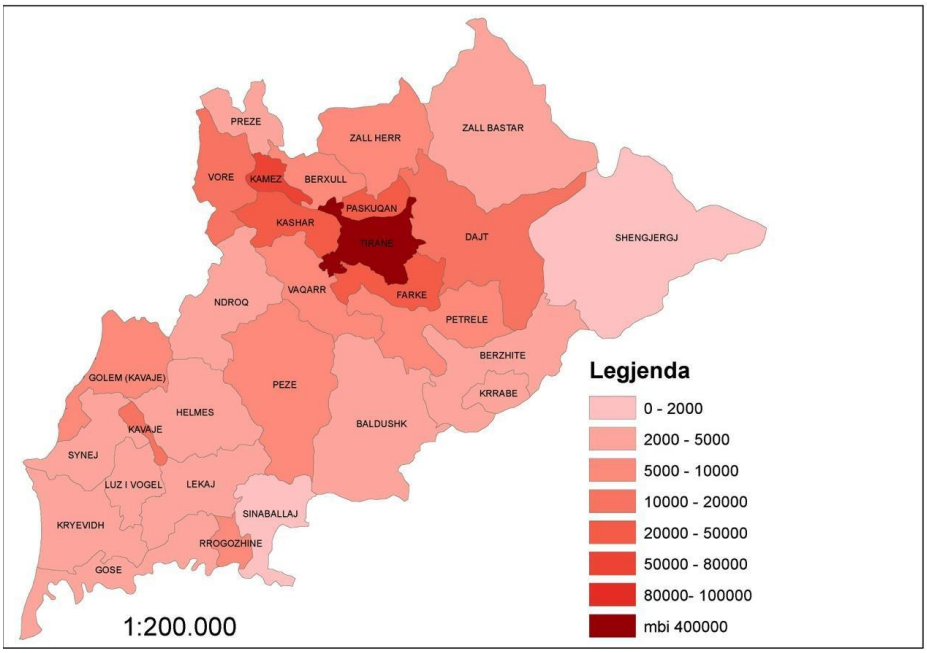

Figure 1: LGU in Tirana based on Population

In these map, we see that only Kamza and Tirana have a big population so they could be the two centers of the functional areas.

3.2 Infrastructure scenario

Another criterion for the LGU was the connectivity network between them. Based on the maps result we can analyze which LGU have better connectivity between each other. Based on our analysis shown in figure 3 almost 90 % of the population can reach the center in less than 30 min. Only for Shengjergj and Zall-Bastar, the time travel is more than 50 min.

