A Study on the Sharing of Socio-Economic GIS Data among Regions

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Abstract: Sharing Geographic Information is a challenging task. It stimulates inter-departmental cooperation and economic efficiency through data consistence. Many urban problems come from several factors. It's a kind of market mix. To support efficiently complicated spatial decision making and spatial problems with GIS, It is essential to Share GIS data. But, In spite of the importance of public ownership for GIS data, individual departments or organizations pursue their fixed goals because they prefer autonomy than cooperation. So, sharing GIS data is considered as one of the difficulty tasks. This paper analyzed obstacle factors in type of cooperation. And we suggest multi-agency-based GIS including coordinated GIS and the cooperation program. Also, the details of how to define common data format and how to link data are discussed.
Keywords: Socio-Economic, Decision-Making, Sharing, Web-GIS.

1. Introduction

Issues related to space including spatial planning and developments are very complex that they cannot be assigned to or solved by a specific department. Accordingly, what is important is cooperation among relevant departments as well as collaborative actions among regions and efforts through cooperative systems of civilians and the government.

Moreover, spatial data mainly composed of geographical and topographical features established by the government are not enough to support spatial issues that require unstructured decision-making process, and it is essential to utilize socio-economic GIS data such as economy, environment, population and house.

The sharing of spatial data saves costs, secures the consistency of information, and plays the role of basic frame for collaborative actions against spatial issues. Thus, in order to improve the suitability and efficiency of various spatial plans and developments and produce effects in the national level, we need to share and distribute data from various civil sectors including research institutes, which are derived from basic data supplied by the government. For this, sharing of socio-economic data must be activated and specific researches should be made for sharing.

The present study purposed to examine how data sharing system should be built and operated among neighboring local government and departments in each local government for the sharing of socio-economic GIS data.

Currently data about roads, underground facilities, water and sewage, gas, electricity, etc. constructed in addition to digital maps, which are base maps related to geographical-topographical features produced by the government, are in the form of UIS in the unit of each local government. However, data sharing is not smooth even among departments of governmental institutions. Furthermore, there are few collaborative systems among neighboring local local government or with private sectors. This problem must be solved considering that decision-making process concerning space such as development, planning and coordination is complex and involves multiple administrative regions as well as several departments. Thus, the present research studied data sharing system among regions to cope with great-sphere spatial issues or affairs among neighboring localities sharing the administrative boundaries.

Thus, we analyze the spatial characteristics of socio-economic GIS data for more meaningful data sharing. For this, we surveyed the current state and operation of GIS data sharing systems and obstacles to data sharing among departments

and institutions, conducted basic researches on who should update data, how frequently data should be managed and updated, what expected effects are, etc. for activating GIS data sharing.

2. Sharing System and Their Operation

1) Sharing System and Their Operation in Korea

As for the stages of planning, promoting and managing GIS, Korea is in the stages of execution following planning and promotion, so it still has experiential difficulties in analyzing the factors of benefits and failures resulting from the use of socio-economic data. In addition, most domestic researches on GIS sharing are focused on technical elements such as distributed computing and network, and deal with data on geographical-topographical features shared through GIS data distribution network constructed by the government.

GIS data supplied by governmental institutions are mainly about geographical-topographical features such as topographical maps, soil maps, land use maps, forest maps, land cover maps and altitude maps in the form of digital maps. However, these basic maps have limitations in supporting decision making with regard to spatial development, planning and urban problems. Most spatial decision making processes are unstructured, requiring the supply of data with comprehensiveness.

Thus, the government began to produce GIS data related to population and house, which are basic national statistics, by the unit of survey area from 2000. Moreover, as address data, which are important for converting many existing socio-economic data into GIS data, have been translated into the new address system, existing data with low operability will be geo-referred and, as a result, various GIS data will become available. Accordingly, it is necessary to develop a sharing system to expand the utility of spatial data to be produced in various regions.

