

Integrated Application of Separately Managed GIS Resources for Land Administration

Masaru KAIDZU, Japan

Key words: NSDI, FGD, Development plan, Local community

SUMMARY

Land administration requires information collected and managed by many independent organizations according to different laws or regulations with different budget. Timing of acquisition of data may be different and size of unit area may be different. Those parameters are optimized to application to specific reason why those data are collected. If so, it is not quite wise way to make those data stored in a single database. It will be easier to get accessibility to those data through network. Nowadays, Geodetic Reference System for each data are unified or at least transformation is established. Once those data are coordinated in the same official coordinate system, we can refer to those data through securely encrypted network.

Cadastral data is the smallest unit for land administration. Here, we will demonstrate land information visualized with GIS where cadastral map seamlessly connected in reference to Fundamental Geospatial Data (FGD) in NSDI as base map and zoning data or valuation data superimposed. For an example, large condominium is planned, we can discuss capacity of utility network, possible acquisition of school space and so on. At the same time, some problems like ownership congested through inheritance process may become visible. GIS itself cannot solve such problem but somehow we can visualize the existence of problem in advance.

Integrated application of separately managed GIS resources for land administration

Masaru KAIDZU, Japan

1. INTRODUCTION

Land is immovable property basically fixed on the Earth. Land management is to best utilize this fixed and limited property through proper allocation of population or industry on it and dynamically maintain its utility in long run. Land management thus require information on Natural, Social, Economic condition and facts. Those data are collected under different laws or regulations by different agencies. It is efficient to collect data through routine administration by responsible agencies. To insure overlay of different datasets, it is necessary to prepare datasets in the same coordinates. Nowadays, Japanese land is covered with GEONET (GNSS CORS) and Geospatial Information is based on the same coordinates.

2. NECESSARY DATA FOR LAND MANAGEMENT

For Land management, we need data on population, buildings, land use, industry, facilities, transportation, land value, natural environment, hazards, history, scenery, natural resources and so on. Many of above data can be found in statistics provided by government such as population census and economic census by ministry of internal affairs and communications (MIC), urban planning status survey by ministry of land infrastructure transportation and tourism (MLIT), census of commerce by ministry of economy trade and industry (METI), census of agriculture and forestry and census of fisheries by ministry of agriculture forestry and fisheries (MAFF) and so on. Such official statistics of Japanese government are accessible through a portal site named e-stat. Data collected and maintained by prefectural government are also accessible through internet. Detailed data may include privacy, and they are confined in authorized limited sections. For such purpose, encrypted closed network is available for local government and municipalities. Thus, nowadays, necessary data for land management is accessible via network. To process and visualize necessary information on GIS, seamless reference of position whose coordinates are in reference to national coordinate system is prepared and provided as Fundamental Geospatial Data.

2.1 Fundamental Geospatial Data

In 2007, Basic Act on the Advancement of Utilizing Geospatial Information (NSDI act of Japan) was enforced in Japan (Government of Japan,2007). To support utilize data related to coordinates with GIS, Geospatial Information Authority (GSI), in collaboration with other organizations, prepared seamless positional reference as a digital vector map named Fundamental Geospatial Data (FGD) as a part of NSDI.

FGD is reference of location extracted from maps. It includes coast line, shore line, road edge, central line for railways, administrative boundary, street block boundary, community boundary,

outline of buildings and control stations and points where height is given and so on. FGD covers 100% of Japanese territory with 1/25,000 level and 95% of city planning area with 1/2,500 level. FGD is downloadable at GSI web site.

2.2 Data acquisition with NSDI

NSDI is not only data sets but many services, organizations and rules that support smooth application of Spatial Data and acquisition of position information. In 2016, Geospatial Information Center was established. The center works as Geospatial data depository for government, Geospatial Data distribution service, Information Hub for disaster responses, Hub for Geospatial Open resource and R&D service of Geospatial data applications. Japanese government already distribute their data through e-gov, e-stat and so on. Those data are prepared by taxpayer's money and basically free of charge. There actually exist many data in academic institutions or privately collected, owned data sets which are important, useful and of public interest. The center is established to be a gate way to access such datasets through public private partnership. Thus, some of the data sets are not free of charge. Even so, it is a great advantage that we can access those data. As for January 29th, 2019, number of data accessible through this system is 32,626 files in 4550 datasets provided by 147 organizations (Geospatial Information Center, 2019).

