Indian Journal of Science and Technology, *Vol 8(19), DOI:10.17485/ijst/2015/v8i19/77050, August 2015*
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

Convergence Strategies for Spatial Data Industry based on Industry Value Chain Analysis

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Abstract

Lately, IT pioneers such as Google and Microsoft compete to establish cyber territory on the Internet headed by 'Google Earth' and ' MS Virtual Earth'. Physical border and national authority are disappeared in the cyber territory in which new orders are emerging that provider of cyber territory becomes a governor and its users become citizen. Spatial information industry expands its domain continuously through convergence with the neighboring industries. The objective of this research is to analyze industry value chain and market segments of national spatial data industry to find strategies for enhancing competitiveness of the industry. Based on the industrial value chain analysis we developed microscopic directions for intra-industrial innovation and macroscopic directions for inter-industrial convergence. Finally, we drew 7 detailed policies to promote industrial convergence.

Keywords: Convergence, Cyber Territory, Industry Value Chain, Spatial Information

1. Introduction

Recently, leading IT enterprises such as Google and Microsoft (MS) are under way of keen competition of cyber territory establishment, headed by 'Google Earth' and 'MS Virtual Earth'[1–4]. In cyber territories, the authority and the borders of physical territory countries disappear and a new order is formed that the providers of cyber spaces have powers and the users become the ruled[5,6].

Cyber territories are reinvented spaces through the digitalization of the people's lives, enterprise and government activities as well as natural and artificial environments that consist of real territories. The concept of traditional cyber territories is being evolved to dynamic intelligent spaces through the interactions between users and intellectualized real territories by using ubiquitous techniques. Also with the emergence of Web 2.0, intellectual cyber territories are enlarged and developed as a concept of spatial information society which stresses participation, practical use and common ownership of spatial information infrastructure[7].

Also, in order to realize the vision of intellectualized cyber territories and spatial information society, the spatial data industry is rapidly growing as the most noticeable business in the 21st century, expanding its domain continuously[8]. The spatial data industry provides services and systems that produce, process, and distribute spatial data and enable us to achieve vision of cyber territories.

The goal of this research is to identify industry value chain and market segments of national spatial data industry to find policies enhancing competitiveness of the industry and achieving vision of cyber territories and spatial information society. Based on the industrial value chain analysis, we developed microscopic directions for intra-industrial innovation and macroscopic objectives for inter-industrial convergence.

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2. Industry Analysis

2.1 Industry Value Chain of the Spatial Data Industry

Understanding information distribution and value chain structure is critical to get a precise analysis of the spatial data industry. The distribution from production to consumption of spatial data in the industry is carried out with three steps of data establishment, information processing, and user customization. The original spatial data obtained through measurement in the first stage are accumulated in database after digitalization[9]. The original spatial data distributed to information processing stage are used for commercialization in the form of spatial data services after linked with other information. Finally the end users process it to customized information by mixing UCC (User Created Contents) or real time location data with the worked spatial data from enterprises or government.

Based on the findings of information distribution structure, the value chain structure in the industry is generally developed in the order of public institutes, enterprises, and users and its renovating connections with the related industries are important as shown in Figure 1. The role of public institutes is important because gathering initial original spatial data has low profitability. Enterprises in the stage of information processing consist of the manufacturers of electronic maps, S/W technical firms, contents manufactures and IT service providers and so on. End users are largely classified into government, enterprises and general consumers, and are possible to be subdivided into the public market, the enterprise market and the consumer market according to their user types. The equipment providers and terminal providers lead the technical evolution of the spatial data industry[10].

2.2 Types and Trends of Spatial Data Market

Based on value chain analysis, market in the spatial data industry can be segmented into raw data, solutions, contents, and service market shown as Table 1.