2) Advantage of Sharing and Case of Sharing in Developed Countries

The clear definition of benefits from sharing will play an important role in promoting collaboration among institutions and localities. As for gains from the establishment of a collaboration system among institutions, Budic and Pinto (1999) listed four benefits: first, cost saving; second, productivity; third, improved decision-making; and fourth, public service. Dueker and Vrana (1995) defined the potentials of GIS sharing as follows. First, efficiency is improved as existing tasks can be performed at a lower cost. Second, effectiveness is improved as functions are reinforced and products are high in up-to-dateness and quality. Third, organization benefits are achieved through new responsibilities and widened organizational duties.

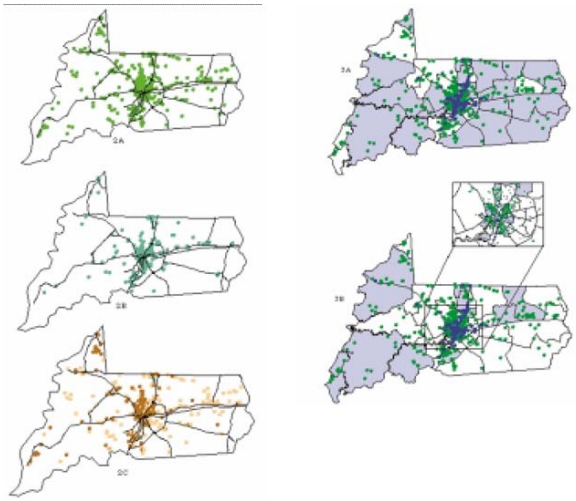

Fig.1 Practical Use Example through GIS Data and Socio-Economic Data's union in Wicomico County in U.S.

GIS-developed countries have made active researches on obstacles to GIS data sharing, collaborative systems for utilizing socio-economic, data sharing among departments in institutions, committees among multiple localities, etc. and some of them are making practical operation. Accordingly, in order to decide the types of data to be shared and to define

the standard forms of data, we need to investigate cases in developed countries and analyze their effects. For example, the U.S. established laws on health and welfare to establish a collaborative system among relevant institutions from the outset of Clinton's government in 1996 and many states began to look for innovative methods of welfare support so that welfare beneficiaries could be self-sufficient economically. As a consequence, collaborative systems or joint researches by institutions have been being settled as innovative approaches for explaining welfare-related issues and helping those in need. It is reported that cooperation among social projects, health and education enhance the effects of social interventions.

As one of these projects, the Wicomico in the State of Maryland, USA, has executed its GIS project for social services in cooperation with various agencies. The fundamental components in GIS are hardware, software, data, network and human resources. In addition, we can improve the effects of cooperation among agencies through sharing resources, specialists' opinions, ideas, prospects, GIS execution methods, etc. based on the sharing of GIS data among departments.

