Impact analysis of digital cadastral information dissemination in Korea
(In the Framework of Korean e-Government Concept)

Lee, Seong-Hwa · Park, Jong-Cheul
Lecturer, Ph. D., Hansung University · Korea Cadastral Survey Corporation, Chung-buk Branch Office

디지털 지적정보 보급의 영향 분석

이성화 · 박종철
한성대학교 부동산학과 겸임교수 · 대한지적공사 충북본부
lsh0817@mogaha.go.kr

국문요약 : 대부분의 지리정보 제공기관들(국가도면제작기관 및 지적관련기관)은 현재 경쟁력강화와 업무효율성을 높이는데 많은 노력을 기울이고 있다. 이러한 변화를 요구하는 외부 환경적 요인으로 지리정보관련 정보통신기술(Geo-ICT)의 발달과 함께 다양한 사용자 요구사항의 증대, 정부의 전자정부 정책, 예산감축 등의 요인이 끊임없는 지적관련기관의 변화를 요구하고 있다. 그렇지만 현재 고도로 발달된 인터넷 통신 기반시설과 지적도면전산화 사업으로 디지털 지적데이터베이스가 구축되었음에도 불구하고 지적정보 발급 업무가 시/군/구청을 방문하여 신청하는 수작업에 의존하고 있어 업무효율성 문제를 발생시키고 있다. 본 연구는 인터넷을 활용한 지적정보 유통의 영향을 경제적, 기술적, 법률적·사회적 측면으로 나누어 분석하고 현재의 문자정보 제공위주의 우리나라 전자정부시스템(G4C)에 지적공간정보를 제공할 수 있는 시스템으로 확장하는 방안을 제시하였다.

Key words : 지적기관, 지리정보 정보통신기술, 전자정부
Cadastral organizations, Geo-ICT, E-government

Ⅰ. Introduction

1. Background

Recent developments in Geo-Information and Communication Technology (Geo-ICT) have given tremendous push toward the development of cadastral systems and geo-spatial data infrastructure (GSDI). This has created new perspectives in both the development of new cadastral systems and in the improvement of or extension of existing cadastral systems. Owing to a cadastral

market pull, new requirements that satisfy users have emerged due not only the changes in Geo-ICT technology but also the changes in government policies, legislation, emerging new tasks of the organizations and users (Oosterom and Lemmen, 2001).

Historically, in many parts of the world, geo-spatial information such as cadastral maps, attribute information from registers such as title and valuation, has traditionally been gathered from isolated systems of surveying, title registrations and valuation assessments. As a result, getting complete and up to date parcel information is often time consuming and difficult. However, the development of Internet technology has allowed Geographic Information (GI) providers an unprecedented opportunity to disseminate data, and conversely, has allowed users an unprecedented access to volumes of GI. (Williamson, 1999).

The access to cadastral information is very important because the information has to serve the land market, credit facilities, urban and rural planning and development, land taxation and management of natural resources, thereby enabling citizens and organizations to take the right decisions.

2. Research problems

Cadastral information usually consists of two parts, one is spatially referenced spatial data (cadastral map) and the other is land attribute data (cadastral register). In 1998 the Korean government initiated a six year cadastral digitization project as one of the important National Geo-spatial Data Infrastructure (NGDI) components. The cadastral map digitization project was completed at the end of 2003.

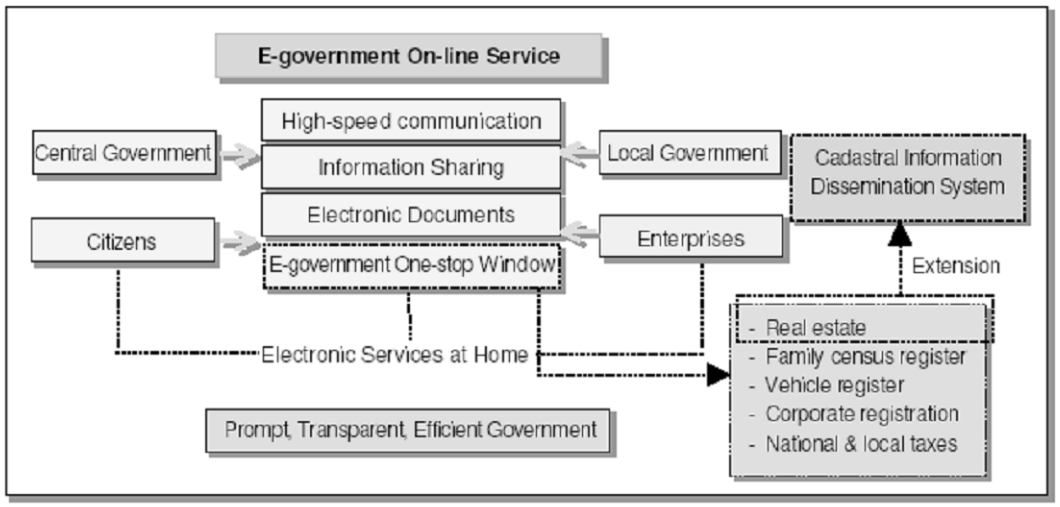
The recent Network Readiness Index (2001~2002) shows that Korea marked 4.86 networked readiness index which means the Information and Communication Technology (ICT) infrastructure ranks 20th in the world (Kirkman, 2002).