Of course, privacy and security matters are protected by regulations and acts activated in advance.

3. Application image

To demonstrate image of application of such data by a city planner or a developer, we are going to discuss virtual project of large condominium complex near a large industrial city. Such a big project affects different groups in different ways. To carry on the project, it is necessary to discuss with many groups of people to get agreement. In discussion, we need some professional technical data shown on map so that people can understand how much the project affect their life. Professional data are to be collected and handled by professional body.

Here, we will discuss who is interested in what and where the necessary data are.

In planning phase, developer or planner will consider feasibility of the project and municipality will consider socio-economical impact of the project. Situation changes as time, it is not desirable to take too much time in clearing regulations or acquiring land. For both developer and municipality, easy access to land owners and good relations with local community are important matters.

Sometimes land owners fail to register who inherited the land. When inheritance occurs a few times, number of persons having right in the parcel becomes large number and it becomes stumbling block for smooth acquisition of land for project. Precise cadastral and registration record is quite important. Figure 1 shows the image of accessing data in preparation phase.

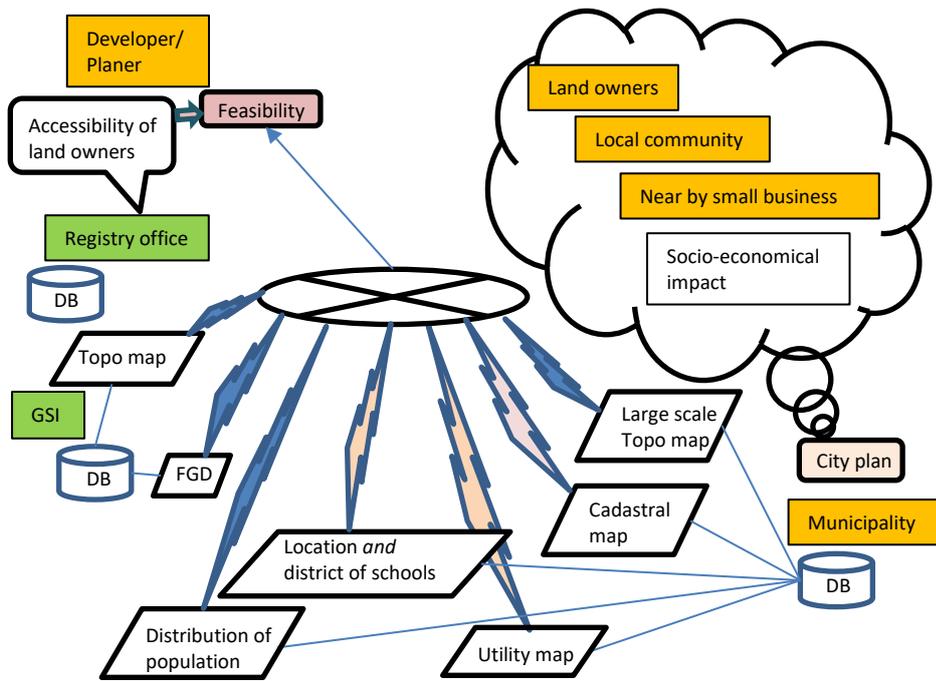


Figure 1 Image of accessing data through network
 Orange boxes show stake holders in planning stage. Different groups have different interest. Municipality must act as middleman to guide project in accordance with city plan and also acceptable for every group. For that, not only their ow data but other data is necessary.

3.1 Scope of the virtual project

Area:	6ha
New buildings:	Two 50 stories condominiums. Primary school
Number of units:	1,000 dwelling units + Shopping stores, Convention facility and Clinics

3.2 Groups and their main concern

Developer:	Smooth acquisition of land Smooth release of product to market Good sales and good reputation
Municipality:	Convenient and active town Increase of residence and increase of tax income Capacity of utility Capacity of schools Public transportation
Old resident:	Change of wind field, especially strong wind caused by high rise building. Shadow created by large building Traffic congestion
Small shops near by:	Suck up customers by large scale commercial facility in new buildings
New resident:	Traffic congestion Nursery

3.3 Data to be prepared

In early stage of the project, having briefing of project concept for public hearing is desirable so that project will go smoothly and after project is completed, area management will start smoothly in collaboration with new and old residents. Those problems different groups are concerned in different way will be objectively discussed based on proper simulation using existing data sets. Above problems can be divided into five categories.

