The Concept of Building Regional Business Spatial Community

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Abstract : Cloud computing is one of the most dynamically developing technologies applied on the Internet. It can be used not only for the purpose of resource management in the network, but also as the platform for network community creation. The paper concerns on one kind of cloud computing utilization. It shows the proposal of regional business spatial community (RBSC) which conjoins local government institutions, enterprise media providers and different kinds of organizations which deal with regional development planning. The notion of the concept is based on the application of commercially accessible software in the cloud which makes possible the accumulation of information resources provided by partners and its usage for the purpose of a given region development, as and by every participant of the venture. As a technological base of RBSC are proposed GIS in cloud solutions by the ESRI firm in the form of the ArcGIS in Cloud software. In the article were presented generalities of spatial community creation beginning from the conceptive phase, across the planning, until implementation. Potential advantages resulting from the accession to RBSC is the increase of the management efficiency in the organizational, social, economic and technological areas.

1 INTRODUCTION

Creation of communities in networks is a matter of substantial concern in the world today. The reasons might be business, social needs or entertainment. A variety of software types can be used for creation of communities (see more: Howard, 2010 or Parks, 2011). Apart from standard tools such as websites or portals which enable sharing experience and views, the cooperation might be also based on the access to specialized software dedicated to a particular society.

The present study investigates the problem of regional cooperation between local entities responsible for providing particular services, such as supply of electricity, gas, water, wastewater management, telecommunication services or development of road infrastructure. Operation of the enterprises which provide the above services affect the safety of the inhabitants in a particular region and quality of their life but has also essential effect on development opportunities in the region.

Contemporary enterprises which supply utilities are standard business entities which are guided by the principles of economic rationality. Therefore, in their operation, they are mainly guided by their own economic interests. However, their development opportunities are somehow interrelated, with particular focus on their potential investments. The arrangement of individual utilities is defined by legal regulations and interrelated. Therefore, the need for using shared information resources arises. They should define the arrangement of particular utilities within a particular area, land development and plans of prospective investments.

One tool which is frequently used in collecting data concerning the utilities in question is Geographic Information System (GIS) (see Harvey, 2008), (Grinderud et al., 2009). They can be used for recording spatial layout of present utilities and planning new investments. Moreover, they can be used for management of the region by the entities of local government (see Greene, 2001). Considering the current status of development, these systems might be also used for evaluation of the investments planned assuming their integration with typical economic systems used in the enterprises, such as MRP/ERP or Business Intelligence (see at Cases, 2011 p.164 or Stair and Reynolds, 2010, p. 217).

The aim of this paper is to present the proposal of establishment of the Regional Business Spatial Community RBSC, which would include the entities

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interested in management and planning of regional development, including the utility suppliers. An integrating factor in the Community is the software available within the cloud that can be used by the associated entities. The paper uses the solution provided by ESRI enterprise, which made the ArcGIS project available to the cloud (about ArcGIS – Johnson et al., 2001).

2 THE IDEA OF THE REGIONAL BUSINESS SPATIAL COMMUNITY

The Regional Business Spatial Community is a proposal for an electronic enterprise based on the Internet, which its aim of creation of shared informational resources of land development nature. The Community can be approached as an electronic consortium which is composed of the entities that operate within the shared environment. "Community" should be regarded as a system of mutual relationships between the entities involved in the activities within such community (about building community see: Kim, 2000).

A prerequisite for definition of RBSC is definition of the goal of establishing the Community. Creation of RBSC is aimed at creation of a consortium of the entities which affect land development in the region. The Community might include a number of entities, including in particular:

- selected entities of public and local administration,
- enterprises which supply utilities or manage the infrastructure in the region,
- organizations interested in development of the region.

The area of cooperation between the entities above is provided by the environment of the Community discussed. The platform for cooperation can be offered by an information system (IS) which can be used by all the involved entities. Nowadays, particular ISs can be shared within a cloud (ArcGIS in Cloud in: Prażmo, 2012). Software supplier defines technical principles of access to data, while the interested entities define the principles of exchange of informational resources.

