SPATIAL DATA FOR BETTER GOVERNMENT OF LARGE CITIES – BULGARIAN CASE

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ABSTRACT

The development of new data, approaches, and spatial analysis tools and data collection methods over the past years has revolutionized the process of governance the large cities. The usage of spatial data helps in researching the milestones in city's government. Innovations in public administration are expressed as delivering new public services and improving the existing. Internet-based GIS enable any department of the public organization to extend the services for citizens and business without time and distance limitation. Government of the cities is dependable and correlated with the size of municipalities, with their geographical location.
The application of integrated data from GIS and satellite data is demonstrated in examples for crisis management in Bulgaria. Researched examples cover GIS help in the situation with a forest fire, monitoring of snow cover on the territory of Bulgaria and explosion in the military section near Sofia.

Key word: e-government, spatial data, innovations in public sector, GIS, city governance.

1. INTRODUCTION

G-government is a concept, reflecting the ever enlargement impact of GIS and its entry into modern management. Using the advantages of GIS and the Internet, G-government makes more efficient government, sets a new level of administrative services.

The objectives of the research are on the first place to identify what information to extract from built up areas for deriving more information on location, condition and evolution of high risk, related to international disaster risk reduction. The research will focus how to quicken government disaster and crisis response capacity. In some aspect it is concerned with development of standardized and defined procedures.

In the terms of cities' problems an objective is to the ability to integrate spatial information because public representatives for disasters and management of crisis can communicate and connect to do business between themselves and the government. Thus individual participants in the process need to connect to each other, sharing and collaborating with different types and formats of spatial information.

Using spatial information requires technologies which are open and can interoperate between each other.

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The integration of data in a territory of a country allow the government to derive the greatest benefit from the stored data in existing systems. Sharing data among government departments and between related institutions will be the main benefit from usage of spatial data.

2. NEW APPROACH TO SPATIAL DATA

Precise spatial information gives new opportunities to researchers because these data raise new challenges - they allow research participants to be identified and therefore threaten the promise of confidentiality made when collecting the social data to which spatial data are linked. The unique capacity of spatial data leads to facilitating the process of identification of individuals on public places. This is absolutely important in the current time when the need of more security is needed in the big cities. Spatial data combine text, graphical and geographical information and as a result a general reports can be provided after processing the data.

The development of new data, approaches, and spatial analysis tools and data collection methods over the past years has revolutionized how researchers approach many questions. The availability of satellite images with high resolution of the Earth, collected repeatedly over time, also availability of software for converting those images into digital information about specific locations, has made possible new methods of analysis. At the last year are available more and improved satellite images as aerial images, become more popular global positioning systems (GPS) and other types of sensors — especially radio frequency identification (RFID) tags. All these data and tools may be used to track people worldwide. That way is possible to provide ubiquitous tracking of individuals and groups. The same technologies also permit enhanced research that may support business enterprises. Such examples are providing tracking information for commercial vehicles to optimize their route and to control their movement. Another example is tracking the shipments of goods. Improved understanding of how these spatial data interact with social variables can help for much clearer picture of the nature of access to health care compared with the time when spatial data were not available. The usage of spatial data for better government of the big cities improves their importance for managing the cities' problems.

These new tools and methods have become more widely available. Their usage needs of more study in depth. For example using these data may be performed an analysis of health services and the focus may be on access as a function of age, sex, race, income, occupation, education and employment. Now is already possible to examine how access and its effects on health are influenced by distances from home and work to health care providers, as well as the quality of the available transportation routes and modes of traveling to providers.

The most important challenge for research the link between public and spatial data is the development and use of geographical information systems (GIS). They make possible to put together data from different sources and points on the surface of the Earth as a result. This connection has great importance because geographic coordinates are a unique and unchanging identification system. Using GIS is possible to collect data from participants in a public survey and these data can be linked to the location where are living the participants or to their workplaces, or land holdings. Then the analysis may be performed in connection with data collected from other sources, such as satellite observations or administrative records that are in connection to the same physical location. Such data linkage can reveal more information about research participants than can be known from either source alone. Such revelations can increase the fund of human knowledge. Such analysis can also be seen by the people whose data are linked as an invasion of privacy or a violation of a pledge of confidentiality.