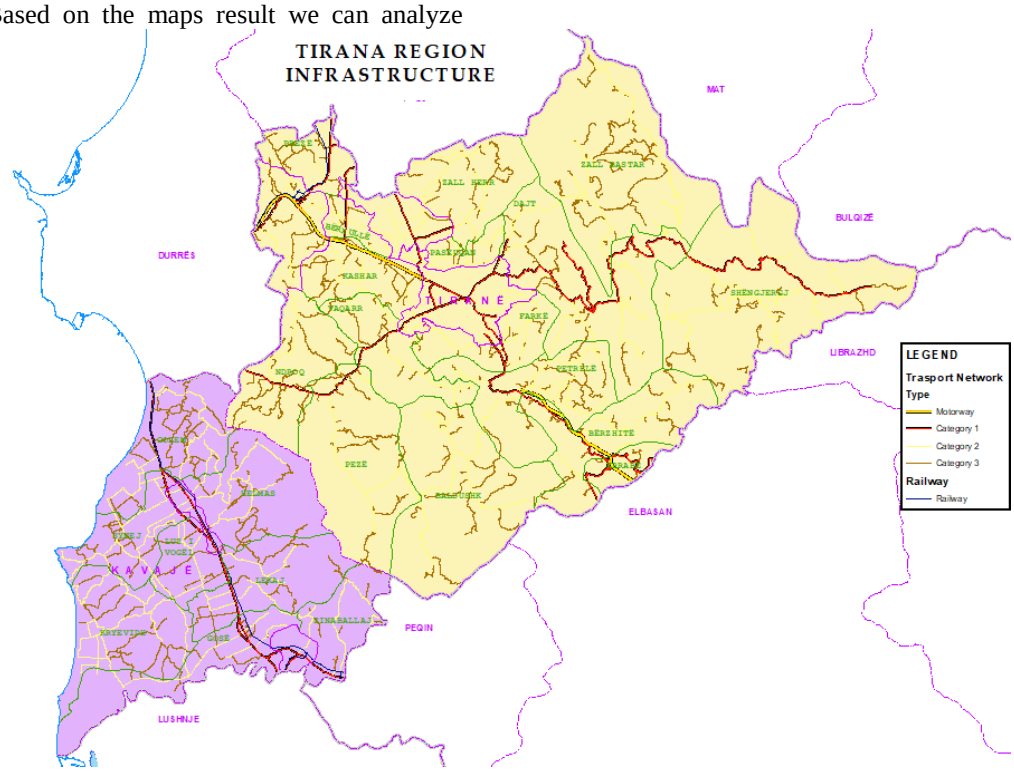

Figure 2: Road connectivity network

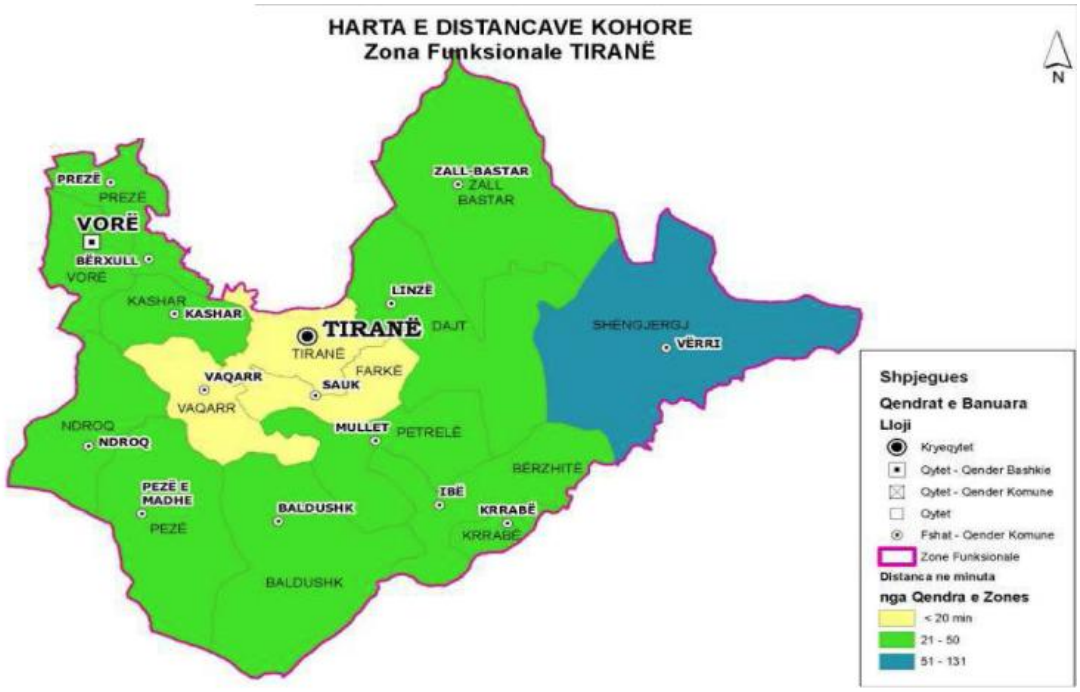

Figure 3: Time distance map from Tiran Center

From the map shown in figure 2, we see that the largest part of the commune connects with Tirana with a good transport network of Motorway, National Road first category, and National road second category.