In the case of RBSC, the system available in the cloud is GIS-class system. It allows for spatial visualization of utility infrastructure of the region. Electronic maps should visualize the data concerning e.g. layout of water and wastewater piping systems, electrical grid, gas piping system, railway, telecommunication cables, mobile network transmitters and other utilities, basic geophysical data, arrangement of plots and land properties.

The data for visualization in the form of digital maps belong to different owners. The owners can collect data in different forms, not always electronic. There are extensive initiatives in Poland aimed at transformation of land development data into the digital form. The data about the infrastructure can be stored in different systems and formats. The main division is into economic data, documents and land development data.

The economic data are stored mainly in MRP/ERP systems and relate to the value of fixed assets and settlements with suppliers and customers (see Garg and Venkitakrishnan, 2003).

Furthermore, the documents can be collected mainly in CAD systems. They contain designs and technical specifications for a network or its individual objects (see Rao, 2006).

The third type is the data stored in the spatial form, using GIS system. GIS is used for description of spatial location of the network and the objects included in the network. The data can be stored in the form of either raster or vector graphics. This means that the data can be stored as maps which can be extended with other layers in the form of particular symbols and signs. The alternative solution is provided by vector maps based on the Spatial Databases (SDB). The maps are generated based on the values of selected attributes of the objects presented in the map and contained in the database. Using this method, it is possible to dynamically generate or modify the maps while changing the number of objects and values of their attributes defined in the database. Hypertext and similar solutions can be also used in order to display higher number of the data about selected objects (see Hu, 2008). An important factor here is map compatibility. Different types of maps and different data formats might represent a serious problem in superimposing different thematic layers provided by different entities.

Another issue is accuracy of the data collected. Different entities use different standards on accuracy and scale of the maps. The problems might also be generated by outdated information, especially on older utility prepared using different standards or resulting from non-recorded alterations made in case of emergency or rebuilding of other media. This is particularly important for 3D models.

While accepting the independence of the entities in the Community, RBSC was meant to be a platform of cooperation between the parts which constitute its environment. The idea of the

cooperation consists in creation of a GIS platform within a cloud provided by GIS developer. The software provider defines the principles for using the licence and permissible technological solutions (e.g. types of compatible maps, file formats, rules for data integrations, symbolization of the objects presented and the methods of map vizualization).

Organization and promotion of the idea of RBSC might be mainly the responsibility of the software providers and/or entities of public administration in a particular region (Fulford, 2007). One benefit of public administration entities is having access to the basic data concerning the particular region, necessity of collecting the data on any investments made in the area governed by the administration, as well as opportunities for influencing other entities that operate in a particular area.

Other entities are supposed to provide the data on their infrastructure according to the adopted technological requirements and to use the data shared with other entities.

Cooperation within the Community should be voluntary; yet the partners should fulfil their informational obligations in a timely manner. Ideally, the GIS platform should operate on-line, based on the data contained within the IT systems shared with the involved entities.

3 POTENTIAL ACTORS OF RBSC

RBSC should be approached as a business-oriented enterprise. In general, it will operate based on the principles of electronic services within the cloud available to a closed environment of dedicated users.

The GIS software suppliers become initiators of the electronic enterprise and are responsible for the technical problems connected with the community. The provider's duty is to develop the service through extending available functions, integration with other IT systems and modification of the present solutions.

An important role in popularization might be played by local government entities. The three functions are essential in this case:

- management of region development,
- recording land development investments,
- ensuring region safety.

Management of the region includes, among other responsibilities, land development planning. This might include passing local land development plans, definition of urban zones, planning of infrastructural investments. In order to perform the above tasks, GIS tools are exceptionally useful. However, public offices do not always have full and actual database concerning utility infrastructure in a particular land in digital form. This concerns in particular the infrastructural networks prepared before popularization of GIS technology. The offices typically do not have data concerning the economic and technical problems of building and managing the individual types of utilities.

At the same time, particular entities of public administration are obliged to record individual investments. In other words, a double recording occurs, by the public office, and by the investor or an entity that manages a particular utility. The data might be recorded using different technologies and software and, in different formats. Some inconsistency might also be observed in recording.

Public administration offices are obliged to ensure safety for the residents in the area of their operation. Managing utilities is one of the most important factors in crisis/emergency management. Having suitable knowledge of utility infrastructure in the region is one of the most basic conditions of ensuring safety.