A number of possible approaches exist for preserving respondent confidentiality when links to geospatial information could raise non-observance. The approaches fall in two main categories: institutional approaches, which involve restricting access to sensitive data; and technical and statistical approaches, which involve transforming the data in various ways to enhance the protection of confidentiality (http://site.ebrary.com/lib/nbu/Doc?id=10170926 &ppg=70, 2007).

3. GIS IMPLEMENTATION AS INNOVATION FOR E-GOVERNMENT

During the process of development of e-government it becomes mature and the expectations for more interactive and responsive e-government have also been growing (Norris & Moon, 2005). Yildiz (2007, p. 647) claims, "E-government research up to date for the most part limited itself to the study of the outcomes and outputs of the e-government project. Thus, understanding the political process behind e-government development is vital for overcoming both definitional and analytical limitation," and also argues, "such an effort requires a historical understanding of the relationship between technology and administration".

The traditional government computer based information systems are built when closed, connected, integrated and and proprietary IT infrastructure exists. The main goal of traditional information systems is to help and support with their functions, connectivity and capacity the end-users because of increasing their productivity. The appearance of the internet and web-based technologies has made the government services more accessible. Organizations in the public sector have higher pressure and demand from the public, businesses and government agencies for more and better services of e-government. A successful implementation of e-government requires careful planning of future strategies for satisfying these higher demands. The integration between the new e-government information systems and the existing internal systems has to be redefined in terms of IT elements and business processes (Fletcher, 2004). The rapidly emerging open and standardized IT environment has generated additional requirements such as security and privacy protection (Abie et al., 2004; Deakins & Dillon, 2002). Moreover, the characteristics of demand for e-government services from the public are often uncertain and the client computing environment is largely unknown. These issues have posed a great amount of challenges for IT managers in the public sector who are charged for satisfying the service demand around the clock with acceptable performance level (Richardson, 2004).

Usually GIS is connected with geographical maps. In fact the map is only one of the types for work with geographical data and that way appears only one of the outputs of GIS. In principle GIS includes 3 aspects – geographical data base (geo-data); maps (interactive maps that demonstrate objects from the earth surface and relationship between objects); models.

The perceived benefits of using the centralized, Internet-based GIS seemed endless. Users could easily interact with the system to obtain the data and information they need according to their requirements. The staff of public organizations has the ability to enter data into the GIS database, to request and receive reports, to generate maps in real time from the workplace computers. That way the public organizations' staff may provide the highest level of public services with minimum resources, because the number of staff becomes less and at the costs are decreasing). Managers of the public organizations have the ability to perform analyses to better understand the resources of any county and circumstances for taking their decisions. Moreover Internet-based GIS enables any department of the public organization to extend the services to citizens and business without any time and distance limitation.

E-government decisions and presence can range from a simple website of the public organization to fully integrated e-government services across government and multi-government administrative boundaries. Each e-government development stage is associated with the triggers and activities that take place in a unique way such that it is critical to understand where the current e-government initiative stands in a continuous e-government process (Tsai N., B. Choi, M. Perry, 2009).

Innovation and implications for public services has been defined as a ‘‘reverse product cycle” – the application of new technology will first lead to an improvement of efficiency in the delivery of existing services, then to a better quality and eventually to the introduction of brand new services (Barras, 1986). The technology adoption and decisions to undertake costly innovation efforts in the public sector also reflect the political will of central and local governments, coupled with the recognition that change requires the allocation of substantial resources (Arduini, D, 2010); and the pressures exerted by users (voters) on local governments to improve the quality of services supplied by public administration (Clark et al., 2008).