However at present the cadastral information is still delivered through a manual process by visiting municipality office or by telephone requests. The manual process of cadastral information delivery has caused the following performance problems:

- High transaction cost (in both money and time)
- Restricted access period (office hours)
- Poor allocation of skilled resources (cadastral public officers)
- Out of date information (updating and disseminating time)

3. Scope of this research

Recently the Korean government has identified the five most frequently applied and used civil service fields: residents, real estate, vehicle, business and taxation. In the field of real estate information e-government service the real estate register information, which is mainly real estate ownership information, is provided through the e-government service system. Thus in this thesis the cadastral information dissemination system is proposed to be an extension of current Korean e-government service system to make use of the established e-government service



【Figure 1】 Scope of this research

infrastructure in the field of real estate information provision.

Since the Korean e-government service system has been primarily focused on text format information provision service, the extension of cadastral information will be the first step to accommodate a spatial component in Korean e-government service system. The diagram below shows the scope of this research.

4. Research objectives

The main objectives of this research are to analyze the impact of digital cadastral information dissemination in Korean society in terms of economical, technical, legal (revision of current Cadastral Act) and social aspects and to investigate the extension of the current Korean e-government system (G4C: Government for citizen) as an alternative to overcome the performance problem of manual cadastral information delivery processes.

5. Research methodology

In order to achieve the research objective, specific research tasks have been executed under the relevant research methodology.

Task 1. Investigating the key drivers to change for cadastral organizations (Descriptive)

A comprehensive literature review has been carried out in order to investigate the key drivers to change for cadastral organization and the recent Geo-ITC development.

Task 2. Impact analysis of digital cadastral information dissemination (Analytical)

The impacts of digital cadastral information dissemination in Korean society in terms of economical, technical, legal (revision of current Cadastral Act) and social aspects have been addressed.

Task 3. Identification of the current cadastral information delivery situation

(Analytical)

A structured questionnaire method has been used to identify the current situation of handling cadastral information request. A questionnaire containing about 18 questions was distributed by e-mail from 6th November 2003 to 18th November 2003. A total of 60 answers to the questionnaire were collected by e-mail from each group: the general public (20), cadastral public officers (20) and Korea Cadastral Survey Corporation (KCSC) staff members (20).

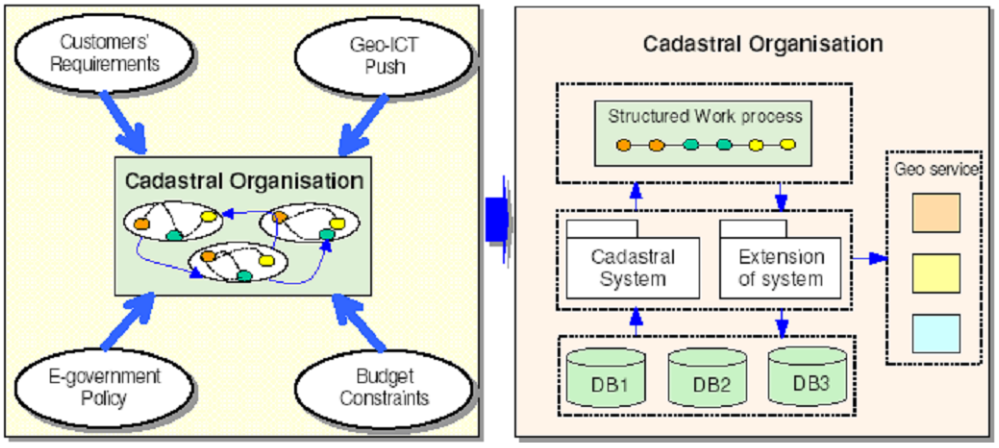
Ⅱ. Challenges of cadastral organizations and situation analysis

Many organizations for mapping and cadastre face similar problems. First of all there is tension between the organizational principles of the public administration and the requirements of an executive organization. The aim for serving customers impact heavily on organizations for mapping and cadastre because they need continuity in investments in ICT and organizational development (Molen, 2003)

1. Key drivers to change

John Meadows and John Formby (2003) states that government organizations are no longer immune to these changes and, like other organizations have had to react in order to prosper and survive and identifies the following external factors influencing HM Land Registry England and Wales renewal strategy.

- Political factors: Political change has taken the form of central government initiatives aimed at increasing the efficiency and accountability of government departments.
- Economic factors: Period of sustained economic growth, relatively high employment, low interest rates and de-regulation of the mortgage market making it easier to obtain secured loans.
- Social factors: Increased customer



【Figure 2】 Key drivers to change for cadastral organizations

awareness, greater public demand for information and increased level of private home ownership.

- Technical factors: The digital revolution, growth in the use and ownership of personal computers, and the growth of e-business and on-line services.

Below is the overall picture of the context that contains cadastral organizations and key drivers to change.

1) Customers' requirements

As consumers we have daily contact with efficient private sector business, which are making full use of recent technologies to improve the convenience of doing business with them. The convenient business interface provided by the private sector contrasts strongly with the bureaucratic government environment still prevalent in many land agencies and other government departments (Roux, 1999).

Citizens are becoming used to ever-faster response times and higher quality of products and services from the private sector. They expect the same performance from public administrations too. Obscure procedures, long queues, having to re-enter information that is already held by the administration, and "one size fits all" approaches are all practices that are increasingly criticized.

As government moves towards the implementation of online services, "one-stop shopping", and integrated service delivery, consumer choice and accessibility should still be key concerns. The possibilities afforded by the available Internet and interoperability technologies are placing pressure on outdated practices, methods, and structures where they still exist within a cadastral organization.

However some customers may choose not to transact business online or may not have access to the Internet, a telephone or a computer. These customers should not be ignored in the evolution of government service delivery and the re-engineering or modernization of a land management infrastructure.