3.2.1 School Infrastructure scenario

Educational infrastructure in Tirana Region

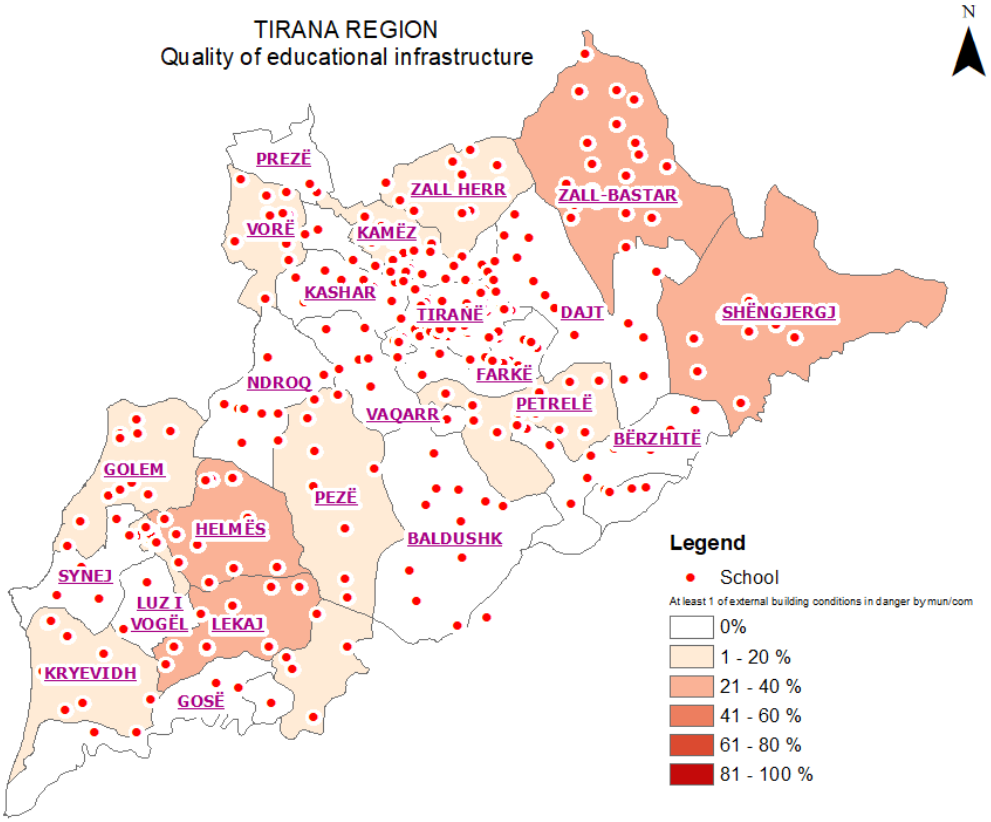

Figure 4: Map of distribution of secondary education infrastructures in Albania and the quality of Buildings by Municipality/Commune

One of the responsibilities of the Municipality is the maintenance of the public education infrastructure; by the analyzing the map we see that are many schools outside the Municipalities in dangers that need intervention. The map shows that remote communes such as Shengjergj, Zall-Bastar, Lekaj and Helmes have over 30% of the schools in danger, this is an indicator that these municipalities should unite with a municipality such as Tirana or Kavaja in order to have more funds to repair those schools.

3.2.2 Institutional interaction scenario

By analyzing the map, referring the institutional interaction, the concentration of Population and businesses as well as the interaction between, in the region of Tirana we Identify two main functional areas: the Tirana-based and the center-based Kavaja. Near Tirana, Kamza and Vora tends to create two others small Functional area as a result mainly of interaction between residents and business Concentration.

