Geographic Information – Organization Challenges in the Hong Kong Context

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Key words :

SUMMARY

The value of geographic information has been widely recognized and highly tagged. But collecting, processing and managing the information for gainful applications require tremendous involvement of the organizations concerned, in aspects like, formulating new policy, justifying new resources for hardware, software, data collection and input, recruiting experienced personnel and experts, retraining of staff, and even to revamp part or whole of the organization.

In the Hong Kong situation, the Survey and Mapping Office (SMO) of the Lands Department started to implement the Computerised Land Information System (CLIS) in 1990. One favourable condition is that Hong Kong is fully covered with scale 1/1000 topographical maps that are updated instantly as changes take place. It had taken six years for the system design and data conversion to complete. The geographic information includes 3000 sheets updated hardcopy maps and graphic boundaries of 300,000 land parcels. For the original system the hardware and software cost is about US$6 million and the data conversion cost is again about US$6 million.

In the original system design, all map features are classified in great detail and are topologically structured. The System also has built-in with convenient location search identifiers such as house number, building names, and road junction.

With the implementation of the CLIS, many traditional survey and mapping processes have to be changed to adapt to the new system, such as, field data collection is automated as far as possible, all data process and data base updating have to use the workstation, data output can be in various forms and media.

I would like to share the challenges that SMO has faced when implementing the System, how the System can support urban and rural development, and my personal view on the urgency for setting up a central data agency to set and monitor standards, to collect and to disseminate the vast amount of data built up by different users.

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1. INTRODUCTION

Hong Kong has a land area of just over 1000 km2 and a population of 6.8 million. 40% of the land is designated as country parks where no development is permitted. Most people live in the urban areas around the harbour and in the new towns. There still remains a large area with cultivation fields but mostly deserted and scattered old Chinese type village houses in the northern region. In the urban and new town areas, buildings are high rising and redevelopment takes place at rather short cycle, normally, 20 to 30 years, mainly to meet the growing and changing demand for various types of premises, for residential, commercial, and industrial uses. Infrastructures, large and small, are being constructed continuously to support the growth of the city. To help monitoring and support the urban and rural development, there is need for a more efficient tool such as Geographic Information System (GIS).

GIS technology has been in use for quite some time. We have witnessed tremendous development of the technology and that is to a large extent due parallel development of the associated computer hardware and software. On the hardware side there has been a quantum leap, in aspects like processing speed and power, storage capacity, more choices and most importantly, prices are getting more and more affordable. On the software side we have also witnessed the coming and going of many packages and by now have left the most proven ones. Generally by now these generic software packages are already embedded with the essential elements of GIS, provide a lot of functionalities for many common applications, are very user-friendly, but price wise, are still beyond the reach of those not so well off users.

We are seeing the number of GIS applications growing every day, as users are getting more aware of and knowledgeable of this technology. No doubt the utilization of the technology will generate benefits of various sizes. But is the technology being appropriately and gainfully used for the particularly application is often arguable. There is one big issue that is often overlooked and under estimated, that is the availability of appropriate data for the application.

The data in a GIS application can be generally grouped into geographical data and textual data. Firstly, geographical data is quite different from the textual data, in that the former has a location element and topological property, generally no fixed shape and size, changes of data take place irregularly and rapidly in built up areas, and more importantly, it is very costly to update. Whereas textual data, as common known to many users, is mostly attribute to the geographical objects, can be generated or collected much easier and comparatively less costly. Perhaps it is because of the high cost of data, be it the initial cost or subsequent maintenance, many applications tend to economize on the use of data, such as, using fewer types of data or not suitable data. And the end users often get carried away just by the fancy

presentation or variety of gadgets. Therefore, such applications cannot achieve the expected results and often short lived.

In fact there are several challenges that an organization must face when considering implementation of GIS applications:
Firstly, new policy will have to be formulated to accommodate and facilitate this new technology. That may require revamping part or whole of the existing operation, business strategy and business plan of part or whole of the organization but for the worthy cause of efficiency of operation, quality of products and enhancement of revenue.
Secondly, how to justify the resources of acquiring the system and collection and maintenance of the geographical data.
Thirdly, how to retrain existing staff to use the system and get their support; and
Fourthly, where to recruit the staff of right level to lead and implement the system.

2. COMPUTERISED LAND INFORMATION SYSTEM OF SURVEY AND MAPPING OFFICE, HONG KONG

Survey and Mapping Office (SMO) is the survey and mapping authority in Hong Kong and has the obligation to supply the geographic information to other government departments and to the general public and at a charge to the latter. The implementation of the CLIS by the SMO is a good illustration of how to deal with such challenges and the basis of a successful implementation.

