

INNOVATIVE USE OF GIS IN THE KEY BUSINESS PROCESSES OF COMPANIES

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Rezime: U ne tako davnoj prošlosti, poslovni procesi i GIS tehnologija su se razvijali nezavisno jedni od drugih bez ikakvih dodirnih tačaka uopšte. Međutim, smanjenjem cijena tehnoloških uređaja, konstantnim razvojem i sveprisutnošću u današnjem svijetu, počeli su se oblikovati i korisnički zahtjevi za kompletnijom slikom operativne radne sredine. U kreiranju takve slike veliku ulogu mogu imati GIS tehnologije, što je relativno brzo prepoznato od strane raznih kompanija i organizacija kao sredstvo za povećanje efektivnosti poslovnih procesa. U današnje vrijeme, sinergija poslovnih procesa i GIS tehnologija je postala uobičajena pojava i praksa. Potreba za povećanjem efektivnosti poslovnih procesa dovodi do sve većih zahtjeva korisnika, te se sve više javljaju inovativne upotrebe GIS tehnologija kao što je korištenje mobilnih uređaja i prenos i korištenje prikupljenih GIS podataka u realnom vremenu. Odlučivanje na bazi tako prikupljenih lokacijskih informacija se onda vrši u svakodnevnim poslovima, te je integracija i implementacija GIS tehnologija od velikog strateškog značaja, a sve sa ciljem poboljšanja sistema i efektivnosti poslovnih procesa upravljanja.

Abstract: Not so long ago, business processes and GIS technologies have developed independently without any intersection points. But, lower prices of technology, constant growth and presence in today's world, have led to shaping up more and more user requests for having a complete operational picture. Creation of such picture can be very much supported by GIS technologies, which has been quickly recognized by various companies and organizations as an efficient tool for increasing efficiency of business processes. Today, synergy of GIS technologies and business processes has become accustomed practice in the world. Constant need for increased efficiency of business processes is bringing more and more customer demands which lead to innovative use of GIS technologies like usage of mobile devices and transfer and usage of collected GIS data in real time. Decisions made on basis of such collected information is done in everyday work, so integration and implementation of GIS technologies has become great strategic importance, and with one goal: to improve the system and efficiency of business management processes.

1. INTRODUCTION TO GIS

Geographic information represents and information which can be assigned to place, street address, zip code, or coordinates. Geographic information system technology or GIS technology is computer based tool which enables presentation and manipulating of geo information. GIS technology

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has, with final full operation of GPS (Global Positioning System), and development of computer technologies, achieved significant breakthrough in last years. With the help of GIS, it is possible to connect all geographical information into one joint system which then enables conducting of various statistical analyses in order to create predictive models.

In general, GIS technologies have seven basic tasks to perform:

- Input of data,
- Creating of maps,
- Data manipulation,
- Database management,
- Search and analysis,
- Visualization of results.

With today's technologies, GIS is produced fast, data are easier and simpler to manipulate, and entire visualization of collected data has already reached state of the art level.

It is also necessary to give a brief view of basic elements of GIS:

- Hardware,
- Software,
- Data,
- People and
- Analysis methods

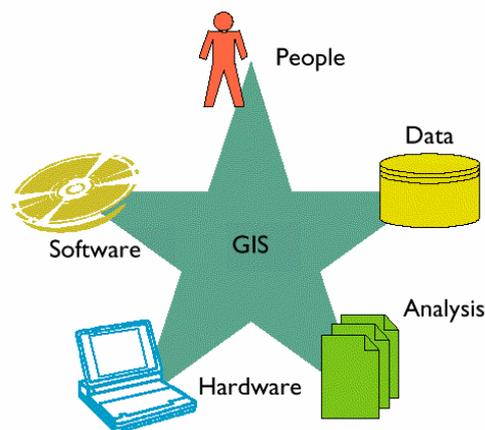


Figure 1 - Basic elements of GIS system

Hardware component of GIS is presented with a PC in standalone or network configuration, which has enough processing power to handle all necessary data and enough memory to keep all the records.

Software component of GIS is GIS software alone, which functions and tools enable storing, analysis and visualization of geographic information. Key software elements are represented by tools for input of geographic information, database, visualization tools, analysis and search of data, and graphic use interface – GUI.

Data are most important GIS component. GIS integrates spatial geographic data with other data in the database to enable its easier organization and manipulation. Data can be collected personally, bought from the third party, or received from the authorized national body. Personal data collection is usually most expensive, but also the most relevant one, whilst data gained from the authorized national bodies can be free of charge, but also outdated.