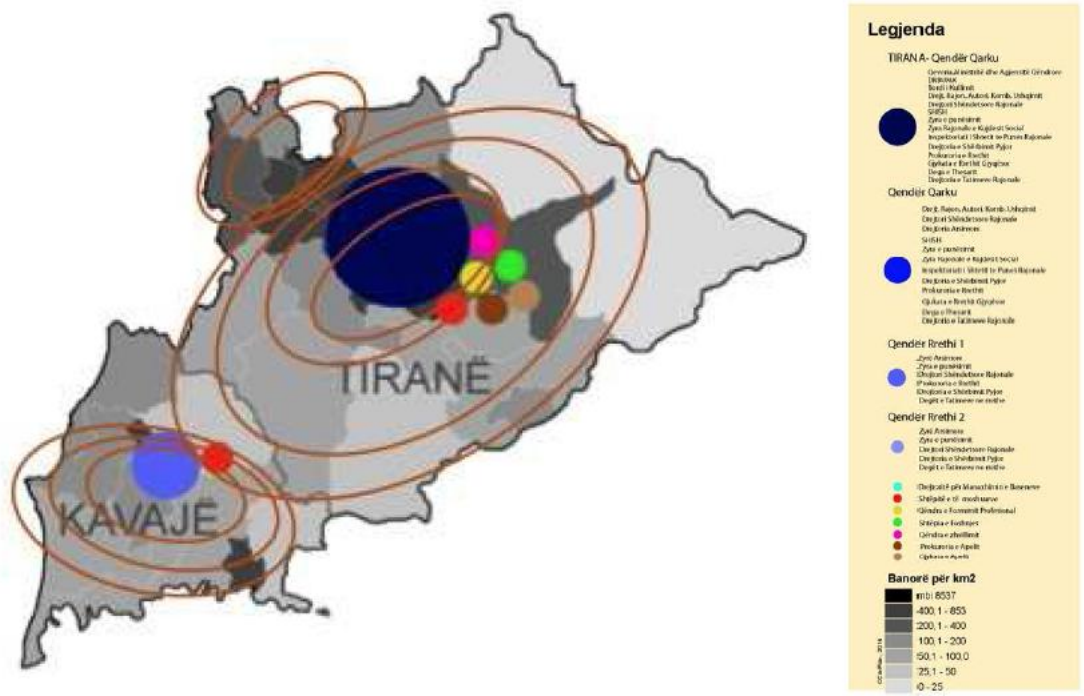

Figure 5: Distribution of agencies and central

Institution and Institution Interaction in the Region

3.2.3 Commute scenario

Analyzing the Map and the direction of the arrows, we see that four centers emerge, Tirana, Vore, Kavaja, and Kamza. In Tirana over 80% of the population does not travel outside Tirana the rest mostly moves towards Vore, Kamza and the areas around Tirana. This map clearly shows the creation of four functional area (Tirana, Vore,Kavaje and Kamza).

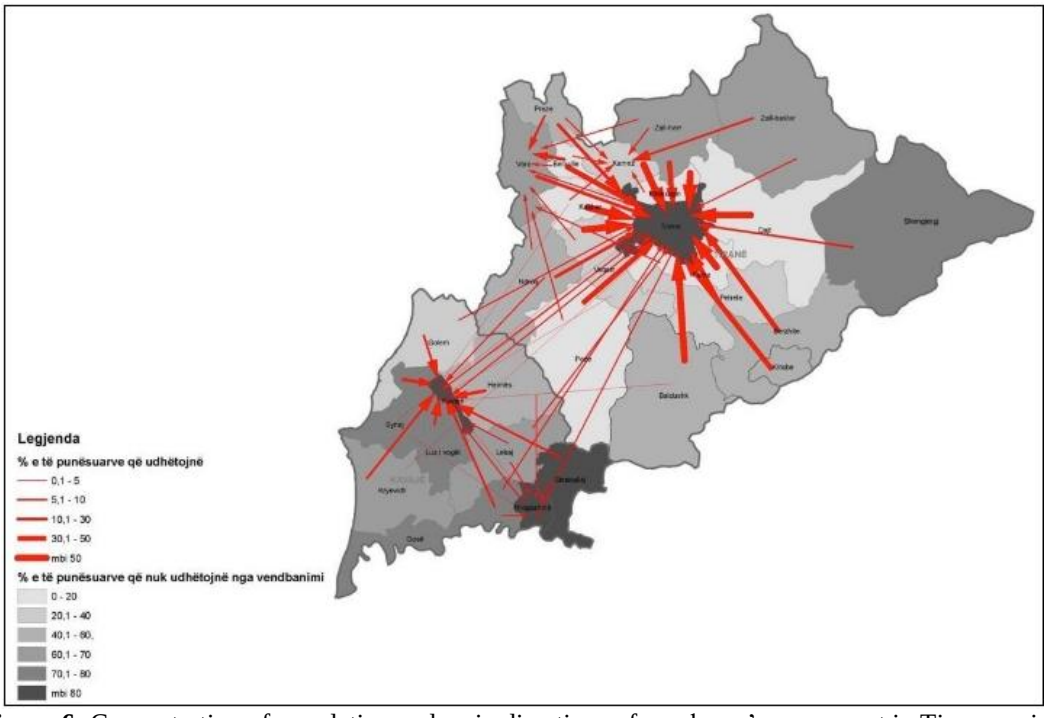

Figure 6: Concentration of population and main directions of employee's movement in Tirana region

3.2.4 Building concentration scenario

Analyzing the map here, we notice the commune in general do not have a lot of building. Tirana and Kamza are the top municipality in this scenario. Kashar and Paskuqan are commune near Tirana they had a lot building construction in the last 10 year. It is natural to merge to Tirana or Kamza. Another municipality that we see far from Tirana is Kavaja