2) Geo-ICT development

Recent developments in Geo-ICT, such as information system modeling standards, database technology, global poisoning system, Internet technology development, wireless communication and acceptance of geometry standards have given push toward in both the development of new cadastral systems and in the improvement of or extension of existing cadastral system (Van Oosterom, 2002).

As described in the previous section the developments in Geo-ICT has been key drivers to change in cadastral organizations. On the other hand the developments in Geo-ICT is the main supporter enabling cadastral organizations to keep pace with the changing environment. Geo-ICT is closely related to most of the working processes in cadastral organizations i.e. data acquisition, data processing, data retrieval and dissemination of products. Introduction of new Geo-ICT into cadastral organization causes significant operational changes.

Key tasks	Description
Innovative and better services public and businesses	
1. Public-oriented service through a Single Window (G4C: Government for Citizen)	Establishing portal site and public information sharing system for five major databases in the areas of resident registration, real estate, vehicles, corporate and tax
2. Linking four major social insurance information systems	Linking medical, national pension, employment, and accident compensation insurances and activating information sharing
3. Home tax service via the Internet	24 hour online service such as tax declaration and payment, affairs document issuance and tax counseling
4. G2B: Integrated e-procurement system	Establishing a single procurement window and making all procurement related processes electronic such as registration, tender, contract and payment
Productivity and efficiency government	
5. Integrated national finance management system	Establishing a system for information sharing and linkage for finance related institutions
6. Integrated administration information system in local government	Completing information for all administrative affairs such as resident registration and real estate, finance, tax, etc. in 21 cities
7. Nation-wide education administration information system	Establishing an online logistics system for school affairs and education administration material connecting schools, Office of Education and Ministry of Education and Human Resources Development
8. Personnel policy management system	Developing and diffusing a standardized system for the whole human resources including recruitment, promotion, payment and training of public service personnel
9. Government e-document exchange	E-processing of preparation, approval, distribution and storage of all governmental documents
Building an infrastructure for e-government	
10. Government e-signature and e-seal system	Securing reliability for information distribution and e-administration such as private information protection and security
11. Consolidation of government computing centers	Protecting 24 hour working, professional service, and secure information resources by managing computing environment in an integrated manner

<Table 1> Korean e-government initiatives (Tim Kelly, 2003)

3) E-government policy

The UN/DPEPA benchmarking e-government report (UN/DPEPA, 2002) defines e-government as utilization of the Internet and the world-wide-web for delivering government information and services to citizens. But in the broad sense e-government can include virtually all information and present a straightforward benchmark for information communication technology (ICT) platforms and applications in use by the public sector.

Since the mid 1990s governments around the world have been executing major initiatives in order to tap the vast potential of the Internet for the distinct purpose of improving the governing process. Changes in government policy and regulations are a critical driving force to change in cadastral organizations. Roux (1999) underlined the following e-government drivers for change:

- The need to generate more non-tax revenue in order to fund required government operations without tax increase.
- Process reform and improvement, driven by demand for increased efficiency and speed in handling volumes of transactions.
- Public demand for integrated service delivery and improved front-end customer interfaces and services.

Especially the Korean government has been active in establishing e-government. According to the recent UN report (UN/DPEPA, 2002) Republic of Korea is classified into the "High e-government capacity counties" and marked 2.30 which is 15th highest e-government index points among the all UN member countries. Recently Korean government has released the "Strategy report for E-government" which has officially announced the 11 key tasks to complete the framework for e-government by 2002 (Table 1).

In particular, Government for Citizens (G4C) has been established as one of the core projects of the Korean e-government. Services are provided in the five most frequently used fields: residents, real estate, vehicle, business and taxation. Service consists of 12 areas based on user convenience. Guides are provided for the 4,000 services that appear in the Civil Service Standards List. A total of 393 services can be accessed online.

4) Budget constraints

Due to the serious governmental deficits, most countries have been trying to reduce the size of government and funds. Many governmental organizations have been privatized or independent from governmental intervention. Cadastral organizations are also confronted with the pressure of being independent organizations. It means that some portion of cost should be recovered by its own income. This situation however requires a new business paradigm.

Governments are under pressure to deliver more value for taxpayers' money. Administrations have to deliver more and better services with equal or fewer resources. Public expenditure is severely constrained in many countries due to slow economic growth and the need to reduce budget deficits. The challenge is to achieve productivity growth in the public sector in order to create more opportunity for service improvement at equal cost (COEC, 2003).

Dutch Kadaster (The Cadastre and Public Registers Agency of the Netherlands) is one of the significant successful cadastral organizations. In 1982, the Dutch Government decided to improve the efficiency of government departments and the Dutch Kadastre undertook a series of reform. The goal of the Dutch Kadastre reform was to achieve cost-effectiveness by providing excellent services using advanced information technology, remaining a cost-effective operation, cooperating well with universities and private companies, and providing international consultancy. The organization moved towards the direction of a self-supporting agency with large scale of

contracting out of survey and mapping services.

2. Situation analysis of cadastral information dissemination in Korea

In the recent past the Korean government initiated a six years (1996~2003) cadastral digitization project as one of National Geo-spatial Data Infrastructure (NGDI) components. As of December 2002, digitization of 613,000 maps out of a total of 748,000 maps (representing 82%) was completed. It is expected that a digital cadastral database will be available by the end of 2003.

The recent Network Readiness Index (2001~2002) shows that Korea marked 4.86 networked readiness index which means the Information and Communication Technology (ICT) infrastructure ranks 20th in the world (Kirkman, 2002). An OECD (Organization of Economic Cooperation and Development) report (OECD, 2001) states that Korea is the one of the most advanced country in the world in terms of broadband Internet network connections.

