

# Web GIS Albania Platform, an Informative Technology for the Albanian Territory

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*The paper offers a detailed analysis of GIS integration as a curricula and technology in the Albanian market and institutional environment. The growing market needs for GIS utilities in Albania and the handicap, due to the lack of experts in geospatial technology constitutes a major concern. The research goal is to concentrate on the undisputed fact that the development of GIS curricula in the academic institutions will have an imminent impact on the integration of GIS technology in the market environment and vice versa the growing market needs for GIS specialists with increase the predisposition for a closer approach toward this technology in the academic environment. It is presented the development of a geospatial platform (Web GIS Albania) able to be managed and exploited, not only as a web mapping source of information, but also for individual scientific investigations, academic researches, business management, etc. Developing a platform such as Web GIS Albania will give a new impetus to every potential field, where geospatial technology can be integrated. It will have an imminent impact on both academic and market environment. Also it will create a new vision of managing specific issues by performing individual researches. In this paper it is presented a general overview necessary for a proper interpretation of the Web GIS Albania platform.*

*Povzetek: Predstavljen je albanski sistem GIS.*

## 1 Introduction

Today, more than ever, we are living in a society where most of the decisions are based on the existence of geographic information. Maps are becoming a determinant issue with a developed ability to transform numerical and statistical information into "visual" perspective, object to a much easier analysis and manipulation process.

As in many other countries of the world, the approach toward geospatial technology has been raised to a satisfactory level in Albania in the last years, being integrated into competitive environments, educative or informative institutions, research entities, etc. However, this process requires a greater support from the state and private structures through funding and incentives regarding basically the economic aspect.

The project Web GIS Albania is a promising and demanding step towards an important change in the integration of GIS technology in Albania. Efforts are made that a large number of areas such as business, tourism, education institutions, management of natural hazards, etc, find support and incentive facilities created by this platform in many delicate and complex issues, that require effective solutions through alternatives

submission, analyzing opportunities, etc, in this way taking advantage of both from its informative character (communication) and the numerous analytical opportunities in processing and structuring geographic information.

The carried out research, unless a long-term geospatial project, aims to raise the population awareness toward the creation of a closer approach on dynamic maps and geographic information systems as a whole and as a "phenomenon" that is expanding quickly. On the other hand it is impossible to give a correct contribution into this project unless we don't have the necessary academic preparation and the basis for a successful GIS specialist.

The role of higher education is to assist students in becoming effective thinkers with the knowledge and skills that will lead them toward becoming meaningful contributors to society "(ESRI, 2009)". Nowadays, more and more, schools are including GIS in their curricula to help their students to gain valuable background knowledge and skills which they need to face global challenges. Three are the main reasons leading to the rapid development of GIS in Albania especially in the

last years; education, Internet and the growing market needs for geospatial data "(Hysenaj, 2011)".

The goal of the paper is to emphasize the future GIS development policy in Albania by enforcing a strict mutual relationship between these three factors and their potential environment. For each of these categories we are going to present a full picture containing their weak and strong points.

## 2 GIS Education in Albania

Geographic Information Systems in higher education provide an integrated solution to assist faculties and students with their educational goals. The advance of GIS has opened up millions of employment opportunities. More than 3,000 colleges and universities have developed excellent courses, certificate and degree programs in GIS "(ESRI, 2010)". GIS has a vast extent starting from government level down to municipality or commune. In the state universities of Albania GIS is introduced only as a single general course called Geographical Information Systems, including this way a compressed program that many times results inadequate to be acquired by students. The main reason of this phenomenon is the fact that GIS is developed only at a single level in the Albanian Education Institutions which is the state university. The lack of the subject development at the secondary school level is the primary reason of such a handicap. The major problem is the lack of geospatial information.

In Albania only few institutions have operational GIS databases. We are facing the fact that most of geographic data is owned by private agencies for their personal needs, using inconsistent data which is mostly not updated. Inadequate development of geospatial technology is also closely connected to the evolution of computer science. In 2009, as reported in Figure 1, among 9478 students graduated in public universities, only 171 belonged to computer science profile "(INSTAT, 2012)". Still, it remains determinant the increasing role the government is playing through substantial reforms which aim to develop internet utilities in a large scale environment in Albania.

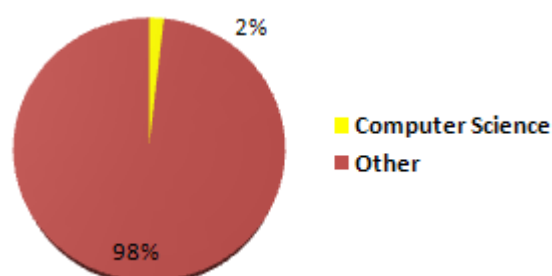


Figure 1: Computer Science attendance toward (compared) other fields.