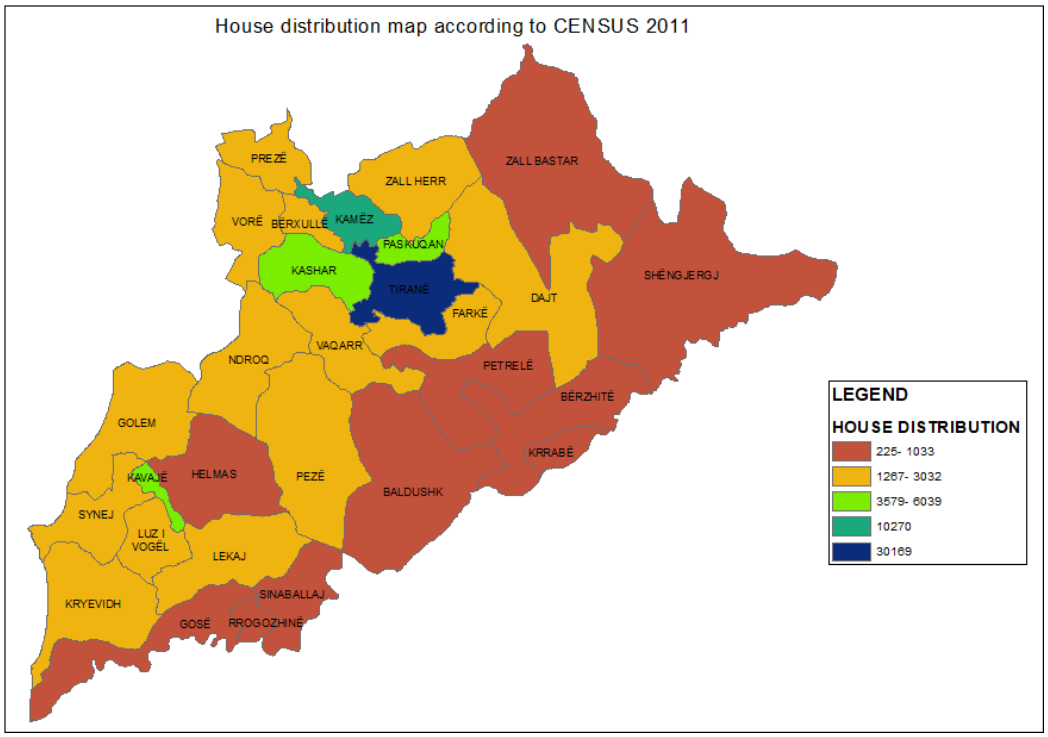

Figure 7: Building concentration map

3.2.5 Water and Wastewater scenario

The supply of drinking water supply and sewage disposal is an important issue, which is expected to function better and more efficiently. The map below shows the organization of Water and water utilities today. As can be seen from the figure below Water supply management today is done through boards (most of them Cases) selected by a large number of LGUs, in many cases difficult to make decisions and to manage the enterprise. Reorganization by Zone Functional approach seems to the region create better conditions for good management and organization.