However in spite of highly developed Internet network infrastructure and availability of a digital cadastral database both administrative and spatial data, the cadastral information is still delivered through a manual process by visiting municipality office or by telephone request. This manual process of cadastral information delivery has caused the following performance problems:

- High transaction cost (in both money and time)
- Restricted access period (office hours)
- Poor allocation of skilled resources (cadastral public officers)
- Out of date information (long updating and disseminating time)

According to the annual cadastre statistics (MOGAHA, 2003) the number of cadastral information application is gradually increasing. During the year 2002 over 46 millions of cadastral information applications which are mostly from the general public and government organizations have been handled by cadastral public officers at municipality offices.

Issuing copies of cadastral register and cadastral map is time consuming but simple work process. If this labour-intensive manual process is replaced by an electronic system, it will give two options for the organization: reducing staff numbers or redeploying staff to other priorities or more complex work. But both of options will increase organization's operational efficiency. Then how many cadastral public officers are involved with this work process and what is the annual volume of the transactions?

According to the responses from the questionnaire, of which 20 cadastral public officers replied, the average number of employees handling this task is 2.7. There are about 260 municipality/ district/ county offices, which are responsible for maintenance cadastral records in Korea. From the information, we can conclude that there are approximately 700 cadastral public officers involved in issuing cadastral information.

The service fee varies from 500 Won to

Category	2002	2001	2000	1999	1998
Cadastral register (Number of application)	34,008,783	27,806,115	26,257,484	29,991,854	27,217,167
Cadastral map (Number of application)	12,632,990	10,538,549	11,607,792	14,502,385	13,229,412
Total	46,641,773	38,344,664	37,865,276	44,494,239	40,446,579
Estimated transaction volume (million Won)	27,985	23,006	22,719	26,696	24,268

<Table 2> Volume of annual cadastral information delivery transactions
(MOGAHA, 2003)

700 Won per one parcel but in this calculation 600 Won per one parcel single service fee is applied. Based on this assumption the monetary value of annual cadastral information transaction in the year 2002 was approximately 28,000 million Korean Won (approximately 22 million Euro). Table 2 shows the volume of annual cadastral information delivery transactions in terms of application numbers and monetary value.

In summary, the Internet infrastructure is highly developed in Korea and digital cadastral database both administrative and spatial data will be available by the end of 2003. This new environment provides many opportunities to cadastral organizations. However at present the cadastral information is still delivered through a manual process by visiting municipality offices or by telephone requests.

In this section the volume of annual cadastral information delivery transaction is estimated in terms of application numbers and transaction volume. From an economic point of view, the extension of cadastral information in e-government service is already big enough. The volume of annual cadastral information transaction in the year 2002 was approximately 28,000 million Korean Won (approximately 22 million Euro).

Ⅲ. Impact analysis of digital cadastral information dissemination

The cadastral information dissemination system is proposed to be an extension of the current Korean e-government service system (Government for Citizen: G4C). On the customer side, citizens will be able to access a wide range of cadastral information 24 hours a day and to apply for and receive copies of cadastral records at home or working place. On the organization side, the labour-intensive manual process can be replaced by an electronic system.

1. Economic impact

From an economic perspective, an electronic access is expected to increase the demand for products, which will decrease the price of transactions. Increased and improved access to cadastral information will provide support to legal security of rights of persons to land.

This improvement in security of tenure will in turn stimulate the land market. Subsequently the stimulated land market could contribute to the development of economy in general.

1) Transaction cost

An economic definition of transaction costs is the costs of measuring what is being exchanged and enforcing agreements. In the larger context of societal evolution they are all the costs involved in human interaction over time. However in this research mainly focuses on in both money and time cost to get cadastral information: for instance, if a citizen has to visit a municipality office only during working hours to get cadastral information, it will require a lot of travelling time and money.

The competitiveness of business is strongly influenced by the transaction costs incurred in dealing with administrations. As international competition becomes fiercer, governments are also responsible for many or the inputs to production processes. Firms therefore expect cheaper and better public services in order that they may stay competitive (COEC, 2003).

From a customer's point of view, travelling to the municipality office only during the working hours to get copies of cadastral records (cadastral register and cadastral map), it costs a lot of travelling time and money. From an organization's point of view, the issuing of copies of cadastral records is time consuming but simple work process. If this labour-intensive manual process is replaced by an electronic system, it will give two options for the organization: reducing staff numbers or redeploying staff to other priorities or more complex work. But both of options will increase organization's operational efficiency.

2) Land market

Land markets, including purchase, lease and other transactions with land, have been vital to the successful development of all the advanced market economies. Land has also been regarded as the best kind of collateral in developed market economies. System for enabling land to be used for this purpose, and thereby laying the foundation for a well functioning land market, are necessary ingredients in a functioning market economy (UN/ECE/WPLA, 1996)

It further states that the land market shows many similarities with the stock market. In most of counties, the stock market have been established quite rapidly, while the land markets lag far behind. Those are mainly because of the lack of information about real estate such as annual reports from the cadastral or land registration authorities, in contrast to information more readily available on the stock exchange. Thus the land market needs access to cadastral information.