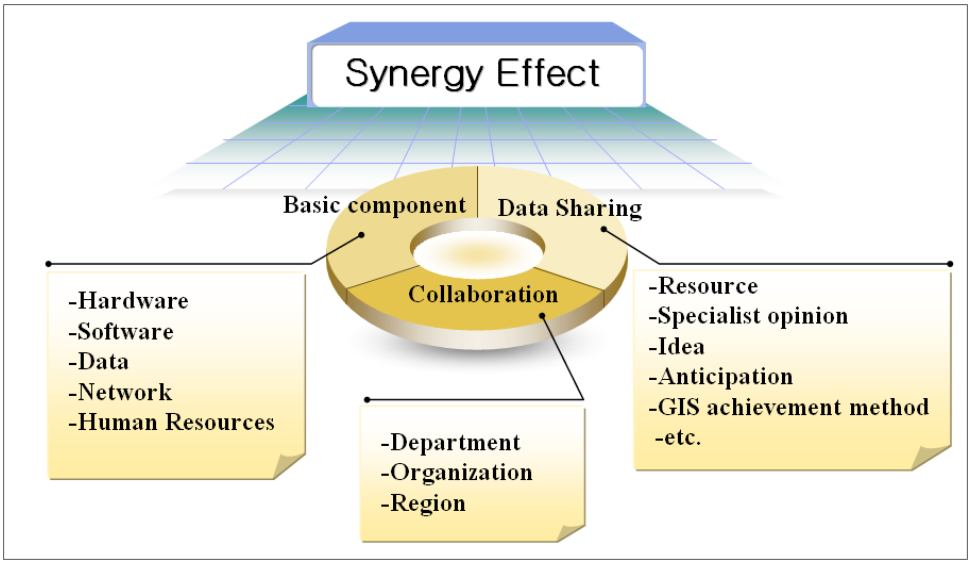

Fig.2 Effect through factors' union

3) Obstacles to the Sharing of GIS Data

Obstacles to GIS data sharing can be largely divided into technological and non-technological elements. Technological elements include heterogeneity of GIS data, difference in time resolution and problems in hardware and software supports, and excluding these elements are non-technological elements.

In the U.S., a GIS-developed country, each of city, county and state governments has its own person in charge of GIS, meeting various demands for spatial data but, even in such an advanced country, there are many cases of failure in sharing spatial data among different departments. With regard to the causes of rejection of collaborative systems, Craig (1995) mentioned, first, plain rejections and, second, putting up conditions equivalent to rejections. These types of rejections are usually related to non-business issues but sometimes are caused by charges for the use of shared data or regulations on data sharing with other institutions. Another reason for the restriction of data sharing is an unreasonably high price. After all, failure in data sharing mainly comes not from technological elements but from non-technological elements or environment.

Many GIS-developed countries have conducted diverse researches on cases of failure in data sharing. "Sharing Geographic Information," in which Onsrud and Gerard (1995) participated as editors, carried out a total of 29 researches on GIS data sharing including Bamberger (1995) and seven other studies on cases of GIS data sharing in the San Diego area and King (1995) and five other studies on the financial, legal and accessibility aspects of GIS data sharing

3. Models for Activating of GIS Data Sharing

When the objective of GIS is creating high added value including support to complicated spatial decision-making, spatial issues comprehending spatial planning and development are so complicated that they cannot be defined or solved

by a single department. Accordingly, a collaborative system among departments and regions is extremely important in coping with spatial issues. Moreover, spatial data focused on geographical-topographical features produced in the national level have limitations in providing effective support to unstructured decision-making process, and it is essential to utilize socio-economic GIS data such as economy, environment, population and house. As mentioned earlier, however, data sharing among departments, institutions and localities does not occur frequently due to various obstacles.

Considering such obstacles to data sharing, we can consider solutions for socio-economic GIS data in two parts - system and material. First, as for system, we need system components such as working documents, communication means, and shared workspace.