Administration offices have systems of information that are used for recording utility infrastructure in the region (within local competencies). However, it should be remembered that the administration structures are extended and do not always have opportunities for data exchange between individual offices. In order to record utility infrastructure, the two types of information systems can be used: GIS systems and systems of flow of documents that allows for creation of the document databases in the digital form. They might be stored in electronic versions of document databases (e-BDoc) available in the Extranet or Virutal Private Network (VPN) to authorized offices of public administration.

Regardless of the property relationships, the enterprises that provide utilities are independent business entities which operate based on the economic account principles. The collected data, both economic and those concerning the utilities managed represent their property and commercial secret at the same time. Therefore, it is difficult to force the enterprises to share their own information resources.

The entities can independently affect their relationships with customers and clients and solve the economic problems. However, the question of planning and development of the utility infrastructure remains. The enterprises in this area depend on the decisions of local government bodies and are mutually interdependent.

As mentioned before, location of particular types

of media is interdependent. Therefore, huge investments necessitate mutual agreements concerning the layout of utility networks and systems. This is necessary for evaluation of the concrete layout of individual media and verification of the values of the investments planned.

Individual entities store their information resources in different types of IT systems. The economic data are stored mainly in the systems of MRP/ERP class supported by BI and Customer Relationships Management (CRM) in order to maintain the relationships with contractors. The design an infrastructural network can be supported by the systems of Computer Aided Design (CAD). The design documentation and the documents for individual terminals can be contained in the document databases (BDoc). The layout of the terminals can be specified and visualized in GIS systems.

The access to shared information resources can be also given to the entities involved in regional development. These include e.g. consulting services providers, social organizations, political parties or organizations interested in the development of a particular region. Obviously, this is possible only if the property rights for information resources owned by other entities are respected.

Formally the affiliation to the Community is voluntary and payable (the charge for the supplier of the GIS in Cloud tool). The success of such a venture may occur exclusively if subjects to which it is addressed will express the wish of the mutual collaboration and want to exchange informational resources. This is possible, when they will be aware of their own business correlation.

4 GIS IN CLOUD

Geographic Information Systems are IT solutions which play increasingly important role in the economy. Scattering of the enterprises and establishment of the multi-plant enterprises have caused that the GIS systems are frequently used in business. The RBSC concept assumes that the entities included in an electronic consortium might have their own solutions of GIS type.

However, they have a heterogeneous character while their integration and data exchange might generate a number of problems. These problems result not only from the technological aspects but also from organizational, legal and business ones. Therefore, the RBSC concept assumes that the data and information about the geographical character will be provided by Cloud computing model.

The use of the idea of Cloud Computing in the context of regional distributed business societies involves a plethora of benefits. The most important benefits include: increased efficiency, cost reduction, improved willingness to cooperate, opportunities to attract new partners (see more Nowicki and Turek, 2010).

Increased efficiency in the RBSC area connected with the use of GIS in Cloud results from a radical changes in the approach to the geographical systems. Instead of several heterogeneous systems, with their integration and communication problems, a single comprehensive solution emerges. The data stored in a cloud are uniform, which makes collecting, processing, sending, visualization, interpretation and archiving much easier. Furthermore, this technology allows for a relatively easy access to the resources by means of the Internet technologies (see more: Zhu, 2010). Generally, the costs will be limited to subscription fee paid to the software provider. (see also, Antonopoulos and Gillam, 2010).

Using GIS in Cloud in the concept of building RBSC is also connected with greater openness to operation among individual entities. The enterprises that have their own (local) solutions of GIS might be a little apprehensive of this type of agreements and contracts, since data and information contained in their system are often a resource of strategic character to them. Being afraid of making them available and used by other entities is natural and results from the need for protecting their own interests. However, this apprehension about RBSC is not entirely justified. Individual enterprises that provide utility services might have access to updated maps of layout of other utilities in order not to damage them during construction, maintenance or repair works in their own infrastructure. Another problem is that the GIS systems might contain the data and information which are protected by legal regulations.

Building RBSC system based on Cloud Computing allows for reducing these apprehensive attitudes. The cloud-based GIS system is supplied by the partners with the data which are essential from the standpoint of the general community of the entrepreneurs. Each entity filters the data of strategic importance to them. The system is fed by the resources which are made available in a reasonable and rational manner.