Dealing with geospatial data is strictly connected to terrain practice. This way we can develop students concept and knowledge about GIS structure and give a sense to their theoretical conceptions. Unfortunately we have not reached this stage, which remarks us (*specialists*

*of the field*) the essential task of digitizing the Albanian territory with updated geospatial information. First of all this process needs the government enrolment which must be the primary support in fulfilling this mission basically by covering financial, logistic and technical aspect. Second it is important the collaboration between universities and private agencies offering their field experts. Actually laboratory practices are limited up to *data manipulation* and not *data creation*, which means that we do not have the proper conditions to accomplish a full map process including data collection, data processing and output.

A survey involving 1000 students was made (figure 2). The outcome of this survey intended to define the relation between their approach toward GIS utilities. These students were asked about their knowledge of GIS concept. From the results we see that 87% of them didn't know what GIS meant, 11% were familiar to the concept and only 2% of them had the chance to use GIS utilities. This is a meaningful contrast to the fact that students use GIS applications like Google Map, Google Earth, etc but are not aware of the concept of dynamic maps.

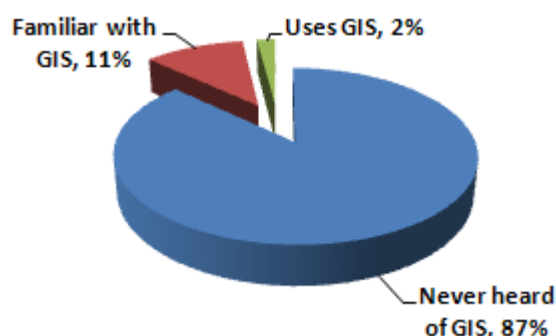


Figure 2: GIS integration into the University Environment.

According to statistics it results that among many annual conferences that take place in Albania none of them refers to Geographic Information Systems as a primary field or topic to relay on. This induce the necessity of paying greater attention by the departments in introducing step by step GIS as a modern and undisputed technology. Gradually it is necessary to start from several national conferences followed by international ones. Also another issue is the fact that students prefer to avoid GIS profile subjects as a possible theme during their master thesis defending (*either professional or scientific*). This is another delicate point which requires the intervention of the Ministry of Education (MASH).

## 3 GIS Market in Albania

GIS allows interactivity, querying and makes us understand better and evaluate the data by creating graphical presentation through information derived from databases "(Hysenaj, 2011)". The economic crisis that has affected the world in recent years has made it possible for many organizations to restructure their operating practices. Many of these businesses are aware of finding new ways to develop their activities, primarily

through internal sources. Now it is the time to invest in geographic information systems, a solution that has helped many organizations to overcome their operational challenges and increase profits.

According to statistics only in private universities we find 229 curricula included into different levels of programs like Bachelor, Master of Science or Professional Master. The contrast in this scenario is that during the last five years the number of private universities in Albania has increased consistently but none of them offers a GIS course.

They focus on social and economic curricula which actually are easier to integrate and adopt rather than taking the risk to involve students into a course that still suffers from government indifference in launching this “product” on the market and at the same time stimulate private companies in embracing the idea of GIS position. This scenario reflects their pessimistic point of view according to GIS technology. Their choice not to introduce GIS into their curricula makes us believe that although GIS usage has evolved and has found more space in the Albanian market than before, private university boards are still doubtful of its real capabilities and potential.

The research goal is to concentrate on the undisputed fact that the development of GIS curricula in the academic institutions will have an imminent impact on the integration of GIS technology in the market environment and vice versa the growing market needs for

range of people who have been a kind of “forced-adopted” experts in an environment condition which suffered from the lack of real GIS experts. That’s why very often geospatial tasks have been performed from geographers who had little computer knowledge or computer experts who held the responsibility to manipulate and manage geographic information, producing a range of non-professional results.

Nowadays the market in Albania is eager in finding new human resources specialized in geospatial information management which can help them solve many important issues getting away from simple techniques used recently. The Digital Albania program is one of the many future projects that require GIS experts. State institutions like the prefecture, municipality, commune, private organizations and many other NGOs are more than ever aware about the great importance of dynamic mapping and satellite images, followed by the integration of these concepts and technology into the spatial decision making processes in the country.

That's why we have initiated this project with the hope of building a platform that will work not only as an informative guidance to a vast range of population, keeping simplicity and usability as primary factors, but also will be downloaded as a free software including its most recent database, containing modules that will make it much more approachable to the client eyes and to the necessities of personalizing the information according to the required tasks.