The interactive and comprehensive nature of innovation is mediated by spatial factors, such as geographic closeness and local knowledge collection. There are strong examples of inter-regional variations in the formation and adoption of applied new technology in the public sector services, uncovered that innovation tends to be geographically limited. Innovations in public administration are dependable and correlated with the size of municipalities, with their geographical location. For example e-government service supply provided by Italian municipalities is a non-homogeneous and strongly asymmetrical process presenting intensities which vary according to the geographical localization of every municipality. (Arduini, D, 2010).

Some of GIS application for better government of the modern city is:

- Optimization of the planning process of the cities
- Planning the communication infrastructure on the territory of the city
- Urban development
- Building underground infrastructure

Internet-based GIS represent a new approach to innovation in the public administration. First of all the better services are delivered to the users of the system; they interact easy with the system and to access data and information. On the other hand the administrative staff enters data into GIS database, also receive reports, and generate maps in a real time. The administration provides sophisticated public services with minimum resources. Managers of the public organizations make analyses because of future research on specific country part.

It is obvious that by the help of a new technology, using geographical dependant information can be researched and improved better the process of innovations used in the public sector.

4. SPATIAL DATA INFRASTRUCTURE ASSESSMENT

The Spatial Data Infrastructure (SDI) carries a lot of benefits to the information society with its implementation. There arises a need for SDI assessment because of the changes in government fiscal policies, market-oriented economies and the further development of first generation SDIs. The sum effect is that governments, as main financiers of SDI, are now demanding that methodology be put in place to justify the implementation of SDIs before additional funds can be accessed (Stewart, 2006).

SDIs are usually complex, with various components, many stakeholders, monopolistic tendencies and therefore, will have complex performances. A consequent of the maturity of first generation SDIs is the fact that they will require or soon will require reengineering and recapitalization to transform them into SDIs capable of providing the services demanded by current and future users (Giff G., J. Crompvoets, 2008). For example SDIs may require technological upgrades, more effective policies to better support their objectives. In some cases this means more current e-government initiatives, informed decision-making, sustainable development, more flexible land administration systems, national security. Therefore, SDIs must be assessed within these objectives and performance information on these objectives reported to the financiers.

5. GIS FOR GETTING OVER CRISIS SITUATIONS – BULGARIAN CASE STUDY

In the current environment of lage cities with millions inhabitans and business companies the public organizations are dealing with a great amount of data that are stored in different formats and on various places. Because of the aim to take better managerial decision the data are to be integrated and analyzed. GIS are able to integrate and connect data including spatial component independently of data source. GIS also helps for combination the spatial location of the objects and the descriptive information (attributes) for the objects. For example data for citizens may be connected with addresses; buildings in the city may be connected with plots and streets with networks. The information in the system is combining and visualizing in several layers and that way helps in better comprehension of events and interconnections between objects. As a result the person responsible to take decisions for better government the large city may become aware of the realtion between posted data and final decision. GIS takes in consideration automatically all available data and that way the possibility for better managerial activity is real.

Because of the tendency for optimizing the administrative structure in Bulgarian administration, the chahges on organizational level are recently made. The administrative structure responsible now for crisis management are based in the Ministry of Internal affairs and in the Ministry of Transport, Information Technologies and Communication.

The Executive Agency ESMIS, founded in September 2009 under the management of the Ministry of Transport, Information Technologies and Communication uses integration of distance and geoinformation technologies for crisis management. The goal of the Agency is to develop and support the National Portal for spatial data. During the process of administrative changes a project BulgaRisk is started in 2008 with the aim to integrate satellite images in the process of risk management for natural disasters in the country. According the plan of the European Comission, the members of EC will make a risk assessment for the water basin's beds till 2011 and prepare crisis recovery plans till 2013.

5.1. Checking and tracking of events danger for environment and people.

Because to secure the citizens in the large modern cities the government should use modern technologies and innovative decisions for public services. Fires arise from natural occurrence or because of human intervention.

For the purpose the equipment for functioning GIS systems is two terrestrial satellite stations that receipt and process data in real time. Via Internet the stations send satellite images with 32 m resolution.