First, as to the raw data market, the existing measurement concept has been being changed into the concept of data scanning, processing and DB establishment by the introduction of high technology and the digitalization of equipment, and they are using various methods such

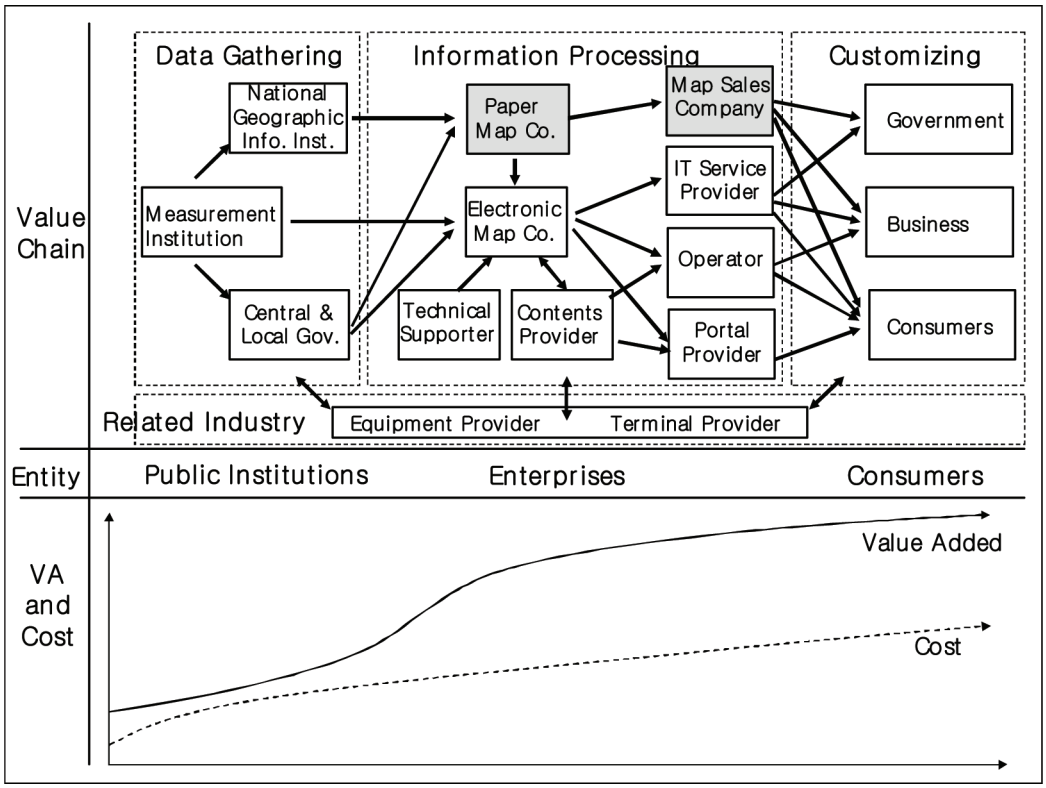

Figure 1. Value chain of spatial data industry.

Table 1. Market segments of spatial data industry

Market Type	Products or Services
Raw data market	Products and services related to acquisition of raw spatial data mainly by order of public institution
Solution market	S/W, solution, technical services to manufacture electronic map
Contents market	Services related to manufacturing of electronic map mixing and processing raw spatial data and other contents
Service market	Services of providing spatial information contents and added services using wired and non-wired systems

as past numeric maps in spatial data acquisition, aerial photographs, satellite images, aerial laser measurements, RFID/USN etc. in the method of putting measurement data first.

Second, as to the solution market, the improvements of DBMS, engines and tools to embody Web GIS, Mobile GIS and 3D/4D GIS is in progress, and especially, Web GIS supports the combinations of data and functions that are scattered at numerous servers linked to the Internet according to users' requirements. Besides, Mobile GIS supports users in retrievals, additions and renewals of geographical information, and 3D GIS helps users understand on the spatial phenomena of the real world by supplying three-dimensional spatial data similar to the real world and supports various analysis performances. As 4D spatial data technology accepting time dimension becomes generalized, cyber territories in computers are changing to lively dynamic spaces, not static spaces[11,12].