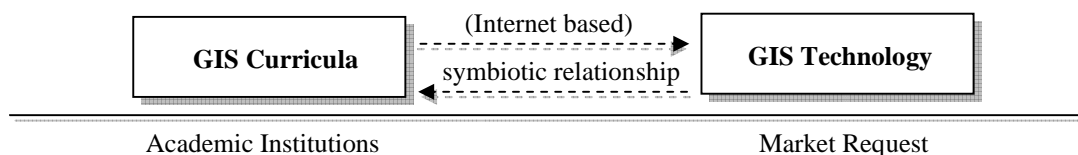


Figure 3: Symbiosis (GIS Curricula - GIS Technology).

## 4 Internet Evolution

The evolution of GIS in Albania has been strictly connected to the evolution of Internet. The number of Internet users is an important indicator because it reflects the spread of information technology in one place and the global exchange of information "(Hafkin & Taggart, 2001)". Actually Albanian government is following a strong policy named “Albania in the age of the internet”, which aims to rank Albania among the countries with the highest internet usage in Europe. This has caused an immediate effect not only in the extend of internet distribution but also in laboratory equipments.

GIS specialists will increase the predisposition for a closer approach toward this technology in the academic environment (figure 3).

Up to now Albanian market has been handled from a

Internet conditions such as speed, availability, price and professionalism have had a great improvement (Table 1). Almost all the secondary schools have also been equipped with new laboratories. This led to a closer approach to the internet as far as the students are concerned and online software like “Google Earth”, “Google Map”, or ESRI applications which only a couple of years ago were unknown for many people, now have turned familiar and easy to use and manage.

The World Economic Forum (WEF) has published a global report according to which Albania has improved its global ranking of The Networked Readiness Index 2012 by going 19 places upper within a year positioning itself in the 68th place and gaining the right to be part among the ten most improved countries in the NRI (Table 2).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fixed Int. sub./100 inh.	0.16	0.32	0.64	N/A	N/A	N/A	1.26	2.64	3.29	3.49

Note: Fixed Internet subscriptions (FIS) per 100 inhabitants

Source: International Union of Communication

Table 1: FIS Indicator.

This index has been calculated based on four primary sub-indexes which are: the regulatory-politic for the information technology, improvement of digital infrastructure; management of e-skills and services; using information technology by the population, business or government units; social and economic impact.

The Internet and Communication Technology sector is rapidly expanding in Albania because it is both a stand-alone sector and a cross-cutting enabling technology for other industries "(USAID, 2011)". Basically we have the necessary tools to aim at developing GIS image in the market and institutional levels.

## 5 Evaluation Technique

One of the most important advantages of using GIS technology consists in obtaining considerable amounts of information which can be subject to a better evaluation process compared to the data stored in “common” databases. Displaying data through the exploitation of digital mapping will give us greater possibilities during the analysis and managing process. All these capabilities offered through the implementation of GIS technology combined with the “human skills” perceptions for specific geospatial issues extend GIS potentialities beyond what most of the databases generally offer.

Below (figure 4) we are going to offer a concrete example of how expressing information through digital mapping can turn into a better solution for data authenticity. Two digital maps which presume to display

the density of the Albanian population according to the last official statistics offered by Census Albania 2011 have been presented.

The analytical process comes to be much easier and approachable from the user's side not only to distinguish but also to define the areas that need correction or the type of errors that have been made. The fact that the geographical data is expressed through digital mapping and not rough database rows increases the possibilities of perception that the map on the left is the correct one, meanwhile the one on the right contains corrupted data. The understanding of the analytical perception of the human choice for the current situation comes as a result of several factors:

- The user may have personal knowledge of the Albanian territory
- The user may know that generally the population trends to concentrate around the capital areas and the coastal areas and that the density gets lower moving from the center to the suburbs.
- Generally the smaller surface areas (expressed in the map) imply higher densities.

## 6 Web GIS Albania Platform

Based on the recent events in Albania such as continuous floods, illegal constructions, the lack of information in business and tourism sector leading to unfair competition, educative and scientific elements, projects and platforms managed not correctly, etc it has been evaluated the possibility and the potentiality of