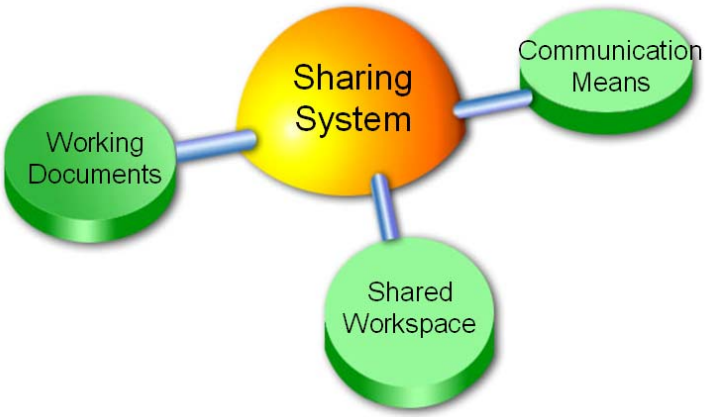

Fig.3 Consist of sharing system in Web-GIS

First, working documents are produced through individual works and joint works. They compose a hierarchical and dynamic documentary information structure for the system for systematic managerial support of documents. The utility of documentary information can be enhanced through version management and various search methods. Second, communication means is not simply a messaging system for communication but a system sharing user information, user group information, working group information, etc. for smooth and efficient joint works. Lastly, shared workspace is a Web-based virtual space for working groups performing joint projects. The members of working groups performing joint projects can share and manage data using the Web-based shared workspace. They share their personal materials through the shared workspace and, as a result, all working group members can share data for executing joint projects. Working groups in the workspace can be organized by level for security or other purposes. Web-based sharing system is the best sharing system reflecting such needs.

Second, as for material, the key issues in sharing spatial data are resolving heterogeneity resulting from the diversity of data models and activating data update. Methods of resolving heterogeneity include data standardization, database integration and open GIS environment. Standardization is designing data models according to a specifically defined frame, and database integration is using distributed databases as if they are logically a single database. Open GIS environment is attempting free exchange of information using open data models and common source freeware development rules. Data updating can be made by setting time frequency to GIS data. That GIS includes time means that temporal relationship is defined among spatial objects. This is a basic element for highly changeable socio-economic data, and can be utilized as a new variable for various analyses. Moreover, time can be utilized in identifying and forecasting trends using temporal topology. Temporal relationships can be divided into four types: first, metric represented in a measurable time distance; second, topology representing the topological relations among points of times; third, Boolean-operational relations representing the time of spatial phenomena in AND, OR and NOT, and topology through the generalization of time resolution.

4. Significances and Expected Effects of the Research

Benefits from research on how to share socio-economic GIS data include support to spatial decision making, the reinforcement of national information competitiveness, the advanced utilization of socio-economic GIS data and the coordination and practical application of national standards. These benefits are detailed as follows.

1) Support to Decision-Making

Currently the use of various GIS data is rapidly expanding in Korean governmental organizations, local government and private sectors. While the use of GIS data emphasized data management and the efficiency of existing task performance in the 1990s, it emphasizes the promotion of effectiveness through the systematization of GIS data in the early 2000s. That is, the introduction of GIS data system enables the acquisition and service of more essential, meaningful and valuable information. From the mid-2000s, we will enter upon the stage of advanced decision making through the use of full-fledged GIS data. For the support of more sophisticated decision making, various socio-economic data will be required in addition to the supply of existing data focused on geographical-topographical features. This trend is obvious in UIS application system developments planned by local government in Korea.

2) Reinforcing National Information Competitiveness

The supply of electronic information related to GIS data is mainly made through portal sites on the Internet. The U.S., Canada, the U.K., Australia, Singapore, etc. has digitized all governmental services during the period from 2001 to 2005 and plan to provide them online. As information is provided through the Internet, users can obtain data easily when they need, and various forms of information can be produced through the secondary processing of raw data. The online distribution of socio-economic data is even more diversified under the guidance of the state and large-sized local governments, and spreads to small-sized local government, local communities, organizations, etc. in the form of small GIS.

3) Advanced Utilization of Socio-Economic GIS Data

Since the beginning of NGIS aiming at the digitization of the whole country, we are facing new environment in many aspects. Since the new address system project, in which lands are separated from buildings in existing lot numbers assigned to lands, existing lot numbers are used only in land management, and new addresses are assigned to buildings according to street names, was suggested in the National Competitiveness Reinforcement Planning Team, many local government have been participating in the projects. This has a significant meaning from the perspective of transformation of socio-economic information into GIS data. Not only benefits from the new address system itself, institutions and departments can assign positional information to their data only with the address system and without using coordinates and, as a consequence, they can utilize diverse types of information related to lands and urban spaces in extracting spatial contexts or the characteristics of distribution. Moreover, as population and household census data, which are the bases of all statistic materials, collected every five years taken the form of GIS from 2000, we expect the reduction of information processing time and more effective uses of outcomes. As demonstrated by cases in developed countries, as the government computerizes national survey data so that users can utilize the data, new information is created from the raw data and spatial decision making in various regions are greatly improved. Thus, we expect the advanced utilization of socio-economic GIS data through these opportunities.