Third, the contents market is developing in the direction of maximizing realism, connections, interactions, etc. beyond the stage of the simple digitalization of analog spatial data, and contents providers are improving added values, by grafting spatial data contents onto virtual reality techniques or by linking other contents such as life information, traffic conditions etc. As spatial data consumers become consumer-oriented, end users resupply them to other consumers after transforming spatial data contents or adding new information.

Finally, renovating services such as u-city, location-based services, intellectual traffic systems etc. are emerging as contents, and services are creatively assembled in correspondence of various spatial data demand in the spatial data service market. IT service providers, mobile communication providers, portal providers who are the service providers with customer contacts provide them to consumers unifying contents, H/W and additional services. Especially, with the changes of information distribution paradigm according to emergence of Web 2.0, the providers concentrate their efforts on making an environment in which anybody can create spatial data, not one-sided contents supply.

The spatial data industry has a large influence from technical innovation of the equipment industry and the terminal industry that is the related industries and provides innovation to the related industries at the same time. The development of remote sensing and GPS technologies enables the acquisition of exact and high-quality spatial information, and the digital convergence and ubiquitous-orientation between cell phones, DMB terminals, navigation terminals promotes the function expansion of spatial data services and its expansion of domain[13].

3. Major Features of National Spatial Data Industry

3.1 Government-leading Industry Fostering

The domestic spatial data industry has an underdeveloped value chain structure because it was led by the country unlike foreign countries grown from private enterprises (refer to Table 2). Because the members in value chains are very heterogeneous and complex, they can be causes of fragile industry competitiveness. Also, because the business information sharing and standardization in the public sector is dull, there is much waist due to the overlapping investments by the private corporations and offices of central and municipal governments. This is because governmental policy establishments remain in the shortsighted approach limited at specific solutions and services, not a macroscopic viewpoint of value chains and convergence between industries.

Table 2. History of government leading spatial data industry development

Period	Stage	Goal	Major Trends
Before 1995	Introduction of Technology	Introduction of GIS Solution and Technology	Improvement of GIS Technology and Application of GIS to SOC
1995 ~ 2000	The 1st National GIS	Government Leading Expansion of Spatial Industry	Focus on Acquisition of fundamental Geospatial Data driven by Government
2001 ~ 2005	The 2nd National GIS	Fostering of Spatial Industry as Service Industry	Development of Various Geographic Information System and Web based Contents
After 2006	The 3rd National GIS	Enhancing Quality of Life and Creation of Value through Spatial Information	Shift from Government to Private orientation

Table 3. The Size of global spatial information industry

Type	2007	2008	2009	2010	2011	2012	CAGR
Total	285	363	458	543	744	988	28%
Raw Data, Contents, and Solution Market	178	229	294	337	484	660	35%
Service and System Market	106	134	164	206	260	328	26%

Source: Daratech, GPS International Trade Office, Unit: Billion Dollars

3.2 Percentage of Korea of No More than 4.5% in the World Market

Also, despite annual average about 40% of fast industry growth, the percentage of Korea occupying the world spatial data industry is 4.5%. The scale of the whole world spatial data industry is 98.8 billion dollars and goes on fast growth of annual average 28% as of 2012 as shown in Table 3. The scale of the entire market of the national spatial data industry as of 2012 is estimated as 300 billion won and the 40% cumulative average growth rate was recorded from 2002 to 2012[13].

3.3 Stagnant Data Establishment Market

The national GIS business progressed in the first and the second prepared the national spatial data basis including basic geographical information, GIS standard, GIS information distribution, GIS techniques etc. and the provincial governments established specialized spatial data bases for the efficiency of administration according to needs[14]. But the legal systems and institutional supports are insufficient for the industry wide sharing of the national spatial data public institutions own.