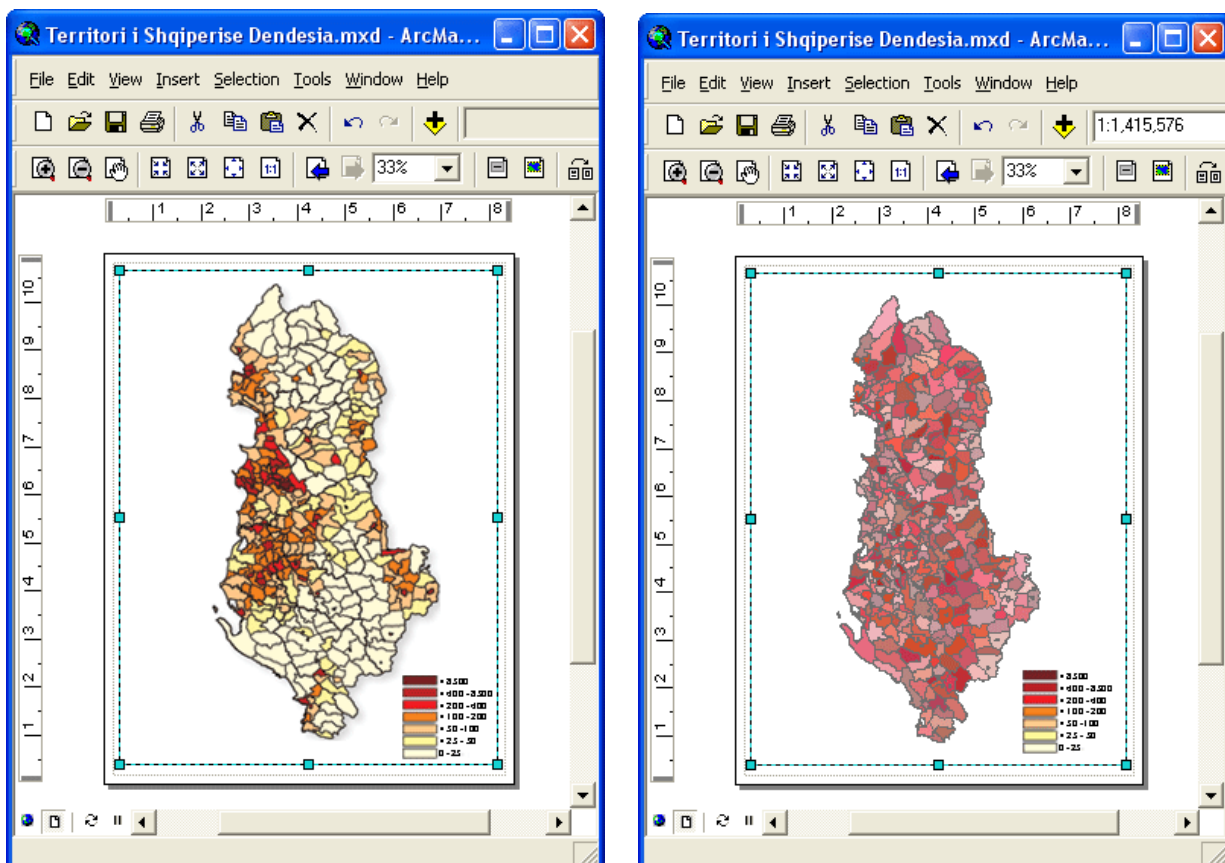


Figure 4: Verification of spatial issues. The density of the Albanian territory at a comparative level. Development software ArcGIS 10.1, (Data Source: INSTAT, 2011).