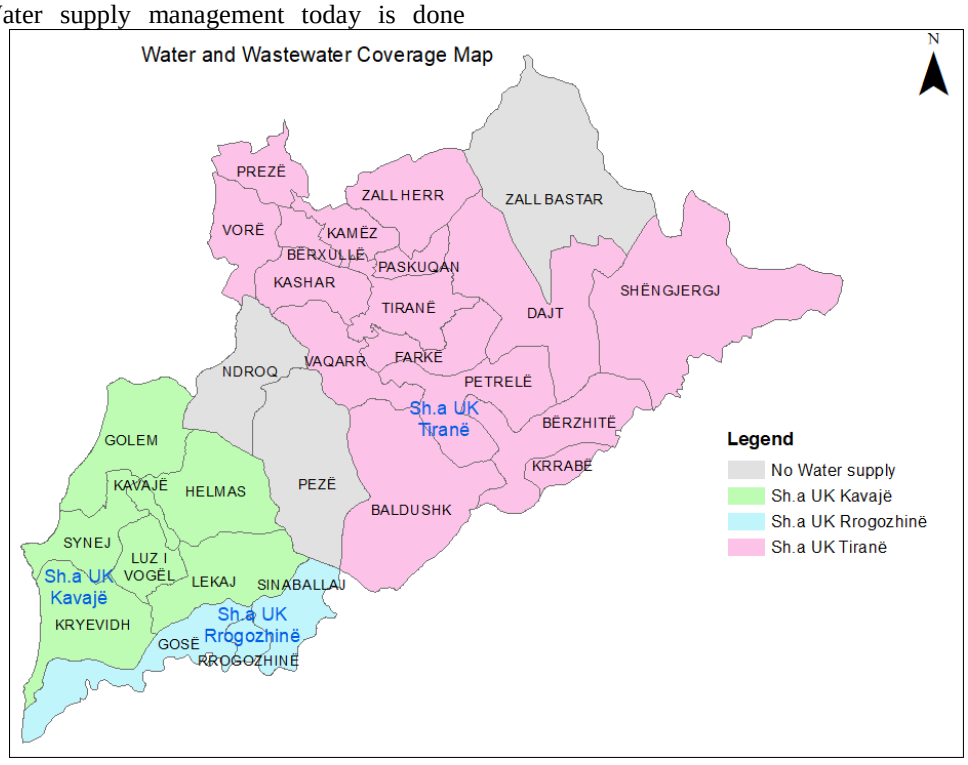

Figure 8: Water and Wastewater Company Covering

4. Results

Based on the analysis and result from the scenarios applied for every region, 5 alternative were emerged.

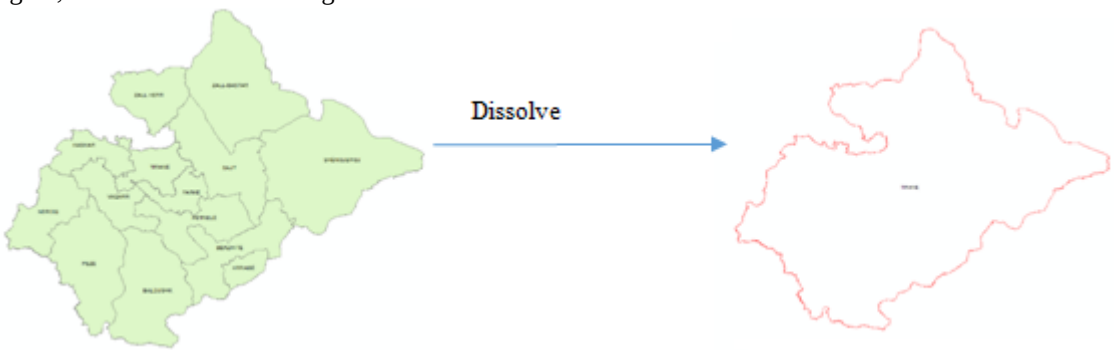

Figure 9: LGU before and after Dissolved into one Tirana functional area

The function that allows you to merge objects based on a common attribute is dissolve; geometrically the dissolving function will cause the removal of the boundaries between the objects that share the same value specified. [2]