GIS depends a lot on people, specialists which create and maintain the system, thus enabling its everyday operation. Today, with the increased development of GIS web applications, company does not have to employ specialized GIS experts.

Development of other technologies has led to simplification of map digitalization and its broad availability, where besides geographical data one can visualize other elements in special, separate layers like political and organizational borders, service areas, etc. With development of web interface, usage and availability of GIS data has become accessible worldwide. All in all, GIS enables research

and analysis of different geographical information with different level of details from different perspectives, as well as visualization of such research and analysis from the users personalized aspect.

2. INTRODUCTION TO KEY BUSINESS PROCESSES

Business process represents a set of business activities combined with one goal of creation value for a customer. Basic goal of every company is creation of values. Insight into process management provides a best possible picture about the company business quality because with good quality definition the process of realization of business strategies is enhanced and enables execution of business tasks on the top quality level of company management. Process oriented organizations give most attention to the key concept – business process organization with a goal of efficiency enhancement and with that efficiency of business results. Key processes are the ones which help creation of products and values and are directly involved into creation of company values.

Management processes have a goal to increase creation of the value, while support processes help in this creation of values, without loss of the value itself. Identification, categorization, tracking and measurement of business processes are done by business process management system. With collected results, companies are taking corrective measures, suggesting enhancements of business processes, and define successful strategy of the company.

Identification of the key business processes is based on tracking of the key state changes which occur during creation of the value, and on defining contact points with the key consumers. Because of such identification, various methods, dynamical and program tools are being introduced which make the complete identification process easier. Business processes need constant tracking. They have to be measured in order to obtain an answer on effectiveness of implemented processes. Starting from the static process control which tracks the stability of the process itself, through large number of dynamic analysis like simulation, what-if analysis, business expense analysis, to determination of the level of satisfaction of internal and external consumers, customers, and also process owners, employees and deliverers of the process.

Lately, considering the fact that geographic information enables simpler and more practical visualization of collected data, as well as more quality data analysis, GIS technologies are starting to become significant factor in identification of key business processes, but also a mean for development of dynamic strategy of the company. GIS technologies can also provide a quality foundation on which basis can be done and developed various analyses for tracking and enhancement of key business processes.

3. INTEGRATION OF GIS AND BUSINESS PROCESSES

Business processes have been before very often non-flexible because the participants in the business process shown very poor understanding of the overall picture, and understanding of such picture is a key condition to achieve possibilities of enhancements of the process itself.

As a support tool, GIS has enormous possibilities for enhancement of the business process, and its effectiveness has to be observed through the prism of business optimization successfulness. GIS technologies enable effectiveness of the business processes if they are used to perform those tasks which cannot be done in a different way. Effectiveness of the business processes itself is in that case shown through significant savings in time and finance. In order to incorporate GIS qualitatively in the business processes, it is necessary to perform good planning and to make a good GIS usage development strategy. It is not worth to integrate GIS technologies into business processes just to have a new kind of technology, because in that case, the value of the product decreases, and consequently GIS investment is worthless. Lately, GIS technologies are being more and more incorporated into company business processes as a key component of overall system architecture. Depending of company and kind of business process, associated GIS technologies must be specially planned, designed and implemented.

Benefits which GIS technologies bring to business processes are:

- Savings in time and finance,

- Increase of efficiency, productivity, communications and cooperation,
- Generation of profit,
- Decrease of expenses,
- Decision making help,
- Building of database and
- Resource management.

Industries which use GIS tools and information can be broadly categorized as:

- GIS industry (providers of GIS services and information),
- Industries which traditionally have a need for GIS technologies (geodesy, utilities, telecommunications, natural resource management, etc),
- Industries which recently started with usage of GIS technologies (real estate agencies, marketing agencies, etc).