Land acquisition

For smooth acquisition of land, we must find owners of land. This usually is done through registry office, Cadastral map and book contains same information but right, responsibility and restriction is contained in registration. If some of the owners failed to renew registration on inheritance, we need to chase present owners and get agreement. This sometimes is quite labourious and time consuming process. Presently Japanese government is working hard to solve this problem but the effort is still on going. Such effort needs expertise to handle right and sometimes settle dispute.

Problems due to natural phenomena

Wind field and Shadow are both theoretically estimable problem. Once shape and size of buildings are given and distribution of buildings are given, meteorologists can estimate wind field under different conditions. In this case, Topography, weather chart of typical condition will be necessary. Shadow can be calculated from topography, shape and size of buildings

and their distribution with latitude, longitude and date and time of the point concerned. Topography data with relatively small scale is available in Survey departments (Geospatial Information Authority: GSI in case of Japan). Large scale topographical data will be available in municipalities. Shape, size and distribution of buildings are available in department of municipality in charge of city plan. Usually we ask consultants to carry out such simulation. Figure 2 shows image of data exchange through network and preparing explanation materials. This typically shows external data and experts involved in the process.

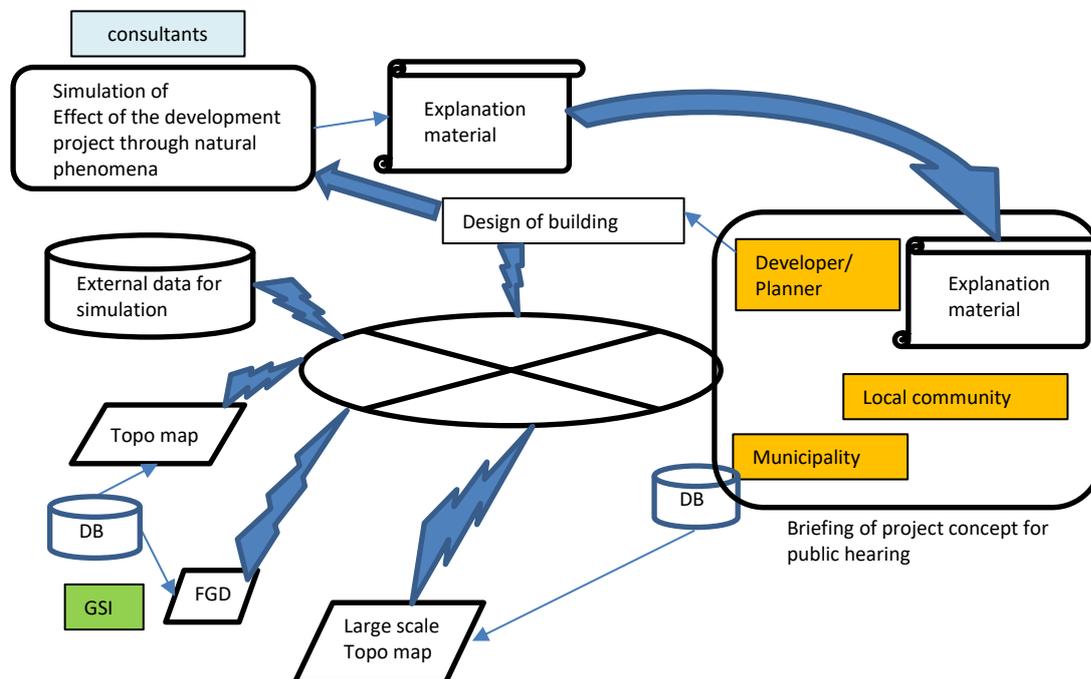


Figure 2. Effect of the project through natural phenomena
Effect like change in wind field, shadow and so on can be simulated in advance. To carry out such simulation, sometimes we need external data.