The last of the benefits mentioned concerns the opportunities of attracting new partners and entities to RBSC. The established community of the enterprises and the data contained in the system will

also be noticed by other entities in the region. The services, data and applications offered will attract new enterprises which influence building or functioning of the utility infrastructure in the region. Application of the model of Cloud Computing will be conducive to these processes. Joining the community will not be connected with incurring costs, installation of the infrastructure and the necessity of time-consuming implementations. The model of Cloud Computing allows for flexible scaling of the functional scope and the number of partners.

Contemporary solutions for the services within a cloud include the following basic models: IaaS, PaaS, SaaS (http://www.arcgis.com).

These tendencies also concern the GIS solutions. In the IaaS model (Infrastructure as a Service), the users are able to use GIS system and 'lease' the computing power in the form of physical servers and virtual hardware with particular parameters. This infrastructure was located in the server room of the service-provider, whereas the client (RBSC in this case) decides on which software they want to install and use. Payment for the services is usually deducted in the form of a subscription fee which depends on the resources used.

Unlike Iaas, the service-provider in the PaaS model (Platform as a Service) (apart from the computing power of the infrastructure) also offers the intermediate software i.e. the platform which provides opportunities of developing their own applications. The most important benefit that results from using this type of model is the fact of that the user does not have install and configure the infrastructure and the platform.

The last of the above models of Cloud Computing is SaaS (Software as a Service). It consists in making available of a ready-made application, which is often served by the web-engine and does not need to be installed. This model of Cloud Computing is now the most popular.

One example of GIS, available in the SaaS is AcGIS Explorer Online (http://www.arcgis.com). This solution allows for storing and processing of thematic maps in different formats (e.g. SHP, GPX, KML, CSV) and presenting them on the updated maps. The application is capable of geocoding the text data, performing analyses and connecting external services.

The conceptual model of GIS solutions in the Cloud for the needs of RBSC was presented in the figure 1.

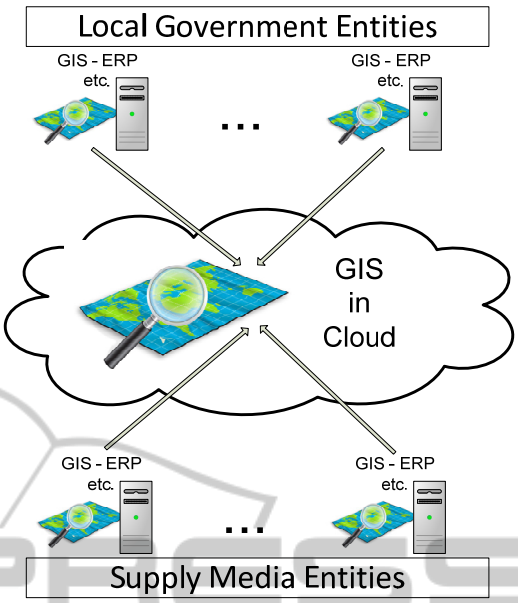

Figure 1: The conceptual model of RBSC.

The solutions offered by ESRI represent a wide spectrum of opportunities and seem to be very useful from the perspective of building RBSC. As already mentioned before, this concept is supposed to support local cooperation of the entities that supply media. ESRI has been involved in a variety of implementations in this area, e.g. (see ArcanaGIS 2012):

- ENERGA-OPERATOR – during creation of the Integrated System of Managing Network Property in the process of passportization of electrical grid,
- ISOK – IT System of State Security, protecting the country from extraordinary threats.

The above applications are based on the solutions of Cloud Computing, whereas they are capable of existing in the cloud more extensively.

5 GENERAL PRINCIPLES OF CREATION OF RBSC

Creation of the Regional Business Spatial Community is a complex process and, similar to other projects of IT character. It should be noted that the technological base is provided by commercial GIS project in clouds, which might be used in a number of other projects. The RBSC project is in this case only one of the projects. Moreover, different projects can be created for each region, with its own specific properties. The place of RBSC in "ArcGIS in Cloud" project presents figure 2.