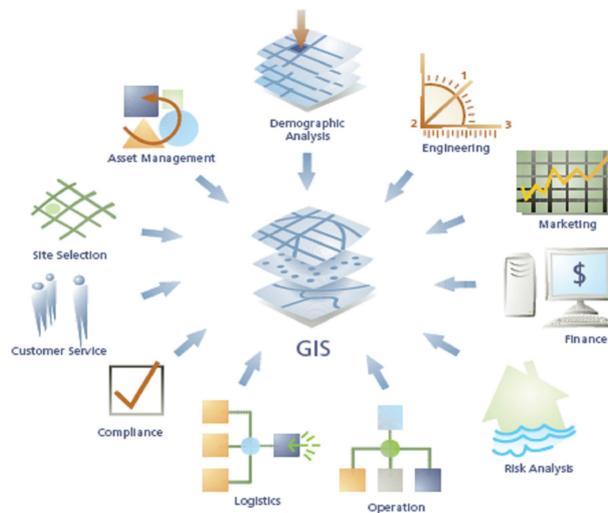


Figure 2 - Integration of GIS with other systems

In given categories, usage and goals of GIS technologies are very much different. In the first category, GIS technologies represent core business, and development and sustainability of such companies is very much dependable on GIS technologies. In the companies from the second category, using of GIS has become standard practice over the years, which led to creation of admirable database that is helping to use GIS in a better and fulfilling way. Usage of GIS in the third category companies has become a challenge for many. Anyhow, justification of GIS usage does not seem appropriate in the beginning because it takes some time to return of the investment, and some also may find business processes weakened. But, with innovative usage of GIS technologies, more and more third category companies is starting to integrate GIS into its business architecture which helps them to differentiate and upgrade their key business processes. With availability of advanced mobile devices, integration of GIS and business processes is gaining on its significance and distribution. Mobile GIS integrates new technologies: new generation mobile devices, GPS system and wireless Internet access, and with integration of these technologies, companies are opening number of ways to increase effectiveness of their key business processes.

4. INNOVATIVE USAGE OF GIS

Independently of their usage, GIS technologies must justify their role as a key part of the company system architecture. In order to use geographic information in a best possible way, from the key business process efficiency increase viewpoint, it is necessary to have geographic information as updated as possible and to have appropriate sampling period. Before, gathering of geographic information was a hand written job, in terms of collecting data and database entry. It was not done

very often and it required a lot of time. Mobile computers have enabled avoidance of paper forms and have enabled automatic digitalization of collected data, but which have later on had to be filled into central GIS database. With emersion of mobile internet access (Wi-Fi, 3G – UMTS, etc) gathering data, their database entry, and even visualization have become a real time task, which means it is being done automatically on the field. GPS system has also shown to be of a great help in gathering geographic information, and it showed high location accuracy. With handheld computers/smart phones containing integrated GPS receiver and digital camera, possibilities of using and developing various applicative software for ensuring geographic information with high location accuracy and digital photo have enormously increased.

Yet, gathering data in such a way is still a hard job, and it is mostly used by the industries which have enough human resources on the field already. People on the field have in this way double task: doing their own job of direct interaction with customers, and gathering information and inputting them directly into central GIS database of the company system.

These industries must generate everyday location based decisions and integration of GIS and updated data in business processes is a key part of their strategy for accomplishing business processes effectiveness and return of investment.



Figure 3 - Mobile GIS devices

One example of such GIS usage is real estate agency. Real estate agent collects all relevant data of a certain real estate which is for sale. Data are gathered during location visit, and all information together with pictures is sent from the mobile device to database. Analyzing customer requests, real estate agent can either through its mobile device, or through a desktop PC create a list of appropriate real estates in accordance to requested location, nominal surface, rooms, and send the created list to a customer through e-mail. Customer review all provided real estates and decides which one they want to check out personally.

In this way, real estate agent is much more efficient in its everyday work (gathers information, doing sales), and customer itself is pleased because they do not need to waste time on checking real estate's which they do not like.

Results 1-10 of 10.

Previous · Next · [1] · Bottom

<input type="checkbox"/>	Received	Stat	ML#	Address	List Price	BR	FB	HB	Lvl	Fpl	Gar	Bsmt	Acres	Age	I
<input type="checkbox"/>		Act	FX7224758	11806 Rockaway Ln #28	\$342,999	3	2	1	3	1	1	No	0	19	
<input type="checkbox"/>		Act	FX7248836	10252 Colony Park Dr	\$344,800	4	3	1	3	1	0	Yes	0.033	26	
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<input type="checkbox"/>		Cnko	FX7263668	14661 Winterfield Dr	\$274,900	3	2	1	3	1	0	Yes	0.034	18	
<input type="checkbox"/>		Act	FX7264800	5182 Glen Meadow Dr	\$324,900	3	3	1	3	2	0	Yes	0.061	22	
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<input type="checkbox"/>		Act	FX7265852	4585 Whittemore Pl #1221	\$324,000	3	2	1	2	1	1	No	0	4	
<input type="checkbox"/>		Act	FX7265916	6203 Frosty Winter Ct	\$284,900	3	3	1	3	0	0	No	0.037	14	