In the early 80's the idea of setting up a land data bank was conceived. Then as the GIS technology became more mature and proven in late 80's, it was demonstrated that such kind of system would bring substantial benefits not only to the SMO and the Government but also to the community as a whole. Therefore funds were allocated and the implementation started in 1990. It had taken six years for the system design and data conversion to complete. The geographic information includes 3000 sheets of updated topographical maps at scale 1/1000 and the graphic boundaries of 300,000 land parcels. Most of the conversion from hard copy maps was by manual digitization. For the original system, the hardware and software cost is about US$6 million and the data conversion cost is about another US$6 million.

In the original design of the CLIS, particular emphasis is placed on: the map features are topologically structured and stored in different layers for easy retrieval; the map features and their attributes are closely related; map features are classified in great detail; convenient and commonly used location identifiers are created, such as by house number, building names, road junctions, efficient updating procedures of map and textual data.

3. ORGANISATION CHALLENGES FACED

With the implementation of the CLIS, many traditional survey and mapping processes have to be changed or modernized in order to support the System. For example, field data collection is automated so as to directly download the new data into the system without having to go through any intermediate process, and in the office the processing of the new data uses the CLIS workstation and the products are output through the printers or plotters.

Therefore additional resources have to be sought for the new or replacement equipment as well as to design new survey standard and procedures.

Along side with the new service of selling digital maps the traditional way of producing hard copy maps has to be revamped. The map data in digital form can support more variety of products and at lower cost. For some not so popular maps or to meet urgent need for the most up to date maps these can be plotted on demand. There will be opportunity for a whole line of new map products both hard copy and digital, a new approach of production and methods of distributing and selling the products on-line through the Internet. That does require new vision and idea from the management.

There are about 600 professional and technical staff in SMO and the implementation of this new technology do affect them. The first task is how to mentally orient them so as to get their support and willingness to learn and use the various new tools and new procedures. It does require enormous effort and resources to retrain all the existing staff and to conduct refresher courses from time to time because of new or revised procedures.

Apart from retraining existing staff, additional staff has to be recruited at different levels for various stages of system implementation, such as, system design, application programming, and system administration. These types of staff are difficult to recruit because there are very few with the appropriate expertise and experience, and at high time of implementation of information technology in other areas, they are scarce as well and hence expensive to recruit.

Generally speaking, the implementation of the CLIS has brought about substantial and tangible benefits to the SMO, has provided the opportunity for more efficiency and diversified services and products, the staff are more receptive to new technology and are more skillful and productive, and SMO is put in the leading position in providing the basic land information including very detailed topographical and land parcel boundary information and expert advice to other government departments in implementing system basing on the information from SMO.

4. POTENTIAL FOR SUPPORTING URBAN AND RURAL DEVELOPMENT

In fact, the availability of the topographical and land parcel boundary information covering the whole territory has greatly facilitated the city planning and land administration of the land resource in the city as well as in the rural areas.

In the urban area, it is already fully developed, and to build more usable floor area or to meet demand for particular usage is to redevelop old buildings, and to exploit the contemporary building design and materials for higher yield of space at competitive cost. Another topic that is causing public concern is environmental protection. The policy makers and the building and construction industry are endeavouring to build a greener city for Hong Kong and to enhance the quality of living for its citizen. This current and detailed map information no doubt will greatly assist the decision makers to answer a lot of 'what if' questions and quickly too, thereby coming up a quality decisions that meet most if not all the demand of the community.

In the rural area, after series of land resumption for infrastructure and public housing projects, there are still some 200,000 land parcels remaining. These land parcels are mostly agriculture land and with old Chinese village houses scattering here and there. The parcels were surveyed about a century ago using primitive methods for taxation purpose and the plans were drawn at the scale of either 1/2000 or 1/4000. The boundary lines are generally following existing occupation features, such as, field bunds, court yards and village houses. The boundaries thus surveyed are not coordinated, not precise and not accurate enough for present day use. Therefore has stifled the development of these land parcels. Also because of the uncertainty in boundaries, disputes over boundaries often arise and have led to costly and lengthy litigation. Buyers are hesitant in acquiring these land parcels and properties developed on it and banks are reluctant to grant loan or might charge a much higher interest.

Compared with the land price in the urban area, land in the rural area is much lower, largely because of uncertainty in the parcel boundaries. Although the ultimate solution is to conduct a proper survey for these parcels, yet time and cost might be prohibitive. It is estimated that the cost to survey all these land parcels would be around US$200 million. Enlarging these graphical boundaries to scale 1/1000 and correlating them with the topographical features has proven to be an effective intermediate solution. At least it gives a more certainty of the position of land parcels thereby facilitating the land transaction and promoting the property market. Hong Kong is very much in need of land, and if the land reserve in the rural area can be exploited properly and fully, that will relieve the land shortage problem and allow greater flexibility in planning and building a greener city for everyone living in it.