GIS uses centralized geodata base with special information for the objects like structures, events, critical infrastructure and operation that should be taken in the time of crisis. The systems are analyzing and estimating the current status of the atmosphere, land and water surface. For example if about any place the information for the rainfall is compared with the air pictures from the same place is possible to define the places where all the year there is water.

GIS makes analysis of output data and marks the position with x, y and z coordinates for length, width and height or with another geocodes, like post code or road milestone. Any variable is possible to be entered in GIS and to be positioned in the space. The system converts any information in digital form. The system is used for localization of fires on the base of satellite data recent to the real time. The image is accompanied with geocoordinates of the fire, information for the damage area and fire intensity. Data for atmosphere pressure, direction and speed of the wind are represented in graphical type.

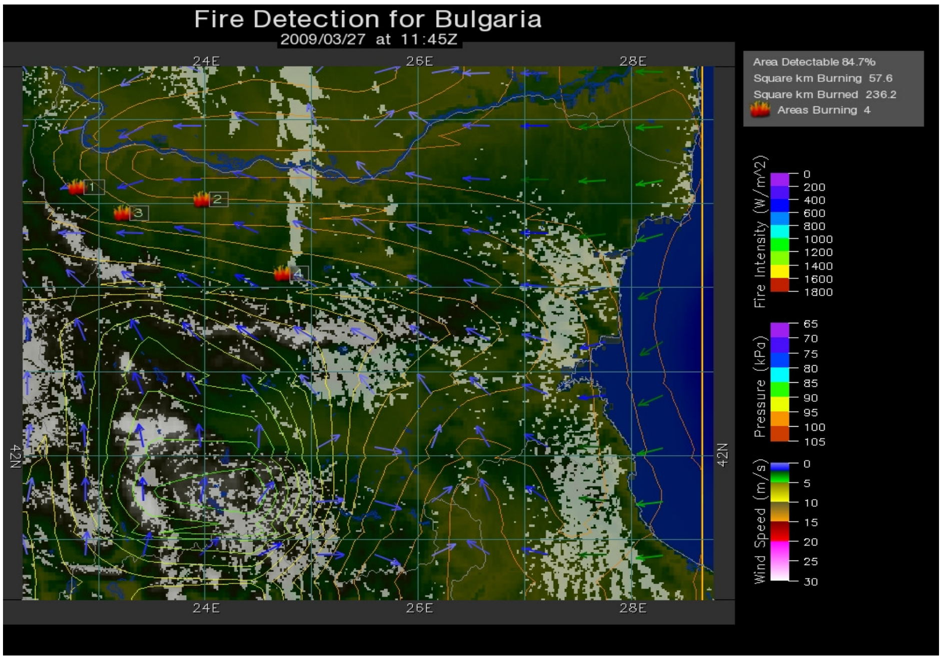

Fig. 1. Fire detection for Bulgaria.

The use of the system is for more effective operating in prognosis, planning, prevention, preparation and operation of arising crises. The system covers all stages in the crisis action. For proper functioning of the system a support of the actual state of information is needed. Information covers all about the territory, forces of reaction, available resources in exact territory, critical infrastructure near the territory, meteorological status and other important factors.

GIS integrates the information entering of different sources, makes georeferenting and submits a new, qualitative view on the integrated information. An example about information hold in the system is whether the fire brigade has enough a specialized technique for dealing with a concrete fire (Fig.1). The system is functioning at several levels. The first two levels communicate each other and integrate the information. At the first level a centralized data base is used storing always actual information. On the second level the county administrative organization have the opportunity to enter and to use information and then to coordinate the activities against crisis. The lowest level is the local government. It is the main source for input actual information in the system because the events are happened at local level, also most of the crises are happening locally. In case of destroying the communications between the levels GIS continues to function. The reason is that the exchange of information may realize via Internet or through external electronic device.

Functioning of the system via Internet has no special requirements for installation, that way the staff has a quick access to the system in the time of crisis. The information flows easy to the media. That way is possible control over the published information on purpose to help the quick decision of the crisis.