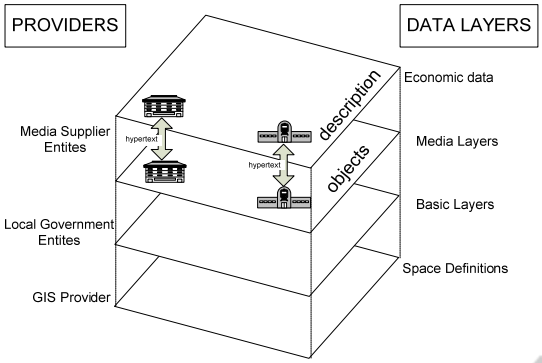

Figure 2: The place of RBSC in "ArcGIS in Cloud" project.

When creating the RBSC project, one should define, among other things, system logics, required thematic layers and the relationships between each other (L - see p. 2), principles for relations within the Community and technical method of their realization in consideration of the software, hardware and communication layers.

The system allows for building distributed business communities at the moment when it is passed for use. Individual participants feed the system with their data (e.g. from ERP, CAD, Business Intelligence), maps (mainly from GIS systems) and other resources. Proper aggregation of the resources and further representation of the thematic and conceptual layers is the effect of system operation. These resources can be used by all the entities which are included in the community and the external entities. The number of the entities should extend as the project develops.

Continuous development of ICT (Information and Communication Technology) and changing requirements of the enterprises affect the necessity of modernization of RBSC solutions. Similar to conventional social portals, modernization of the system will allow for adding new functionalities, which will make it more attractive to the beneficiaries.

Building Spatial Community necessitates consideration of the two basic types of resources: technological and organizational.

Technological resources relate to the hardware infrastructure, application and communication solutions. The base for RBSC in any case is the web service, which, in technological terms, is similar to the sector-based portal available to a particular community. Depending on the adopted logic, it might be of closed character (only for selected users) or open (each enterprise is free to join). In the case of RBSC, the participation will be controlled. The portal implements a dynamic data exchange with the environment, with particular focus on:

- IT systems of the partners,
- GIS in the cloud,
- Data warehouses in the cloud.

Data exchange with IT systems owned by the partners concerns extending the portal with IT resources of economic character. The queries are sent to the system dynamically, and the feedback is sent according to the adopted system operation logic.

The resources contained in the GIS systems are another essential element in functioning of business communities. As demonstrated in the previous part of this study, geographical data are placed in the computing cloud.

Mutual complementariness of the data from IT systems and GIS systems represent the value added for the RBSC concept and is supposed to be a factor in attracting new partners.

Using the technologies of data warehouse might be necessary in the case of collecting the data from many sources with different formats. The tools contained in the data warehouse will allow for homogenization of the data and feeding the system with the resources of a standardized form.

Further, organizational resources reflect the system operation logic. The most basic organizational resource is aerial or satellite orthophotomaps. Making these resources available in the proposed RBSC concept is the responsibility of public administration institutions. These maps contain data of kadastral character, concerning the geometry of the borders of plots included in the register. Furthermore, GIS data should contain communication, topographical and hydrographical maps.

The resources made available by public administration represent the base for further development of the system. The layers delivered by the systems of public administration are added another data of spatial character. They are sent by the enterprises that supply utilities and operate within a particular area. These data include the layout of electrical grids, wastewater piping, telecommunication grid etc. For the objects included in the available thematic layers, one can add economic data contained in the IT systems: ERP, CRM etc. This will help include them in the maps in the form of a hypertext. Relations between data suppiers and data layers shows figure 3.

The supplementation for the above layers in the system is information about mutual relations between the data contained in RBSC. These

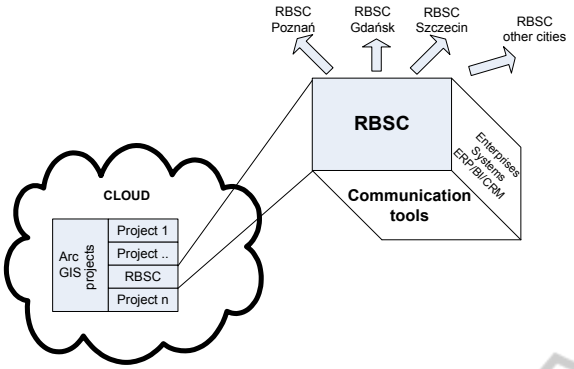

Figure 3: Relations between data suppiers and data layers.

relations might alarm about mutual exclusions in implementation of the investment (e.g. electrical main line cannot be crossed with the gas line) or inform about the opportunities of joint projects.