5. TOWARDS BUILDING UP THE COMPREHENSIVE GEOGRAPHIC INFORMATION DATABASE

With the successful completion of the CLIS by SMO, many other GIS systems have been or are being developed in other government departments, utility companies, estate agents and land developers. One common aspect of these systems is that they all use the basic mapping and land parcel boundary information supplied by the SMO. Why other users so rely on such geographic information is that SMO is putting a lot of effort and resource in updating the information and supplying the information through various efficient means. SMO is deploying about one-quarter of its resources in mapping and related work. That other users using the same basic geographic information has several advantages:

Firstly, of course it will minimize or even avoid the cost in building up their respective basic mapping information database.
Secondly, these users can have common identifiers and reference features thereby avoiding differing interpretation and definition of map features and textual attributes as far as those contained in the CLIS are concerned, and
Thirdly, the CLIS is built upon a unique geographical coordinate system and height datum, therefore if these different users also collected and overlay their data on top, that means data from these different users is on the same coordinate system and can be share used by others readily without having to go through lengthy data transformation from one coordinate system to another.

Hong Kong has several favourable conditions for implementing GIS systems and building up a comprehensive geographic information database:

Clear government structure, good working relationship between the public and private sectors, the availability of state-of-the-art technology and abundant supply of experts and staff at all levels is a favourable success factor for the implementation of GIS within different organizations and integration of the systems for sharing of geographic information;
Hong Kong is small in area and everywhere is easily accessible for data collection and subsequent updating;
The whole territory is fully covered with large scale and detailed maps and are constantly being updated, and are readily available to all users both inside and outside the government;
The basic mapping supplied by SMO in on a single coordinate system related to universal co-ordinates, the geographic features are topologically structured, and common identifiers for locations and buildings are built in;
All users both inside and outside the government are using the same map base supplied by the SMO, and that provides a common reference base for integrating geographic information from various sources; and
The well established 1/1000 base map serves as a reference base for producing smaller scale maps, which can be used for different GIS applications.

Building up a comprehensive geographic information database to facilitate data access and sharing and to minimize cost in data collection and maintenance has long been the desire and outcry from many sectors involved in GIS. But all that depends very much on whether organizations are willing to take up the challenges and the policy makers have that vision and courage to take on board that geographic information will be a precious asset for generations to come.

6. THE WAY FORWARD

In my opinion, in order to bring GIS into every or many sectors of the community and to reap the most benefits from it and on long term basis, it calls for the initiative from all the players concerned and the cooperation amongst them.

Firstly, it is imperative that a top down approach be adopted. Implementing GIS, particularly that involves massive original data, is expensive initially and subsequently, requires long lead time, and the benefits do not come in quickly and easily quantifiable. Therefore it requires the full support from the top administration, in formulating the requisite policy and providing the funding resources. In that connection, the top administration must have the vision that GIS will bring substantial benefits to the community as a whole and in the long run, and the courage to formulate new policy or to change existing policy and to face opposition from different interest parties.

Secondly, a dedicated and specialized team or agency is set up charged with the duties of laying down geographic data standard, building up towards a comprehensive geographic database, coordinating and enforcing the supply and screening of data from various sources,

maintaining and safeguarding the centralized database, and disseminating the data to various users by the most efficient means. This agency at the same time has the authority to order or modify data from the providers that meets the needs of most users and has the greatest benefits as a whole. It also serves as a resource authority to provide financial and staff resources to support implementation of GIS systems and collection of geographic data for shared use, because some organizations may not have the resources and expertise to do so.

Thirdly, data plays the most important role in GIS and normally originates from many different sources. As mentioned earlier, data is expensive and time consuming to collect and update. Therefore, many of the organizations just collect the data that is of absolute necessity to meet their own needs and often for short-lived projects. To require them to provide data to the agency or other users means they have to be responsible for the reliability of the data they provide and that the data thus provided had to meet additional specification means they have to deploy additional resource to doing that and which they often do not have. Therefore they must be provided with the necessary financial resource and staff with appropriate GIS knowledge and experience in order that they may set up the GIS systems for their own applications and to collect and prepare the data for others to use via the centralized database. They must also realize that they may enjoy the share use of others' data as well.

7. CONCLUSION

With the concerted effort of all the players concerned, I am confident that the GIS technology if properly utilised will bring tremendous benefits to the community and support a sustainable development for generations to come. For example, it will enable the administration to better utilize and distribute the often scarce resources to where they are needed most; facilitate the planning and development, of both the urban and rural areas, to better meet the growing and changing needs; to enhance the quality of living through better control of the polluting elements and improvement of the environment; to promote business opportunities through improved logistics and movement of consumers; the public at large being more aware of their surrounding, i.e. their home, schools, offices, workplaces, etc. thereby becoming more social conscious.

However, a caution note is that GIS implementation does not come cheaply and easily. It requires long lead time and substantial investment, initially and subsequently; vision and courage from the administration to initiate a top down approach, and staff with appropriate GIS knowledge and experience at various stages of implementation and data management.

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