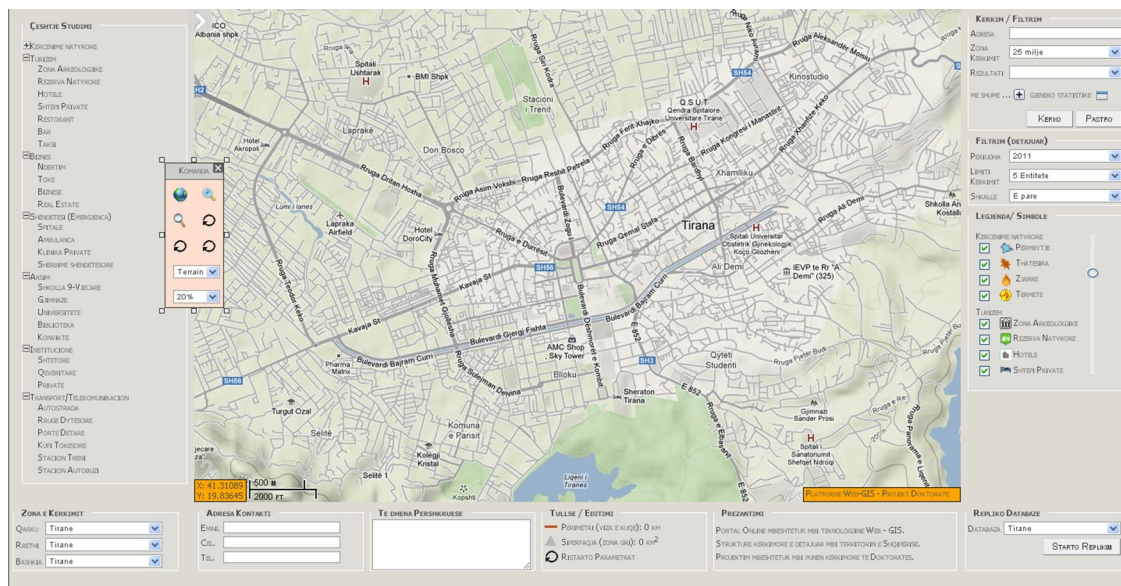


Figure 5: Web GIS Albania Platform v1.1

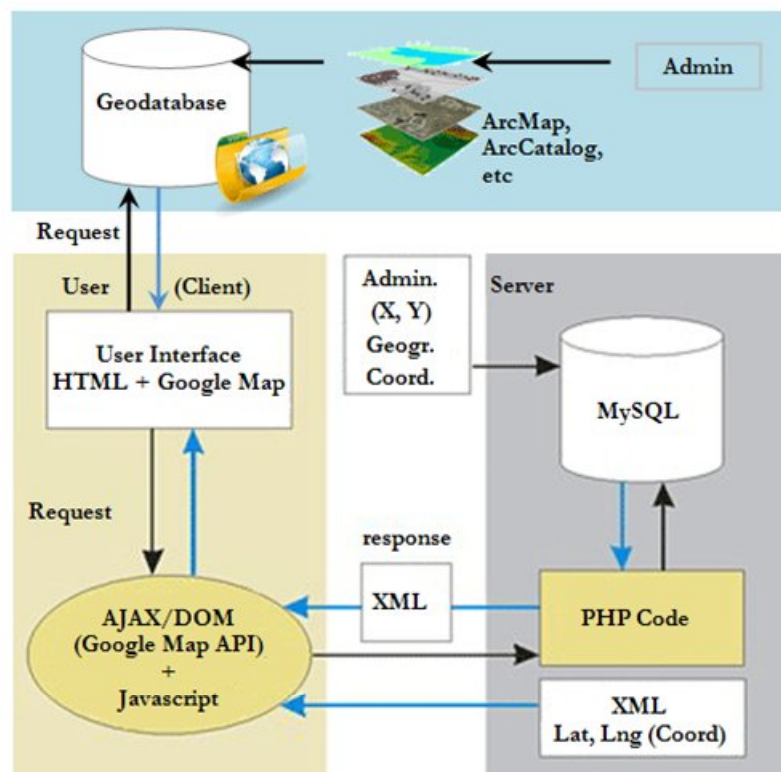


Figure 6: Flow data chart, Web GIS Albania Platform

integrating GIS technology as an optimal solution to redirect to a well managed plan such delicate issues for the surrounding environment.

Web GIS Albania is a web mapping platform based on the combination of PHP, MySQL and Google Maps API modules. The purpose of initiating this project was to build a multi-functional system able to be exploited by a vast range of population which may not have developed computer capabilities and knowledge.

As already known one of the main directive of the European Union (EU) consists in orienting responsible authorities to develop a well managed informative and

communicative system able to act as a regulatory and instructive guidance to the population.

As a conclusion to the above mentioned notations it has been conceived to build a multifunctional platform, open-sourced (free web access and download) for a vast range of population which may not have extended computer knowledge but due to the practical and functional interface that the platform is going to develop, users will manage more effectively their specific requests and demands. This platform has been structured to act as a reliable source of information and communication that will affect directly people's decision-making process,