De Soto (2000) argues that poor people without title are unable to raise capital even though they possess assets such as land and buildings, he terms this situation "dead capital." How can one encourage raising capital processes in this situation? The standard model argues that the principal contributor to the process is improving security of tenure: more secure property

Category	E-government	E-commerce
Multi-step process to come to a mutual agreement	- Application for permit	- Simple and fast to implement
Highly distributed stake-holder	- Several government agencies - Citizens - Enterprises	- Enterprises - Customers
Result is a legally binding document	- Notifications - Contracts	- Contracts
Heterogeneous platforms	- Each agency, enterprise and customer runs different platforms to support the internal communication and data processing	- Each enterprise and customer runs different e-business platforms, which are integrated through data exchange formats
Communication via structured compound documents	- Structured data for internal data processing - Multimedia data for evidence reasons	- Structured data within a contract in order to facilitate backend integration of legacy systems - Unstructured multimedia data within a contract
Control of the fulfilment	- Monitoring and controlling of payment - Monitoring and controlling of the constraints defined by the government agency	- Monitoring and controlling of the payment

<Table 3> Structural similarities between e-government and e-commerce

rights for owners and users of land.

Baldwin (2000) considered the land market to be composed of the following elements: the land registry and cadastre (legal basis), the land valuation (market based), the financial service (capital and credit), the participants, the goods and services and the financial institutions. In this three-pillar model, land registry and cadastre is one of the essential pillars, which provides a legal relationship between land and the people.

Thus increased and improved access to cadastral information by an electronic access is expected to increase the demand for products, which will decrease the price of transactions. Increased and improved access to cadastral information will provide support to legal security of rights of persons to land. This improvement in security of tenure will in turn stimulate the land market. Subsequently the stimulated land market could contribute to the development of economy in general.

3) E-government vs. E-commerce

Though one may think that e-government has little to do with e-commerce, Markus (2001) points out the similarities between e-government and e-commerce from a legal, contractual, stakeholders, and fulfillment perspective. He suggests that due to structural similarities between the two types of Internet-based activities, when implementing e-government strategies and solutions, it is essential to refer to experiences from the former to avoid wasted efforts and missed targets. Table 3 shows the structural similarities between e-government and e-commerce. The first column describes the type or category of the similarity. The second and third column is the actual characteristic

of the similarity for e-government and e-commerce.

This analysis led us to the assumption, that the structural characteristics of e-government and e-commerce are the same, and therefore the requirements on e-government enabling infrastructure, which arise from the stakeholders' needs and the enabling technologies, are basically the same as for e-commerce

2. Technical impact

From a technical perspective, the proposed cadastral information dissemination system to be an extension of the current Korean e-government service system (Government for Citizen: G4C). The G4C is highly integrated web based system. Thus the appropriate technologies and Internet infrastructure are an essential part for a successful e-government service. In this section, Internet GIS, Internet security technologies and National Geo-spatial Data Infrastructure (NGDI) issues are addressed.

1) Internet GIS technology

Internet GIS is a special tool that uses Internet as a means to access and transfer remote data, conduct analysis and make GIS presentation. In addition Internet GIS should have additional functions that take advantage of the Internet and its associated protocols such as the World Wide Web (WWW) and the File Transfer Protocol (FTP). These additional functions include exchanging remote data and application programs, presenting interactive maps and data on the Internet.

There are various tools and technologies that could implement a data viewing and update service on the Internet network. Each has strengths and weaknesses, and some are more suitable than others in a particular situation. Analysis of each data viewing and transfer tools' strengths and weaknesses is a crucial step for further designing of an information system.

In this section various Internet GIS technologies focusing on main functionalities, strengths and weakness are investigated. Table 4 shows a summary of different Internet data viewing and transfer tools.

The Geography Markup Language (GML) is an XML encoding for the transport and storage of geographic information, including both the spatial and non-spatial properties of geographic features (Simon Cox, 2002). GML uses the W3C XML Schema Definition Language to define and constrain the contents of its XML documents.

Recently the eXtensible Markup Language (XML) was developed by an XML Working Group (originally known as the SGML Editorial Review Board) formed under the auspices of the World Wide Web Consortium(W3C) in 1996 (Tim Bray, 2000). The W3C approved the first version in 1998. Now XML is the standard for the exchange of structured information and plays an important role in the Internet. It emerged as a new generation language for data description and exchange for Internet use. Data models may be described either within a Document Type Description (DTD) or a more advanced XML Schema document (W3C, 2000a; W3C,

Category	Main functionalities	Strengths	Weakness
HTML	- Provide only for single click operation on image	- Simple and fast to implement	- It was not designed for spatial data - Supports only raster image (GIF and JPEG)
Java	- Object-oriented programming language - Security measures were built from its beginning	- From a security point of view, Java is ideal	- Can not access to remote computer's hard drive or memory stacks
ActiveX	- Development of Microsoft's Object Linking and Exchange (OLE) technology	- Provide access remote computer's hard drive or memory stacks - Existing applications con be converted to ActiveX controls without new programming languages	- Currently only operable on MS Windows platforms - Security was not original design considerations
Plug-ins	- When a browser detects a particular type of content, it redirects that content to the plug-in	- If a type of special content is common, then having the plug-in already loaded prevents the download time	- It has to be installed before download pages with special content - It is considerable task to have them all installed
GML/XML	- Transport and storage of geographic information - Spatial and non-spatial properties of geographic features	- Provide a better quality maps - Works on a browser, without the client-side software - Custom map styling - Editable maps - Better query capability - Control over content - Service chaining	- It creates large volume of data file thus handing this increased data load burdens networks and storage infrastructures - Slowing the Web's move to XML compare to other markup language

<Table 4> Summary of different Internet data viewing and transfer tools

2000b).

Jim Costello (2002) explains the fundamental difference between HTML and XML as follows: HTML tags do not really describe the data itself. While it tells a web browser how to display the data, it does not define the type of data it contains. However XML employs markup in a fundamentally different way: if used properly, XML tags do not just identify data, they describe it. In short, unlike HTML, the XML tags do not contain any information about how the data will be displayed, thus making it possible to separate content from format.