Demographic problems

Capacity of schools or nurseries or capacity of utilities are closely related to demographic change. As number of dwelling units suddenly appears is 1000, According to estimation by Suzuki et.al.(Suzuki et.al.,2018), we can estimate number of household which include more than 2 persons is 34,913 thousand in 2015 and total population of such household is 124,264 thousand. It means mean number of member of non-single household is 3.56. If we multiply this number to number of dwelling units, roughly speaking, 3000 residents flow into the 6ha area. Among them, 1000 will be children of their parents. If they simply sell the dwelling units, young couple will be main customer and children counted above will be mostly babies or school age. Thousand is nearly twice a capacity of usual primary school near Large city. If we are to accept this number, it request space and teachers to take care of them beside existing facility. If they grew up and get job outside of the area and go out, all this area becomes senior people's town just as well observed in many once so called 'New Town' all over Japan. Some way, we must do as much effort to make demographic character

close to average cities through for example accept land owners of the area to exchange their land with dwelling units with equivalent value so that elder people can stay there and mix with new comers. Here, cadastral data and demographic data are necessary. Those are available in municipality.

Traffic problems

Traffic condition is repeatedly surveyed and data are stored in department concerned in municipality. As this project is at near by large industrial city, it is quite likely that the new comers are commuting to the city. Then we can estimate flow of commuting people from their occupation. Future trend also will be estimable with some assumption of demographic condition in and around project area, people live in high rise condominium, and space between two buildings will be sufficiently large. Out side of the project area, there remains old town whose street system corresponds to former demographic condition. We need simulation of traffic condition in advance and take necessary action to ease traffic congestion. Divide flow of commuters by splitting entrance gate apart according to direction of destination and ease congestion at the gate and make flow of commuters will not cross. Person trip data or other traffic data are available from municipalities, rail way company, bus company and so on.

Infrastructure problems

This contains road traffic, water supply, sewerage, power supply, communication network, public space and so on. Those are to be discussed with demographic problem. Data on status and future plan of infrastructure is available in municipal government. In case it is privatized, data is available in the company running the facility.

Although most of necessary data can be accessible in municipality, some of important data are collected and maintained in other organization. Owing to government's policy to promote access to socially useful data smoothly, we can access some of important data through network. As geospatial data encoding is standardized through ISO TC/211 and coordinates is based on ITRF+GRS80, we can use GIS to create persuasive, reliable information for discussion among stakeholders or reference for planners or developers.

4. Conclusion

Land management data is basically available in municipality. Important information, however, is kept by private sector or other agencies. To make persuasive, reliable information and discuss with stake holders to promote project smoothly and in proper direction, it is important to promote present tendency to ease data exchange among administrators, and other stake holders. At the same time, collection and maintenance of database by expert people who understand the data and use the data frequently is actually best for quality of the data. Then, the data should be separately maintained by experts and accessed through network. Unified coordinates and standardized data exchange help this and enhance mutual understanding. Through mutual understanding, smooth and proper development and smooth area management following the project will be promoted.

REFERENCES

Government of Japan (2007): Basic Act on the Advancement of Utilizing Geospatial Information, (Original in Japanese, English translation available at <http://www.gsi.go.jp/common/000002047.pdf>)

SUZUKI Toru, KOYAMA Yasuyo, OIZUMI Ryo, SUGA Keita, KOIKE Shiro, KAMATA, Kenji (2018) : Household Projections for Japan 2015-2040 Outline of Results and Methods, Journal of population problems, Vol.74 No1., 76-86 (in Japanese) (updated English version is available in web site of National Institute of Population and Social Security Research http://www.ipss.go.jp/site-ad/index_english/publication-e.html)

Geospatial Information Center (2019) : Website of Geospatial Information Center (Last accessed on January 29th, 2019) <https://www.geospatial.jp>

BIOGRAPHICAL NOTES

1951 Born in Niigata pref. Japan

1975 Graduate Physics course, Faculty of Science, Nagoya Univ.

Start working at Geographical Survey Institute (GSI)

1997 Director, Survey Department, Construction College

2000 Director, Geography and Crustal Activity Research Center, GSI

2005 Director, Department of GIS Research, Japan Construction Information Center

2015 Principal Engineer, Central Operations Department, PASCO corporation

Since 2009 Chair, Commission 7, Japan Federation of Surveyors

CONTACTS

Mr. Masaru Kaidzu

Japan Federation of Surveyors

HakusanNT Bldg.

Hakusan 1-33-18, Bunkyo-ku

Tokyo

Japan

Tel. +81-3-5684-3350

Email: kaidzu@ra2.so-net.ne.jp

Web site: <http://www.jsurvey.jp/jfs/> (only in Japanese)