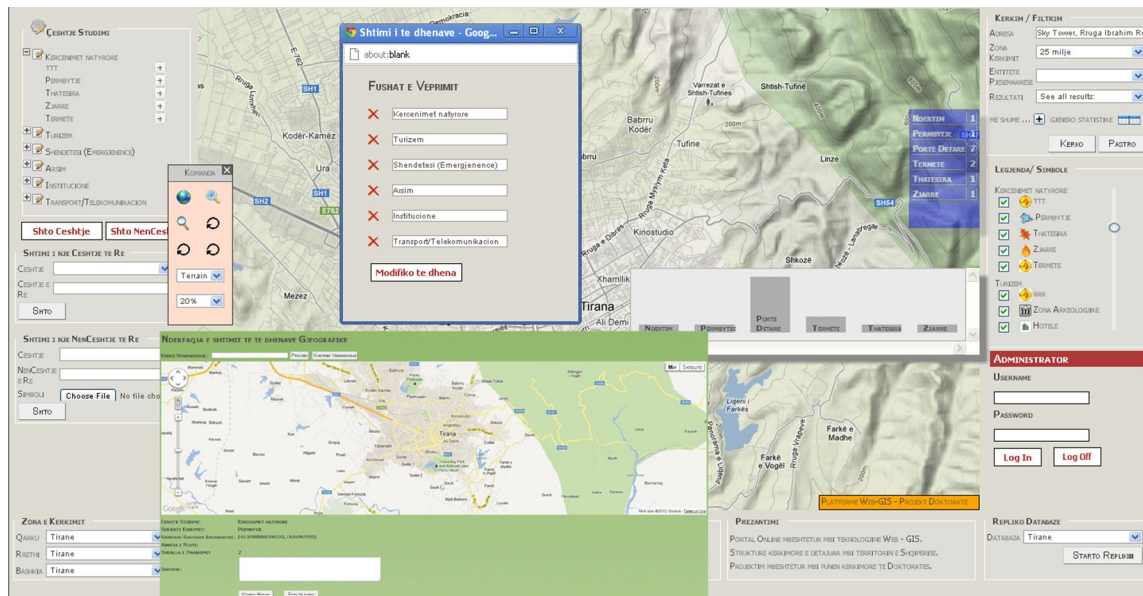


Figure 7: WGA v1.1, Module Level.

raising to a higher level of professionalism the analytic process.

The main source of this platform will be a combined set of private and state institutions and organizations, but it will also be opened to any reliable entity offering consistent data and information (checked by responsible specialists).

The way how it is conceived to collect such a great amount of information is through the multi-directional replication method, which acts as a fast and effective alternative with a high security performance already tested in many global databases of maximum priority.

The schema clearly describes the fact that there are two ways the administrator can supply the platform with data in a parallel way.

Firstly, through the modules based on the geocoding services which turns an inserted address into latitude and longitude coordinates which will be saved into a MySQL database and then retrieved as an XML file ready to be exploited as markers in the map.

Secondly, by using ArcGIS facilities like ArcMap, ArcCatalog, etc. and producing maps and statistics which will be saved into the system rough files and then retrieved as informative and indexing data for specific issues. User requirements are mutual, and each of them requires the use of one of the two types of databases contained in the platform. The geodatabase will be responsible to support detailed analysis which will lead in the generation of complex maps and diagrams. Meanwhile the web mapping database will be responsible to handle user researches through the web interface.

These databases operate independently and are not influenced by each other, and the product (output) generated by each of them serves as input to the requirements of the client.

The way the platform is conceived permits the users not only to work through the web performing researches and outputting diagrams and statistics, but also allows the

application download together with the respective database with the last updated information. The application has the front-office and the back-office layout. The front office can be managed the same way the user navigates on the web and performs researches.

The innovation of this platform is the back-office which contains a set of modules which makes the application fit to user requirements. The idea was to bring to the user a product that didn't behave strictly according to a predefined conception of managing geographical data and issues, but a product able to be adapted to the personal requirements of the client. Today more than ever through projects, tasks exchange, researches and analysis of issues, management of geographical events, etc. users require to settle the management process locally through geospatial technology such as WGA application which will increase the opportunities for further evolution through personal use.

The research process is based on the main issues and fields of interest in Albania such as natural hazards, business, tourism, institutions, etc. The research issues according to the user preferences can be deleted, modified or added as new ones. The modifications act the same with the sub-issues, research fields, marker symbols, etc.

What is most important, the application allows to add personal geographical data through an interface which converts the input address into geographical coordinates followed by extra information which in the future may be used as research elements. The application source-code will be opened to any modification. The logic of the application was to bring the user closer to the problem as much as possible, by offering several categories of structured and organized issues, which intended to reduce the distance between the application interface and the user's knowledge in geospatial technology.

The way how it is perceived to collect the information and to keep it to constant update is through the replication technique, which shows to be an effective and high security alternative, already tested to many worldwide global databases of maximal priority. The structure consists in settling regional offices (units) in every area (depending on the way the information gathering process will be organized we may have administrative structures, such as commune, city, region or prefecture level).

The replication process will create the right impulse for the development of parallel working in the collection analysis and processing of data by increasing the level of responsibility of the regional units which will now act as an autonomous and sufficient structure. However, the reasons for supporting the replication process are analogous to those of the RDBMS. They are based on the database performance, data and network load balancing, system security and data management in case of failure and geospatial data distribution.

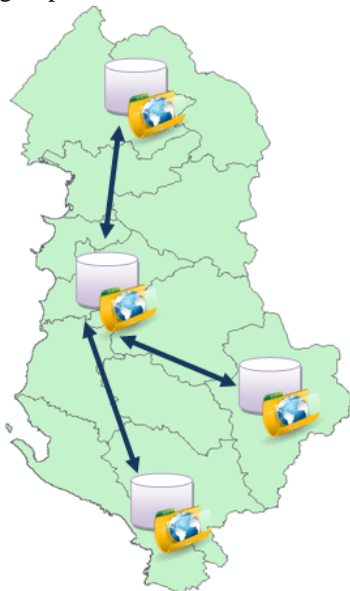


Figure 8: Replication schema. Involved entities, regional - central offices (units).