2) Internet security

The Internet offers unprecedented opportunities for enterprises to provide convenience, increase revenues, reduce costs, and keep ahead of competitors. Government agencies can harness convenience of the Internet to reduce costs and improve the efficiency of delivering services to citizens and businesses. To fully realize these benefits, enterprises, governments, and other entities require an affordable solution that enables them to efficiently and securely exchange

strategic information anywhere, anytime, while providing customer convenience and personalization (VerisignInc, 2001). Data protection, network and information security, the fight against cyber crime and dependability are prerequisites for a properly functioning information society, and consequently core policy issues in many countries.

Early computer security solutions started with user IDs and passwords and then evolved to include PINs, digital certificates, and smart cards. As technology becomes more advanced, security solutions provide not only stronger security, but also greater customer convenience. The most secure, convenient, and practical solution today comes from combining PKI technology and digital certificates into smart cards.

Significant developments in electronic identity and authentication systems have taken place over the past few years in Korea. Access to citizens' data must be in full compliance legislation, where the choice of technology should empower citizens as much as possible to retain control of their personal data. However, it is still in a relatively early stage and experience is being built up. This is therefore the right time to enhance cooperation in this area.

3) National Geo-spatial Data Infrastructure (NGDI)

Groot R. & McLaughlin J. (2000) states that the National Geo-spatial Data Infrastructure (NGDI) seeks to support the sharing of data in the national context by means of a set of standards, such as: national spatial reference systems, a national topographic template, a national elevation model, any other standardized data set of national scope such as geographical names, administrative boundaries, certain thematic data sets (soils, hydrology, vegetation population, etc.), and meta data standards to describe in a consistent manner each of the GDI holdings.

The Korean government has recognised that a National Geographic Information System (NGIS) is one of the most fundamental infrastructures required to promote national competitiveness and productivity. Government has provided substantial funding for the development of the NGIS, based on the fact that the public sector will be the major user of the NGIS and recognizing that geographic information is a basic asset of the nation (MOCT, 1995).

The overall objectives of the NGIS are i) to establish a geographic information infrastructure in Korea, and ii) to eliminate unnecessary duplicate investment for GIS. To achieve the objectives of NGIS, the NGIS Steering Committee developed phase-by-phase strategies, which are shown in figure 3.

However, the current e-government service system (G4C) has not reflected the importance of spatial component so far. The Korean e-government service system (G4C) has been primarily focused on text format information provision service. This is mainly because of the availability of spatial database and complexity of handling spatial information

Phase 1 (1995~2000): GIS Infrastructure foundation period	**Phase 2 (2001~2005):** GIS data utilization period
1. Establishment of basic database for spatial information - Database design - Digital mapping of the topographical data	1. Develop national framework data base
2. Development of GIS-related technology and training of GIS specialists - Development of GIS fundamental technology - Development of GIS application - Training of GIS specialists	2. Create mechanism to ensure adequate management, distribution and security of data
3. Standardization of spatial data - Standard for basic spatial data - Spatial data transfer format	3. Develop mechanism for update of data
4. Financial support for development of GIS application systems - Spatial Decision Support System - Administration Support System	4. Provide mechanism to permit the total integration of government database upon technologies now emerging and national and international standards as relevant
5. Management and distribution of spatial information - Implementation and operation of information database clearing house	5. Provide an environment in which commercial support for NGIS can be agreed and implemented
6. Development of spatial data-related legislative law and framework	6. Training of GIS experts' framework
7. Joint funding between public and private sector	7. Promote partnership between public and private sector
8. Update and modification of the NGIS Master Plan - rolling annual plans	

【Figure 3】 Korean NGIS phase-by-phase strategies (MOCT, 2000)

compare to text format information. The extension of cadastral information will be a first step to accommodate spatial information in Korean e-government service system. Thus the two projects NGIS project, which is mainly focussing on spatial data distribution and e-government project, should be integrated in a more comprehensive perspective.

When GIS and geo-spatial information becomes an essential component e-government in Korea, the goals of e-government: higher administrative efficiency and higher quality citizen-centered services can be realized. Ultimately the spatially enabled e-government service will support the Spatial Decision Support Systems (SDSS), which supports citizens and organizations to take the right decisions.

3. Legal and social impact

This section investigates the legal and social impacts of the implementation of cadastral information dissemination system using Internet. In this regard, the revision of the current Cadastral Act and review of related legislation is proposed as a first step. Further, from a social perspective land administration and land dispute impacts analyzed.

1) Current Cadastral Act revision

The Cadastral Act governs cadastral

activities in Korea. There is a three hierarchical structure in cadastral legislation, which is Cadastral Act, Enforcement Decree of the Cadastral Act and Enforcement Regulation of the Cadastral Act.

According to the "Open cadastral record to the public principle" cadastral records have to be provided to the general public without any restrictions. Anyone who asks for cadastral records gets copies of cadastral records subject to the payment of a service fee. The following cadastral legislation revisions are required to implement a cadastral information dissemination system using Internet network.