Information that helps to foresee some types of crisis is stored continuously in the system. For example if there is data for a concrete place that at summer time often are getting big fires or floods, these disasters may be predicted and timely to take measures for prevention. Data integration helps to find hot points of crisis, to analyze and to prevent future disasters.

5.2. Forest fire in Dabovo.

Using integration of GIS data and satellite data on Fig. 2 is shown a map of forest fire at 2007 in the area of village Dabovo, Stara Zagora district. On the map are shown the satellite images from Disaster Monitoring Constellation with resolution 32 m before the fire, at the time of the fire and after the fire. It is clearly shown the affected territory, the fire at the stage of advance and the direction of smoke dissemination. For evaluation of the after-effects data from Corine Landcover are used.

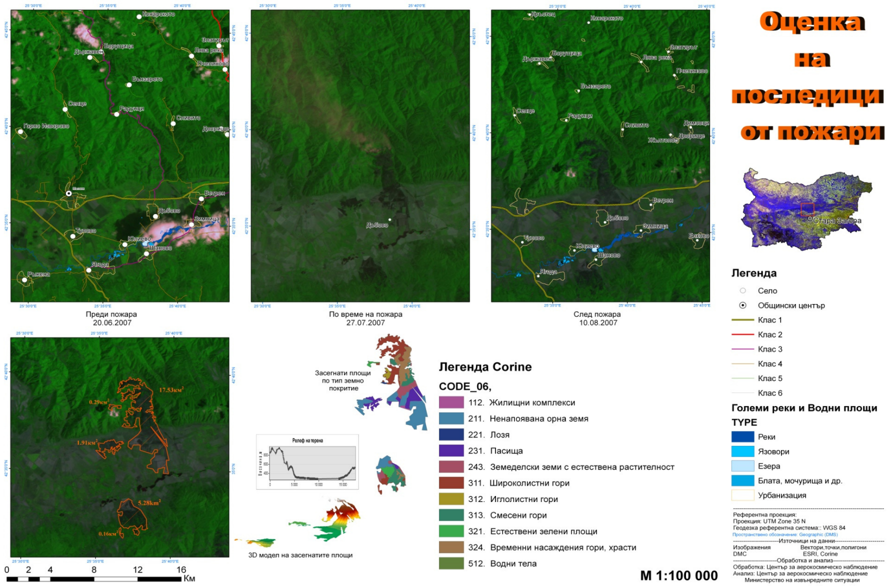

Fig. 2. Fire in Dabovo.

During the time of crisis is very important factor the reaction forces because of victims. Except of fire the crisis may be earthquake, landslide, flood or other. GIS uses systems for tracking GPRS and tracks the actual information. That way in every minute there is information about the place of ambulances, fire brigades. It is possible immediately to send help to victims. The staff for saving operations may be informed using mobile communication for the progress of disaster. At the same time the staff may enter information in the system using various communication channels.
Also may of data at the time of disaster are available using satellite pictures. For example that way may be found easily arising forest fires.

5.3. Examples of other GIS applications in the country.

Monitoring of snow cover on the territory of Bulgaria is a demonstration of application the integration between GIS and distance measurement. Satellite images from the stations MODIS are used. The resolution is 500 m, the applied index, received from the data bases of satellite stations NOAA, gives information for the status of the snow cover over the territory of the country. As a result of integration a one-day and long-time images of the snow cover on the territory of the country are got. The images are as a result of processing with ERDAS.

A National data base and a spectral library exist on the base of archive index of vegetation and agro climate data for the country. For the territory of Bulgaria are defined "standard areas" and a catalogue is published with all processed data and results from estimation the index dynamics of vegetation for the basic agriculture crops.

The data base gives the opportunity to estimate and analyse the results for the last 10 years. That way there is information about the years with worst and optimum conditions for agriculture crops growth. This data base is used as a base for comparison for future and for monitoring of the drought and dry.