4) Coordination and Practical Application of National Standards

Researches on standardization and guideline in the local level can be utilized as basic data for suggesting practical classification and coding systems and improving the practicality of national standards.

Major data standards in socio-economic areas include the standard of the address system considering data associable with the address system, the coding method of polygons, which are basic spatial units considering the characteristics of socio-economic data mainly utilizing aggregation data, and the standard of positioning and identifying spatial unit objects.

Particularly in GIS with positioning information, addresses are used most commonly and provide the smallest identifiers in the real world, so they are useful in associating individual objects with positioning information. Standardization and guidelines for data related to addresses deal with, first, cases that various forms of data including non-spatial data contain addresses and, second, cases that new separate data containing addresses are created. The establishment of standards for addresses and address-related GIS data is the core of socio-economic data

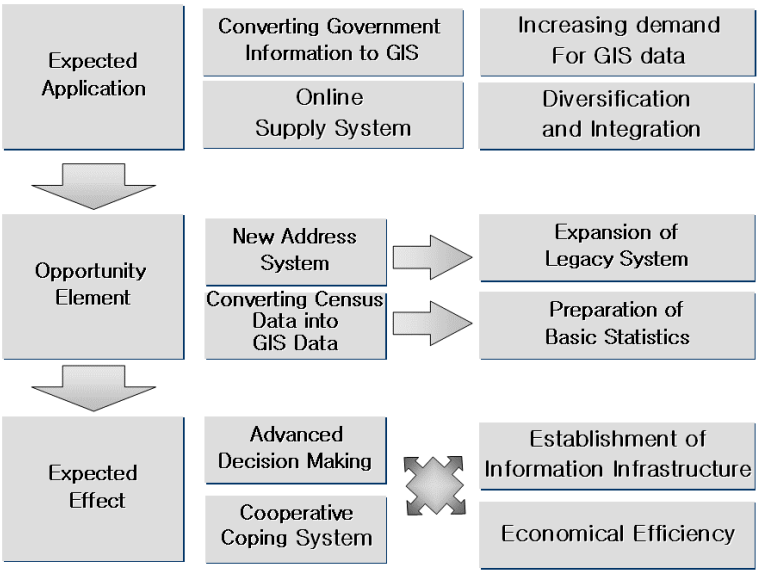

Fig.4 Expected Application and Effect

5. Conclusions

The introduction of GIS is not simply for visual effects. It aims at the creation of high added values including the support of complicated spatial decision making. However, because spatial issues including spatial planning and development are extremely complex, geographical-topological data constructed by the government have limitations in dealing with such issues. The integration of these data with socio-economic GIS data is a way of overcoming the limitations but the data integration has many limitations due to obstacles to data sharing among neighboring localities and departments within institutions.

The present study investigated the obstacles, suggested a model for activating data sharing, and examined expected effects.

First, data sharing can be activated in the part of system and the part of material. One of the best solutions for data sharing is Web-based sharing system comprehending sharing workspace, communication means, working documents, etc. Second, as for the part of material, we suggested data standardization, database integration and GIS environment to resolve the heterogeneity of data models and the assignment of time frequency to GIS data to activate data updating.

The sharing of socio-economic data produces effects such as support to spatial decision making and the reinforcement of national information competitiveness. In addition, effects expected in the academic area include the advanced utilization of socio-economic GIS data and the coordination and practical application of national standards.

This study, however, has not draw out obstacles in various aspects as well as solutions for the obstacles. Accordingly, to find more sophisticated solutions for GIS data sharing, it is considered necessary to subdivide obstacles to sharing among departments, among institutions and among localities, investigate them using direct and indirection methods and explain their causes clearly.

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