6 EFFECTS AND PROBLEMS WITH CREATION OF RBSC

Creation of RBSC should increase the effectiveness of managing a particular development. The benefits can be multifaceted. They can be divided into: organizational, social, economic, technological.

In the organizational aspect, one should emphasize the creation of the platform of cooperation between mentioned types of organizations that operate in a particular area. Using ArcGIS In Cloud software necessitates determination of particular rules for cooperation. It might also provide a platform for exchange of views on regional development and allow for preparation of initial calculations for building new urban zones or revitalization of the present ones. From organizational standpoint, establishment of RBSC will represent a medium of communication in the community discussed since the users will need a means of communication for the shared information resources. Therefore, there is an opportunity of starting new electronic initiatives or building virtual network of organizations (about regional economical netwoork see Domański, 2002, p. 194).

The social aspect is connected with creation of a forum which makes decision on objectives of development in a particular region. It might integrate different entities with the focus on economic and social development. Application of information and communication technologies allows for entering into new contacts and might be conducive to exchange of knowledge concerning the needs in the region and the opportunities that emerge.

Economic problems are essential because integrated IT systems allow for flow of the economic data between the cooperating entities. It should be noted that the enterprises that provide utility services also perform the essential social function as they provide residents in the region with basic facilities such as water, gas and electricity. Opportunities of electronic planning of the initiatives and exchange of economic data might accelerate and rationalize the business and planning processes.

Starting RBSC also opens the access to new technological solutions. The entities that provide services in the cloud are obliged to make modern technological solutions available or they will experience problems with finding customers. The suppliers of other systems, in order to cooperate, should also start integration projects. This might be the matter of interfaces, protocols, file formats and tools for modelling the processes which are compatible with the solutions above.

In general, building RBSC seems to be an initiative which is beneficial to any entitiy that belongs to the environment discussed. In practice, some problems might arise during implementation of this environment. They might be caused by several reasons, e.g.: organizational, psychological, economic, technological.

Organizational problems result from internal barriers found in organizations. They might be caused by internal regulation, particularly if only a daughter company operates in the region and it does not have any decision-making authority.

Psychological problems can derive from organizational. They might results from strictly ordered organizational structures, lack of willingness to open to the outside and being afraid of this phenomenon, internal interests of individual organizational entities within the organization.

Economic problems might be caused by the necessity of incurring certain costs connected with using IT infrastructure present within the Community.

Technological problems might arise from the types of IT systems used in organizations and their incompatibility.

Each of the problems above might decrease the opportunities of implementation of the initiative discussed. However, one should note that contemporary economic processes force electronization and consolidation within electronic initiatives.

7 CONCLUSIONS

In the article was proposed the idea of Regional Business Spatial Community. Such a community integrates the row of acting subjects on local markets. The mutual collaboration involving the accumulation, processing and making availability of spatial information resources (eg. concerning the course of power lines, waterworks, gas pipings, telecommunication networks, roads, sewage systems, etc.) can bring advantages to all participants of the venture. Mentioned resources are indispensable for its functioning and not all kinds of data can be gained individually.

In the elaborated concept was indicated the possibility of cloud computing derivatives solutions' application in the form of the ArcGIS software, making possible the creation of the communities using mutual spatial data resources.

Besides outlining the idea of RBSC the article indicates potential participants of the venture and benefits which can be achieved by them. A prerequisite of such community creation is the appearance of the initiator who will work out the rules of collaboration and will invite enterprises acting in a given region. From the observation may come the results that the best role of such an integrator can by accepted by the local governmet.

Authors of the article conduct at present research, targeting definition of the collaboaration needs of local businesses providing media in one of the regions in Poland. Elaborated results will constitute the base for further reserach papers in the subject of spatial communities. It is assumed here the possibility of the transformation of the RBSC concept into the real platform of the collaboration in the region.

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