Figure 4 - Example of real estate property list from the GIS system

Second example of mobile GIS usage is in the surface coal mines. Given a fact that surface of such coal mine is constantly changing, geodetic measurements have to be done on everyday basis and visualized on appropriate map usually with monthly update. Automatic input of gathered and recorder GIS information through mobile GIS enables to track these everyday changes of the coalmine surface and provides possibilities to create more quality analysis and taking of appropriate steps in enhancement of key business process of the coal mine, which is coal digging.

Besides mobile GIS, more usage finds also web GIS applications. State organizations in many countries, agencies, ministries, etc, are starting to use web GIS applications as a means of citizens information and additional help.

Data input through web applications, ensuring appropriate GIS information even with a photograph, is an option widely used by many world citizens who have least knowledge of PCs and Internet.



Figure 5 - Schema of web-GIS system

Perfect example of such application would be a city or municipality based web application which enables its users to gain various information on city service activities, and even information of the citizen's activities which are taken in order to increase performance of the city authorities. Display of registry of assessment and property, city service activities schedule, pest control locations (stray dogs, rats, etc), earth slide locations, taxi services locations, and other information can be shown on a city web page on joint GIS visualization. Authorized users can add new data and photographs in the database and in such a way they provide support and help to the city authorities in running the city efficiently. On the other hand, city authorities with a proper analysis of a gathered data can develop more efficient strategy for key business processes, which brings to satisfaction of all parties.

5. GIS WEB SERVICES

Geographic information comes from different and diverse sources and in different formats. This is especially true for areas such as environmental, disaster management related information which has to combine data from different sources having different data model and formats. The Spatial Oriented Architecture - SOA approach also applies within the GIS domain where several standards have been launched. This has created a technology evolution that moves from standalone GIS applications towards a more loosely coupled and distributed model based on self-contained, specialized, and interoperable geospatial web services. In order to create SOA architecture for the GIS services it is necessary to create Web Service correspondences of each GIS services. GIS services can be grouped into three categories:

- **Data Services** are tightly coupled with specific data sets and offer access to customized portions of that data. Web Feature Service (WFS), Web Feature Service-Transactional (WFS-T), Web Mapping Service (WMS) and Web Coverage Service (WCS) can be considered in this group. WMS produces maps as two-dimensional visual portrayals of

geospatial data. WCS provides access to un-rendered geospatial information (raster data). WFS provides

Geospatial feature data (vector data) encoded in Geography Markup Language (GML) whereas WFS-T enables editing feature coordinate geometry (i.e. position and shape) and related descriptive information (i.e. attribute values), as well.

- **Processing Services** provide operations for processing or transforming data in a manner determined by user-specific parameters. They provide generic processing functions such as projection and coordinate conversion, rasterization and vectorization. Coverage Portrayal Service (CPS), Coordinate Transformation Service (CTS), and even WMS can be considered in this group.
- **Registry or Catalog Service** allows users and applications to classify, register, describe, search, maintain, and access information about Web Services.

Web services provide an open, interoperable, and highly efficient framework for implementing systems. They are interoperable because each piece of software communicates with each other piece via the standard SOAP and XML protocols. With OpenGIS standards-based interoperable Web mapping, each map server implements a common interface for accepting requests and returning responses. Now, the same client has Web access to potentially all available map servers and multiple data sources, in which each map server is accessed by the same Web client through the common interface. The result is one composite map instead of three. This approach allows, among other things, the user to run a single Web client that accesses all the capabilities of each server. The future of GIS technology depends on the interoperability with Web services. Web services are accessible with browsers, telephones, PDA's and most of the upcoming information devices.

6. CONCLUSION

Successful GIS system is a well designed and adjusted system which corresponds to its business process. For each and every business process and organization, it is necessary to create a separate GIS system with appropriate methods which are used in such process or organization. The OGC Web services architectures and collaboration tools will allow users to work together in new ways and deliver more shortcut solutions to problem solving. Today, integration of GIS technology with company business process is an emerging trend because it provides possibilities for analysis management of various data. Return of investment and increase of efficiency of the business process have become recognizable part of GIS usage, and with development of mobile devices and web applications, one can expect GIS to become unavoidable part of any company, organization or state system architecture.

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