East Asian Spatial Data Infrastructure Development for the Sustainable and Balanced Regional Growth

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Abstract: In recent years, as the trade quantities are increasing in East Asian region and the interdependent relation has strengthened. For the seamless flow of the people, goods and information, the transportation network such as the East Asian one-day return business zone, the next-day freight delivery and etc. has been urged to strengthen, and is required for sustainable economical development. For the sustainable and balanced regional growth, it is necessary to coordinate with related countries, which can lead strengthening international competitiveness and correcting regional disparities.

As the first step for this, the research activities such as to develop spatial indicator, to analysis development trends and to show visually the research results, are helping understand of East Asian region and each country’s situation. And in this report several maps are created using the existing statistical data, and could be discovered some tasks to set up East Asian Spatial Data Infrastructure.

Key Words: East Asian Region, Spatial Data Infrastructure, Statistical Units, NUTS

1. INTRODUCTION

In recent years, it becomes to be argued the idea of transnational cooperation called East Asian community by the economic interdependence having deepened in East Asian region. Under the progress of the international horizontal division of labor system, it is demanded to strengthen the network such as the one-day return business zone in East Asia, the next-day freight delivery, and etc., in other words, the situation to need the seamless flow of the people, goods, and information occurs for the sustainable economic development. As an idea to implement them, the Grand Design for Northeast Asia, which is the vision to comprehensively improve and enhance the international infrastructure through cooperating in the respects of transport / logistics network, energy, environment, and information technologies, started to be discussed among many countries’ researchers.

The European Union (EU), which can be recognized as one of advanced cooperation model, grasps the present condition and subjects on spatial development within the territories and is preparing the future strategic policies for the balanced sustainable development. This is based on the decisions that the amendments of regional disparities and prevention of excessive competitions for infrastructure development among the regions of EU enable the territory to enhance international competitiveness; therefore EU has considered this as an important task to show the strategic visions of spatial development to solve problems above. As a concrete measure to implement vision making, the European Spatial Planning Observation Network (ESPON), which is a collaborative research institute by member states,
was established in EU and they are originally investigating and analyzing on a direction of spatial development within the territory. At that time the EuroGeographics and Eurostat offer the basically map data and statistical data.

On the other hand, in Asia we can see the example of transnational community called Association of South-East Asian Nations (ASEAN), which is doing various cooperation activities for the common benefit within the region. However in northeast Asia, especially in Japan, China, Taiwan and Korea, such cooperation activities are not yet established enough.

Figure 1: Spatial development conditions of the infrastructure in Europe
though the mutual influence and economic dependence caused by geographical conditions deepen. On the contrary, the excessive competitions, which are the development of infrastructure such as airport or seaport that have close relation with the movement of people and goods, are being intensified aiming to become hub facilities in this territory. There is a possibility that the competitiveness of whole East Asia become weaken by the complicated transnational competitions. To implement mutual prosperity in East Asia while maintaining the international competitiveness among the NAFTA region, EU region, and other powerful regions, it is important to have a viewpoint of the cooperation among the Asian neighboring countries and to grasp the present condition and problems of the spatial development within this area.

This paper firstly reviews the situations of collection and usage of spatial information in EU as a case study, and secondly grasps the present condition of spatial development in Japan, China, Taiwan and Korea through using publicly opened statistics data from the viewpoint that it is necessary to development a spatial data infrastructure in East Asian region. And the task and vision are grasped after producing several spatial data maps experimentally, based on existing statistical data and ADC world map data.

2. ANALISIS OF THE SPATIAL STRUCTURE OF EU

The main political purpose of EU is said to achieve a balanced and sustainable economic/social development, common security, defense, etc. And to implement EU policies, the fundamental goals of European policies are, i) economic and social cohesion, ii) conservation of natural resources and cultural heritage, and iii) more balanced competitiveness of the European territory. The central aim is to reinforce economic and social cohesion, and this is based on the way of thinking that, if the economical and social needs in the region were achieved, the natural, ecological and cultural functions would be strengthened and the region’s competitiveness would be improved. These are basic goals not only for the spatial policies, but also for all EU policies. For this purpose, the spatial development policy guideline which is called European Spatial Development Perspective (ESDP) were set out with following contexts: i) development of a balanced and polycentric urban system and a new urban-rural relationship; ii) securing parity of access to infrastructure and knowledge; and iii) sustainable development, prudent management and protection of nature and cultural heritage.

In ESDP, sixty policy options are presented, and they function as the guidelines for the member states’ individual policies and spatial plans.