1. Cadastral Act Article 14. defines the process of applying for cadastral records. In the current Cadastral Act defines one cadastral record applying process. In order for implementation of cadastral information dissemination system using Internet network, another possibility of applying cadastral information through Internet process should be defined.
2. Enforcement Decree of the Cadastral Act Article 10. and Enforcement Regulation of the Cadastral Act 16. describes the fee of getting a copy of cadastral records and defines public organizations which can get cadastral records without any charge. Therefore, the pricing and open access cadastral information for public organizations should be determined based on a sound economic analysis.
3. Under the "Open cadastral record to the public principle" cadastral records should be provided to the general public without any restrictions. But the current Cadastral Act (Enforcement Decree of the Cadastral Act Article 11.) describes an exception for protecting personal information. However the exceptional limitation of cadastral information provision is applied in case of large amount of cadastral information application. The limitation should be extended to one parcel of cadastral information applications.
4. Reliability norms and liability for quality of cadastral spatial data and quality of cadastral spatial data manipulating services are not expressly mentioned in the current Cadastral Act. In general, the liability for cadastral spatial data quality and the level of such responsibility are still technically and legally an open issue.

2) Privacy and consumer protection

Public services can be offered only within an environment where trust and confidence flourish. Such environment should always guarantee secure interaction and access for citizens and businesses (COEC, 2003). Thus protections of personal data, authentication, and identity management are primary issues where no public services should fail. Public institutions should always ensure that digital transactions and communication are secure and that personal data will remain protected.

The Digital Signature Act (refers to

Appendix 3) was enacted on February 5, 1999 and went into force on July 1, 1999. On July 7 of the same year, the Digital Signature Certification Management Center was established within the Korea Information Security Protection Agency to implement the full force of the Act. In recognition of the importance of privacy protection, Korea has set up both a regulatory framework and means for self-regulation. The Korea Information Society Agency (KISA), in particular, has been authorized to oversee privacy protection in the private sector pursuant to the Promotion of Information Communication Network Usage and Information Protection Act (hereinafter referred to as the "Information Communication Network Act").

The Personal Data Dispute Mediation Committee, established within KISA, has established a regulatory framework as a response to the call for strengthened privacy protection measures. The main objectives are to secure various effective means for addressing privacy infringement and complaints while facilitating the players in the economy and society to take the initiative for privacy protection. The Committee is also pursuing various projects to create the social foundation for better privacy protection in Korea.

Although there are such Acts as the Basic Act on Electronic Commerce, which directly regulate e-business, most existing Acts and regulations are geared to ensure fair trade and consumer protection or define e-commerce as a general form of information communication service.

3) Pricing policy

In general there are two different approaches for geo-data pricing policy. One is an open access policy which propagates free geo-data for all users and funding for collection and maintenance by government. The other is a cost recovery policy, which stresses that geo-data is a normal commodity like any other and that users should pay a fair price.

Weiss (2002)presents two different geo-data funding pricing model. One is an open access model (sometimes called as US model), which with an unrestricted information access, produces new companies, new jobs, increased sales and new products. Eventually this leads to increased tax revenues. Government agencies fund their data collection with money from the general budget, appropriated to them by Congress. Public sector information is available freely to other agencies. The other is a cost recovery model (sometimes called as European model) which treasuries and legislation force government agencies to recover costs directly from users. This results in limited use and thus leaves limited resources for the government agency to collect the data. The need for direct funding and cross-subsidies should not be eliminated, as other agencies transfer taxpayer money to originating agencies. Figure 4 illustrates two different funding and pricing models.

Many discussions are going on concerning an optimal economic model for funding and pricing of geo-data. However e-government

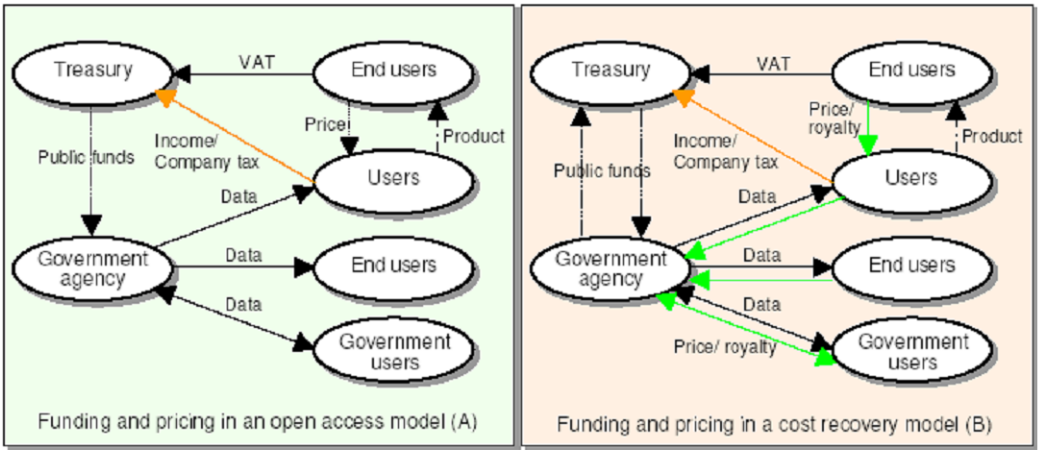
service pricing is not more complicated than other geo-data services. Because Korean e-government service provides e-service to end-users directly, the value adding activities which links the government agencies and end user is not as active as other geo-data provision services.

Currently, the Korean government imposes a minimum service charge for general public users and provides a free access for limited numbers of government organizations, which require cadastral information for doing their tasks. The fee charged to the customer is very sensitive to users' willingness for using the service. Too high a service charge will drive customers away from using the service. Bourn (2002) further states that introduction of an incentive system is important to encourage citizen to take up of on-line services.

4) Land administration

The UN ECE Guidelines on Land Administration defines the term land administration as the process of determining, recording, and disseminating information on ownership, value and use of land when implementing land management(UN/ECE/ WPLA, 1996). Molen(2001) highlighted a growing importance of data communication as a supporting tool focusing on determining, recording and disseminating processes.