On the other hand we will have a central office which will act the same, but meanwhile it will have the general authorization to exploit the replication technology with the aim of gathering all the data from the surrounding entities, which will be integrated into a unique database and transmitted to the population through the web mapping service Web GIS Albania v1.1.

## 7 Conclusion

The goal of the paper trend is to emphasize the future of GIS development policy in Albania by enforcing a strict mutual relationship between education, internet, the growing market needs for geospatial data and their potential environment. A sustainable integration of GIS technology will not only create new opportunities in the Albanian market but also it will create a new vision of business managing through the usage of spatial technology. On the other hand, higher educational

institutions as universities will offer new programs based on GIS curricula enlarging student possibilities for a greater approach toward GIS subjects.

Conditions are already mature, the increasing role the government is playing through substantial reforms toward internet extension, the vast expansion of educative institutions like private universities followed by the growing market needs for geospatial data and experts, creates the perfect circumstances for a sustainable GIS development.

The world is evolving at a rapid pace and in this environment, "information is considered power", and this is what GIS performs best, "manipulates information in favor of better decision-making" (Hysenaj M., 2011).

Developing a platform such as Web GIS Albania, will give a new impetus to every potential field where geospatial technology can be integrated. It will have an imminent impact in both academic and market environment. Also it will create a new vision of managing specific issues by performing individual researches.

As a future perspective a further enrichment of this platform should continue constantly. A richer set of dynamic maps, questionnaires, diagrams and statistical data should be used. The platform should serve as a bridge of communication and information not only for a specific category of people but for a wide range of population, acting as a general regulator. Simplicity in use and interpretation should be of primary importance during further development of this platform.

It is important to consistently maintain the trend of enlarging (in number and diversity) the entities that "play as primary actors" during the information supplying process. Also it is of great importance to create a better checking system for the accuracy and reliability of the input information. Constant update should be the basis of this process.

The purpose of this research consists in emphasizing the great importance it presents the integration of GIS as a future technology in the development and advancement of vision and policy perspectives in many fields such as management of natural and human resource issues, advanced research methodologies, knowledge management and organizational strategies, etc.

In a future perspective it is necessary to strengthen further the collaboration between the academic and business entities with the goal of developing geospatial sciences. GIS deserves a leading role in the surrounding environment.

The concept of the WGA platform should not come to the people as a completed project which can widely support any potential demand and affect every area of life and environment. All we know is the high frequency of factors like evolution, changes of events and entities which we are facing every day. These changes mostly mean displacements and movements in different directions and destinations. This implies a direct impact on their geographical coordinates (location). People's demands keep growing that's why this platform will be constantly opened to continuous restructuring process



involving the introduction of new modules and updating geodatabases with the last geographic data.

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## Appendix

Dynamic indexing and structuring maps acting as models for the Albanian territory, Development software Web GIS Albania.

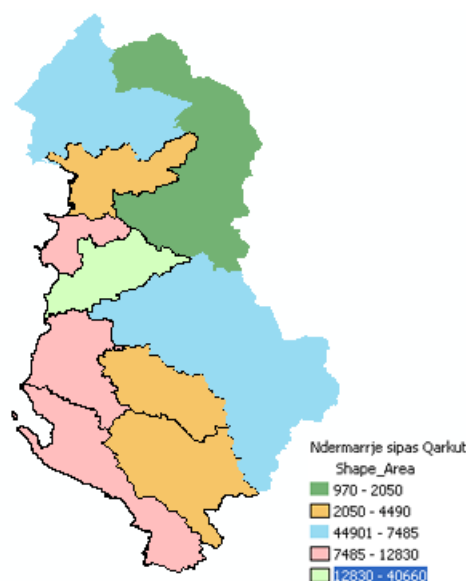


Figure 9: Active Economic Entities 2011-2012, Albania [Business Sector].