Another example of GIS application is the real functioning of the system at the time of explosion in the military section in Chelopechene, on 03.07.2008. On the fig.3 is shown a satellite image, integrated in GIS environment, at the time of damage. The location of the explosion is clearly seen, also the direction of smoke wind. Upper right – the land of the district according Corine Land cover, where the place of explosion is drawn in Black Square. Down left – satellite image of the district before the explosion - the place of explosion is drawn in Black Square. Down right - satellite image of the district after the explosion – the effects are shown in dark grey, with black border.

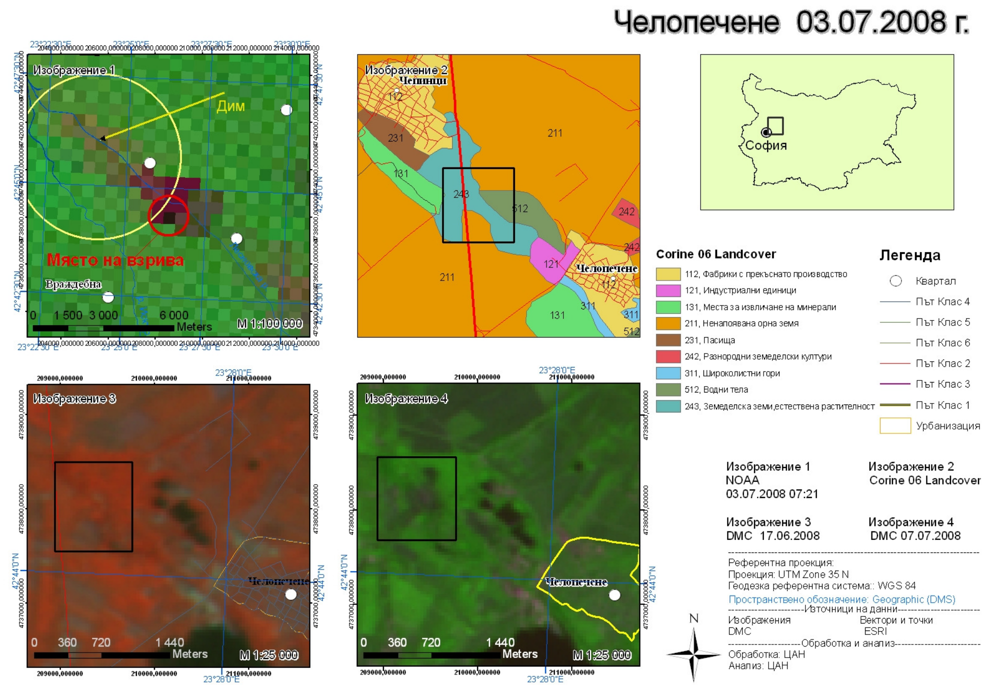

Fig. 3. The explosion in Chelopechene.

6. CONCLUSIONS

GIS application for dealing with crisis situations helps in many aspects as is shown in the examples. First of all the information about the place, size of the fire is detailed and currently actual. The changes in the situation are tracking from the system also. GIS helps the responsible people to be informed about technical and human resources available at the moment near the crisis. That way the system helped for better management of the crisis. Management of crises is an important factor for better government of the places where are living many peoples as in the big cities.

In other aspects GIS prevents from disasters connected with natural effects like drought, heavy snowfall, cool weather.

In a security-related applications, and in particular crisis management, satellite-derived information plays an essential role as a synoptic, independent and objective source, especially in the case of international controversy and conflict related issues. Spatial information allows us to understand cities better and to make better decisions about them as a result. The city of tomorrow will be built upon a foundation of sustainable processes that will generate cleaner air, water and higher energy efficiency while delivering revolutionary transportation systems and quantifiable numbers to prove quality living exists.

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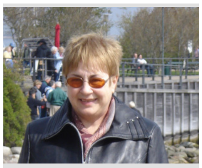
6. BIOGRAPHICAL NOTES OF THE AUTHORS



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