3.4 Solution Market Led by Foreign Solutions

As the national spatial data industry has been developed putting application services first rather than H/W and S/W sectors, the occupation rate in the world market is no more than 3.3% as of 2012. Also, the market occupation rate of foreign-made software in the national spatial data solution market is close in upon 90%. Recently, spatial data solutions are moving the center of gravity from the market of public and private services to the market of enterprise services.

3.5 Oligopolic Contents Market

The core contents of spatial data services are electronic maps and the electronic map market is growing at a fast speed with the rapid distribution of navigations, and the navigation electronic map market of the scale of 50 billion won is an oligopoly market that three companies, Tinkware, MN soft and Citers, accounts for 90% of the market. SK energy advanced to the market as a latecomer and Navtech, Teleatlas etc. who are foreign firms are considering the entries into the domestic market.

3.6 Rapidly Growing Service Market

The spatial data service market is possible to be subdivided into the public service market, the enterprise service market and the private service market in the basis of the types of end users. The public service market is a service market for support of public affairs of central government or provincial governments and is generally

vertically systematized from data establishment to service provision, and the enterprise service market is a service market of GIS products pursuing the efficiency of enterprise operation by adding spatial data in enterprise information. The private service market is a service market provided using the same context with users' location information, and LBS, ITS, Telematics, u city etc. are its representative services.

4. Reconstruction of Industry Value Chain

The domain of spatial data industries can be expanded to infinity through reconstruction of value chains in industries and convergence between industries. Through the dynamic processes of dissolutions and combinations based on the strategies of the interested parties, the reconstruction of value chains can be induced and as to convergence between industries, the domain of the spatial data industry can be expended from traditional domains such as the national facility management, public services to the manufacturing industry which is low in the utility of spatial data[15].

4.1 Reconstruction of Industry Value Chain

The spatial data industry is a convergence industry and, in order to effectively unify its contents, services and hardware, the reconstruction of value chains such as vertical expansion, horizontal convergence must be tried. Through the vertical expansion of value chains, needed is the development of business models connected to multiple businesses of data establishments, solutions, contents and service businesses[16]. Also, the horizontal convergence strategy like connecting cable-based portal services and radio-based mobile services can promote the creation of renovating business models.

4.2 Convergence between Industries

In case of convergence between industries, its utilizing domain can be expanded from traditional public markets and consumer markets to enterprise markets, accelerating the convergence between the spatial information industry and other industries as shown in Figure 2. For the spatial data industry, its domain can be expanded to infinity, contributing the innovation of traditional industries through the convergence with spation information industriy or creation of new industries like u-city industry. Also, the consolidation of management information, spatial information and statistical information related to marketing, financing, personal affairs and supply network leads to the incorporation of g-business with the management of corporation.