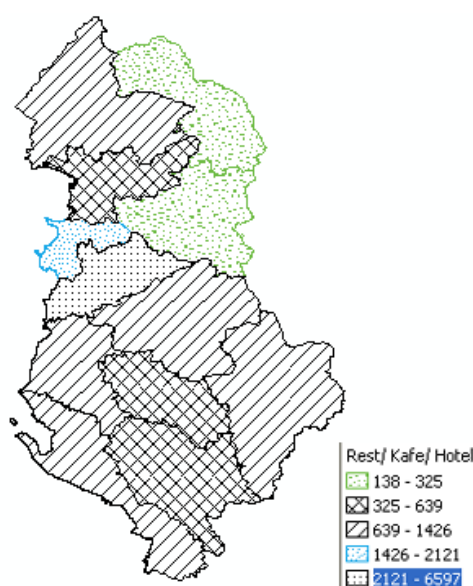


Figure 10: Turistic Entities (Hotels, Restaurant, Bars) 2011-2012, Albania [Business Sector]



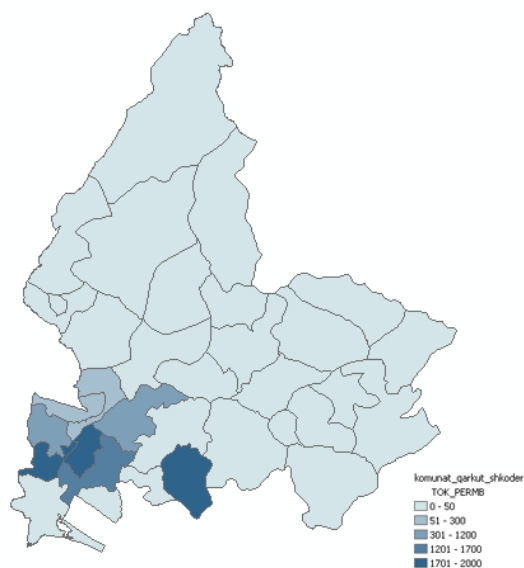


Figure 11: Region of Shkoder, Northwestern part of Albania, Flooded areas period (December-January 2010) (hectare land), Commune level, [Natural Hazards Sector]

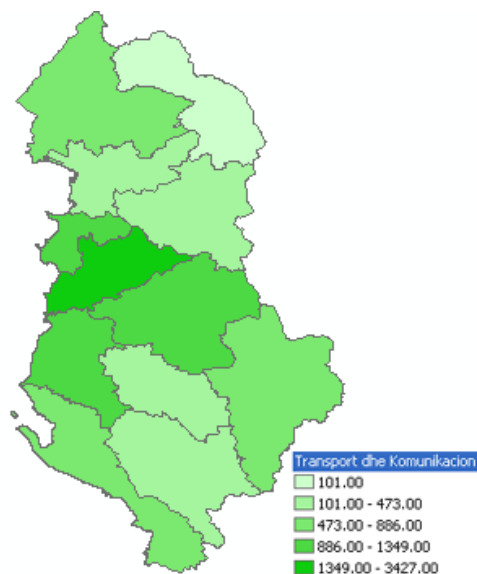


Figure 13: Development of Transport and Communications Sector 2011-2012, Albania [Transport Sector]

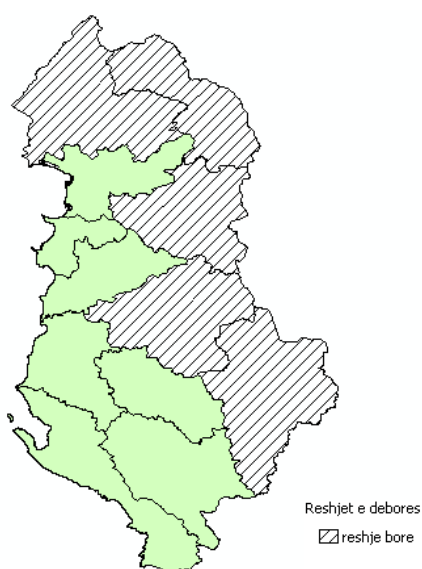


Figure 12: Surfaces covered by snow precipitation, Albania 10 February 2012, [Natural Hazards Sector]

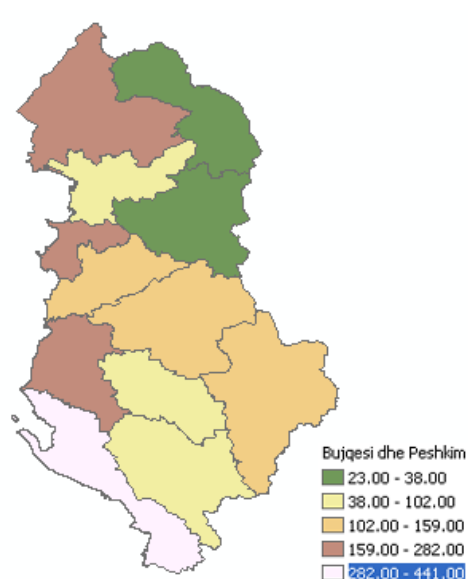


Figure 14: Farming and fishing activities, Albania, [Agriculture Sector]