On the determination side of the land administration process (input), strategic objectives such as faster services to the fast moving property market and to the public administration become possible by offering facilities for electronic conveyancing and easy map updating. *The recording process* (throughput) will be improved through internal data communication offering better integration between centralized and decentralized processes. The integration of work process allows for combining the benefits of centralized IT services and decentralized information management. *On the dissemination side* (output) the strategic objective of making land administration better, easier and cheaper accessible will be



【Figure 4】 Funding and pricing models (Lemmens, 2003)

supported by data communication. Internet services can be applied here, which require a reflection on opening hours, data quality, liability, data protection and copyright, privacy issues and pricing policy.

Already today, good practices in many countries show that e-government is a powerful means indeed to deliver better quality public services, reduce waiting times and improve cost effectiveness, raise productivity, and improve transparency and accountability (COEC, 2003). It further states that just like the rest of the economy, the public sector faces the challenge of responding to new technological development, in particular in information and communication technology. For example, the Internet has enabled new forms of involvement in policy-making, such as rapidly forming on-line opinion groups, public on-line consultations or systematic collection of feedback on needs for help and advice from citizens and business. This means that public administrations must review their established ways of decision-making.

E-government is an enabler to realize a better and more efficient administration. It improves the development and implementation of public policies and helps the public sector to cope with the conflicting demands of delivering more and better services with fewer resources.

Ting (2001) underlines the role of the Internet and communication technologies in the operation of land administration and cadastral system. The Internet is seen as an alternative to delivering cadastral information from public bodies to the public. In fact some land administration organizations are seeing their whole delivery strategy based on the Internet network. She concludes that together with distributed database, the Internet and map servers, a multi-purpose cadastre is expected to allow government agencies to overlay cadastral maps, title registers, planning and other vital land resources live and interactively in order to show the complete legal situation of the land to Internet users across the world. In other words it is becoming possible to identify all the rights, restrictions and responsibilities relating to land over the Internet network.

5) Land dispute

According to the recent statistics (KCSC web site: www.kcsc.co.kr) released by Korea Cadastral Survey Corporation (KCSC) the number of land boundary dispute in Korea increased annually until 1999 and the number drastically decreased during 2001-2002.

However the number of land boundary disputes has drastically decreased since 2001. At this time KCSC seriously recognized this problem and put a lot of efforts to reduce the number of land boundary disputes. For example, KCSC emphasized the importance of staff's working attitude, which is critically influenced to reduce land boundary disputes. Because many land boundary dispute cases have been raised due to staff's bureaucratic working attitude as well as technical constraints. This statistical number implies a very important message to all personnel involved in cadastral surveying activity that technology itself is not sufficient to resolve

land boundary disputes. Beyond the technology, special attention should be paid to regular customer satisfaction surveys which enable an organization to measure the level of customers satisfaction as well as a continuous staff re-education programme focusing on their service mind and professionalism.

The electronic access to cadastral information is expected to increase the demand for products. Increased and improved access to cadastral information will provide support to legal security of rights of persons to land. Although this is not a direct technical improvement, which can serve to improve cadastral surveying accuracy, better accessibility to cadastral information will increase transparency in provision of cadastral information to the public. It is expected that a continuing staff service mind and a professional re-education with improved accessibility to cadastral information, will eventually contribute to the reduction in the number of land boundary disputes in Korea.

Ⅳ. Conclusions

The main objective of this research is to identify the key drivers to change for cadastral organizations and analyze the impact of digital cadastral information dissemination in Korea.

In order to achieve the research objectives, an impact analysis of digital cadastral information is conducted in terms of economical, technical, legal (revision of current Cadastral ACT) and social aspects. From this research the following conclusions are made.

1. Recent development in Geo-ICT, such as information system modeling standards, database technology, global positioning system and Internet technology development etc., customers' requirements, e-government policy and budget constraints are identified as key drivers to change for cadastral organizations. These external environmental factors push cadastral organizations in both the development of new cadastral systems and in the improvement of existing systems.

2. An impact analysis of digital cadastral information is conducted in terms of economical, technical, legal (revision of current Cadastral ACT) and social aspects.

   On the economic impact side, an electronic access is expected to increase the demand for products, which will decrease the price of transactions. Increased and improved access to cadastral information will provide support to legal security of rights of persons to land. This improvement in security of tenure will in turn stimulate in turn the land market. Subsequently the stimulated land market could contribute to the development of economy in general.

   From a technical perspective, the cadastral information dissemination system is proposed to be an extension of the current Korean e-government service system (G4C) and cadastral spatial information will be a first step to

accommodate a spatial component in the G4C. Ultimately the spatially enabled e-government service will support the Spatial Decision Support Systems (SDSS), which supports citizens and organizations to take the right decisions.

On the social impact side, the Internet and communication technologies are expected to have impact on efficient and transparent land administration processes and this improvement is expected to contribute to the reduction of the number of land disputes in Korea. In order to implement the proposed system, a revision of current Cadastral Act and a review of related legislation is proposed as a first step.

3. Particularly in Korea, despite the highly developed Internet network infrastructure and availability of a digital cadastral database including both administrative and spatial data, the cadastral information is still delivered through a manual process by visiting the municipality office or by telephone request. This manual process of cadastral information delivery causes many performance problems.

According to the responses from the questionnaire, it is estimated that currently about 700 public officers are involved in issuing copies of cadastral records in 260 municipality offices in Korea. The volume of annual cadastral information delivery transactions in the year 2002 was approximately 28,000 million Korean Won (approximately 22 million Euro). From an economic point of view, the extension of cadastral information in e-government service system already has a big market.

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