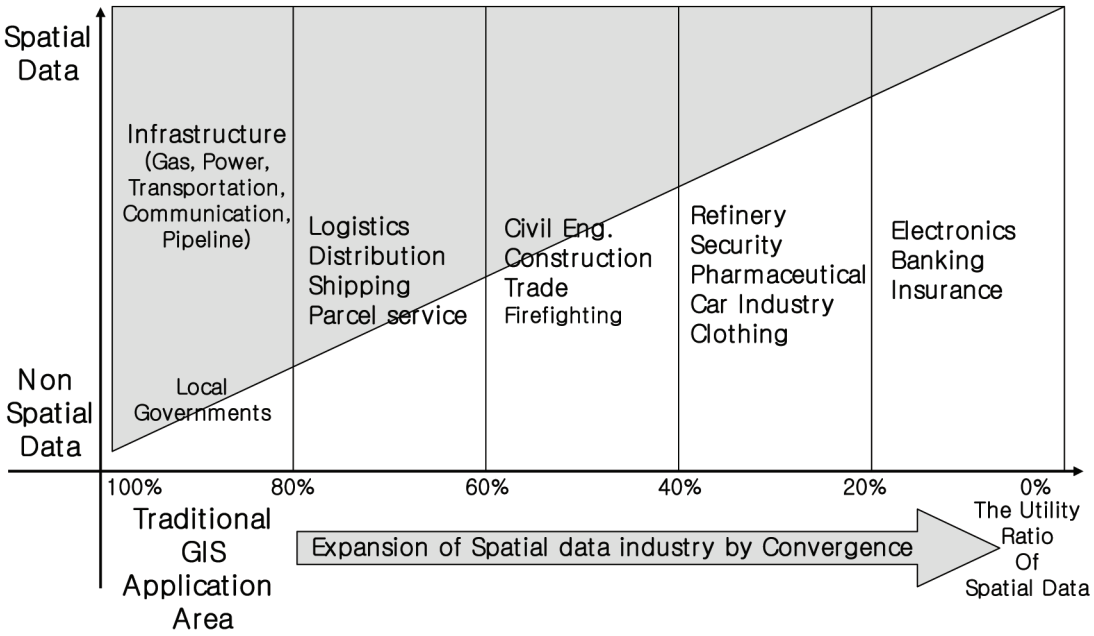

Figure 2. Convergence of spatial data industry and other industries.

5. Conclusion

The detailed convergence strategy to raise the competitiveness of the spatial data industry can be summarized to seven as follows.

First, the establishment of Government policy and enterprise strategies in the viewpoint of overall value chains in the industry and convergence between industries is needed, deviating from the shortsighted approach limited in individual services and contents. Government must promote the convergences in the industry and the convergence between heterogeneous industries in the viewpoint of the distributing structure of spatial data and the advancement of value chains, and enterprises are desirable to try optimization for the entire service life cycles from planning stages to data collections, contents developments and the provision of spatial data services.

Second, needed is bringing up competitive global spatial service providers like Google Earth or Nokia Maps through the vertical expansion of value chains. Google, a portal firm, provides competitive spatial services by undertaking solution firms and establishing independent data through backward integration and Nokia, a terminal manufacturer, undertook Navtech, an electronic map company, at 8.1 billion dollars and provides navigation services called Nokia Maps through forward integration.

Third, they must make the environment enabling them to seamlessly unify the spatial data being obtained through various media and heterogeneous subjects such as satellites, mobile radio communication network, USN etc. by promoting horizontal unification of value chains. For this, establishing standardization policy able to interlock heterogeneous spatial data contents is urgent and it is important to participate in GSDI business, global information-sharing business, and make Cybercity, Cyber territories and Cyber global village mutually connected.

Fourth, policies for the distribution vitalization of spatial data in the initial stage must be urgently prepared in the integrated frame. The largest factor of success that Google Earth dominated cyber territories is in the fact that they freely opened spatial data contents in spite of the grave side effects. In case of the national cyber market, even though original spatial data like digital cadastral maps were established in the national budget, they are not easy for enterprises and individuals to access to data. Accordingly, needed is to promote processing and putting-in-service of original spatial data established by public institutions by introducing a system like Japanese NGIS law and to establish plans of data quality management.

Fifth, they must bring up the enterprise service market that is relatively dull in growth, comparing with the public and individual services by promoting convergence between industries. The spatial data contents properly compounded with other types of contents are possible to be utilized as the core media of convergence between industries and can promote the growth of the enterprise service market. The spatial data solutions developed chiefly to provide public and individual services must be improved to support the introduction of g-business.

Sixth, in case of public services, the standardization for solutions and services must be promoted to block overlapping investments. For this, needed is the standardization of solutions supporting the works related to policy establishment, execution, assessment of the national territories commonly carried out by the central government, the municipal governments etc., and the standardization of solutions are expected to induce even the standardization of public services and the standardization of GIS original data.

Seventh, in order to encourage the public information industry, the expansion of human infrastructure is essential. Though many GIS human power has been produced since the national GIS business started in 1995, they are mostly simple function manpower centered on DB-establishing manpower and middle-ranking expert manpower is lacking. Accordingly, the cultivation of spatial data function manpower skilled in unifying and combining techniques and high-quality experts of masters or doctors must be promoted.

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