LGU_Division

FID	Shape	OBJECTID	Diss_V1	ID_NJQV	NO_COMMUNE	Emer_NJQV	Qen_NJQV	Id_Qarku	Emer_Qarku	Qen_Qarku	Pop_2011	Siperfaqe	E	id_bashkie	Shape_Leng	Shape_Area
0	Polygon	328	TIRANË	3401	335	BALDUSHK	BALDUSHK	11	TIRANË	TIRANË	4576	128.33	T	50	55169.032488	112880185.445
1	Polygon	330	TIRANË	3403	337	BËRZHITË	IBË E SIPËRME	11	TIRANË	TIRANË	4973	68.43	T	50	68083.160383	72240515.5071
2	Polygon	331	TIRANË	3404	338	DAJT	LINZË	11	TIRANË	TIRANË	20139	115.95	T	50	64376.136069	95265185.2658
3	Polygon	333	TIRANË	3406	340	KASHAR	KASHAR	11	TIRANË	TIRANË	43353	37.34	T	50	41907.794079	39133788.8226
4	Polygon	334	TIRANË	3407	341	NDROQ	NDROQ	11	TIRANË	TIRANË	5035	60.79	T	50	48376.646732	63312632.0278
5	Polygon	336	TIRANË	3409	343	PETRELË	PETRELË	11	TIRANË	TIRANË	5542	69.27	T	50	61550.731165	67260466.8928
6	Polygon	337	TIRANË	3410	344	PEZË	PEZË E MADHE	11	TIRANË	TIRANË	6272	98.08	T	50	59227.31688	108245446.678
7	Polygon	339	TIRANË	3412	346	FARKË	LUNDËR	11	TIRANË	TIRANË	22633	34.84	T	50	40534.953184	28029521.6894
8	Polygon	340	TIRANË	3413	347	SHËNGJERGJ	SHËNGJERGJ	11	TIRANË	TIRANË	2186	170.31	T	50	72544.376803	206336108.535
9	Polygon	341	TIRANË	3414	348	TIRANË	TIRANË	11	TIRANË	TIRANË	418495	43.57	T	50	51253.687741	39998804.8907
10	Polygon	342	TIRANË	3415	349	VAQARR	VAQARR	11	TIRANË	TIRANË	9106	45.32	T	50	46112.950501	46425680.7116
11	Polygon	344	TIRANË	3417	351	ZALL-BASTAR	ZALL-BASTAR	11	TIRANË	TIRANË	3380	146.7	T	50	57557.136412	153969546.665
12	Polygon	345	TIRANË	3418	352	ZALL HERR	ZALL-HERR	11	TIRANË	TIRANË	9389	55.85	T	50	36966.423016	58295062.3086
13	Polygon	346	TIRANË	3419	353	KRRABË	KRRABË	11	TIRANË	TIRANË	2343	14.44	T	50	20481.230665	18634566.6896

Figure 10: LGU attribute table

In the LGU table shown on the figure, we notice that there is a column Diss_V1 based on this column we can merge them into one new feature and preserve or make statistic for the other fields we need like the region name, center Region summarize the population data and other statistic.

For every alternative proposed, we applied this procedure. The entire alternative created were stored in the database. The results of the implementation were presented in both map and tabular form. In figure below is the final map that approved by the government.[5]

The characteristic:

- Average population 45,925 People / Unit
- The average surface 464 Km^2/Unit

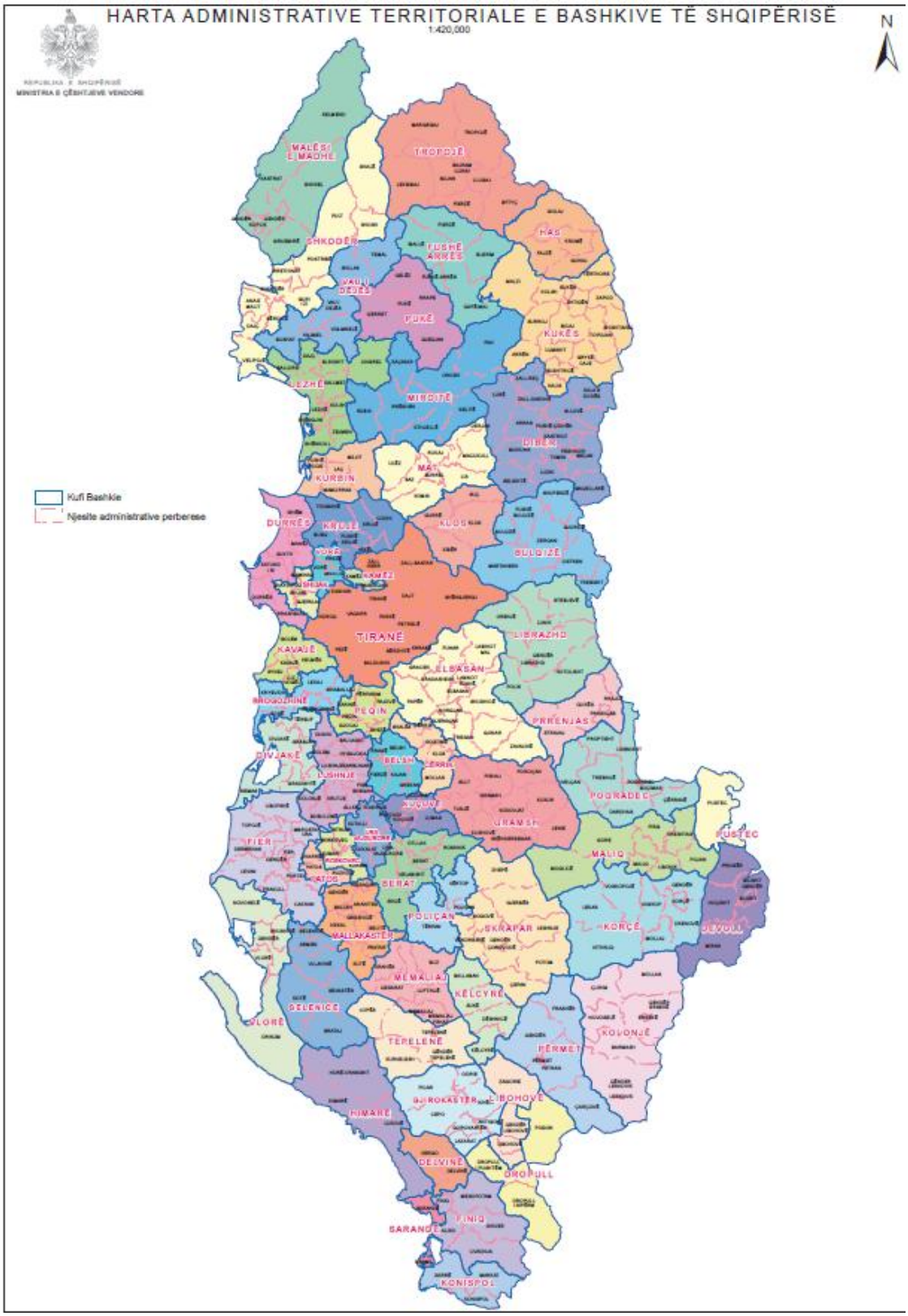

Figure11: New Administrative map with 61 Municipality

5. Conclusion

The objective of this paper was to show the analysis made for the New Administrated and the methods used.

There have been other Administrative reform before in Albania but none of them was done with GIS.

There were produced analogue maps not analyzed with GIS; this was the first of this kind for Albania. From the positive results obtained by applying the described GIS analysis, GIS showed us that it is a very powerful tool for analyzing different situations by taking into account the spatial data combined with the tabular, for transparency in decision-making and for a sustainable development of the region. We concluded that GIS was a fundamental tool, to present and

analyze at a scientific level the criteria required by the Parliamentary Committee. We would suggest that the new municipalities created had copy of this database and maps to help them in the decision-making, in order to have a structured database to update and maintain it, some municipalizes have many data but not organized in a central database.

References

[1] A database oriented approach to GIS designing Daniela Carrion, Andrea Maffeis, Federica Migliaccio DIIAR – Politecnico di Milano [1-4].
[2] GIS në planifikimin e zhvillimit të qëndrueshëm të një rajoni Bujar Drishti-Universiteti Politektin i Tiranes [24-26]
[3] Based location analysis of administrative regions. Applying the median and covering formulations in a comparative evaluation framework, Argiro Papafragkaki[1-3]
[4] ArcGIS™: Working With Geodatabase Topology
[5] TECHNICAL CRITERIA FOR THE NEW ADMINISTRATIVE AND TERRITORIAL DIVISION, Raporti I Zonave Funksionale, http://www.reformaterritoriale.al/en/
[6] INSTAT, Population and housing Census 2011http://www.instat.gov.al/media/177354/main_results__population_and_housing_census_2011.pdf
[7] Serryn Eagleson, Spatial hierarchical reasoning applied to administrative boundary design using GIS administrative boundary design using GIS

Author Profile

Phd.Cand.**Eng. Genc SALJA**: Born in Shkodra, 1989.Lives in Tirana. Completed studies as Geodetic Engineering on 2012. He started PhD studies on 2014. His work experience includes: Geodetic engineer in the private sector, GIS Expertise for EU Project, Freelancer for TomTom; Guest Lecturer at the Polytechnic University of Tirana; Specialist in the GIS/Cadaster Sector in Tirana Municipality. Expert in real estate valuation

Phd.Cand.Eng. Marpol KOÇO, Born in Tirana, 1987. Finished study as Mining Survey Engineer on 2011. He started PhD studies on 2012. His work experience includes: Geodetic engineer in private sector; External Lecture at University; Specialist in the Directorate of Policies and Mining Development; Head of Sector in Cadastral Directorate in Tirana Municipality. Expert real estate valuation.