Another role of the ESDP is to grasp present conditions and trends in the spatial development of Europe, and from those extract problems and reflect their solutions to EU policies. The ESDP is the first challenge to analyze the trends and problems in the spatial development at the EU level. It made clear that the long-term trend of the spatial development in the territory of EU had to be carefully analyzed based on the statistical data. Then the member states enabled information exchange and collaborative research through networking the research institutes (Ex. University, research institute, etc.) of each member state, and came to establish the organizations in each member state to lead political cooperation between the competent authorities of the member states and the EU. This idea had been completed in 1997 as the research network called the ESPON mentioned above which was established as one of the measures to implement the ESDP. The ESPON is an organization that performs policy proposal through assessment of EU spatial policy impact and mapping out spatial information with the purpose of clarifying the concept of territorial unification and to offer a database.
supporting harmonized development in EU. Maps in Figure 1 are examples produced by their research to propose spatial development policy for improving regional disparity. Maps lower place in Figure 1 show a potential of policy progress to connect infrastructure in country borders and inter-regions. And in the ESPON research projects much kind of maps are being created because of strong cooperation with EuroGeographics and Eurostat. To understand regional situation comparably, EU government sets up different scale of regional unit called NUTS (Nomenclature des unités territoriales statistiques) which is mainly considered by population size. There are three levels of NUTS regions (Figure 2). The highest scale of aggregation is NUTS 1, which is then broken down to NUTS 2 regions, which in turn are made up of the smallest regional units, NUTS 3. These comparable regions have been defined within European statistical unit in Eurostat. In the 2004 NUTS version there are in all 282 NUTS 2 regions in the 29 countries (NUTS 1) participating in the ESPON program. The NUTS 2 regions are seen as basic regions for socio - economic analysis. NUTS 3 regions now represent the lowest level within the NUTS classification system. NUT3 is the main level for regional statistical analysis, because it gives a more differentiated view on the European territory than can be gained from NUTS 2 data. ESPON’s analysis has been at NUTS 3 whenever the data has been available at that level.

Otherwise, EuroGeographics is developing and maintaining European Spatial Data Infrastructure, which include EuroGlobalmap, EuroRegionalMap and EuroBoundaryMap. EuroGlobalMap is a topographic dataset that covers the whole of Europe at the scale 1:1 Million. It is produced in cooperation by the National Mapping Agencies of Europe, using official national databases. The EuroGlobalMap project provides the first seamless European geographic information infrastructure that will be maintained at the source level by the National Mapping Agencies, and by providing harmonized access conditions for geographic information.

The EuroRegionalMap project aims to create a pan-European vector topographic database at scale 1:250 000 (medium scale) used as reference data and enabling spatial analysis and geographic backdrop for presentation and visualization base on the harmonization of already existing National Data Bases of the National Mapping and Cadastral Agencies.

![Figure 2: NUTS 2 and NUTS 3 regions in EU](image)
(NMCAs). The EuroBoundaryMap project is the activity of NMCAs, members of EuroGeographics, producing and maintaining the EuroBoundaryMap product of Europe at the scales 1:100,000 and 1:1 Million. The current version of EuroBoundaryMap contains all administrative units from country down to the commune level of all EU members and 10 other European countries. The term "seamless" means that there are no gaps or overlaps between polygons initially derived from different sources. They incorporate a linkage between the SHN codes of administrative units for all EU countries and the corresponding statistical codes according to the new NUTS regulation issued by EUROSTAT.

3. PRESENT DEVELOPMENT STATUS OF EACH REGION OF EAST ASIA

In Japan the cooperation among East Asian countries that assumed EU as a model are called ‘seamless Asia’, and it is expected to strengthen the network such as \textit{one-day return business zone of East Asia, next-day freight delivery, and Asian broadband}, etc., therefore the viewpoint that recognizes the formation of East Asian community as common goal for sustainable economic development has been gradually extended. For example, as a cooperation project among many countries at pan Asian level in transport section, the \textit{Asian highway} in the field of road infrastructure and the \textit{Trans Asian railway} in the field of railroad are agreed among related countries. On the other hand, strong competes among related countries occur to take a role of Asian gateway, which is large scale international seaports and airports such as the new Shanghai seaport and Pu-dong airport of China, and Pusan new port, Kwang-yang port, Inchon airport and seaport.

Now there has not yet be seen the cooperative challenge to grasp inclusively the present condition of spatial development in East Asia, but considering future development of this region it can be thought that a spatial data infrastructure should be established also in East Asia region. This time I tried to mapping spatial data by unified criterion among three countries as an initial trial using \textit{Global Map, ADC World Map} and an international statistical data on port, logistics and other regional data related of each country.

3.1 Regional information according to spatial unit

The four countries of Japan, China, Taiwan and South Korea, which is different each other on population and territory size than the case of EU, therefore it need to be divided into comparable regional units. Today, there is not a general standard on statistic data collection that is more detail than country level in these four countries, and then the setting of the spatial unit may be the subject that needs a careful argument. As present sub-national spatial units with statistical data of each country, could be found 47 prefectures in Japan, 33 provinces including capital city and autonomous districts in China, 23 cities and counties in Taiwan and 16 provinces including the capital city and metropolitan cities in South Korea(Table1). To see a comparable statistical unit, they are very heterogeneous in their area and number of population. Each spatial unit of China is very big, and some of them far exceed the whole territory of Japan or South Korea. In South Korea, spatial units holding two types of structure that are both smaller area but high populated metropolitan city and bigger area with low populated provinces. In Japan, each regional spatial unit size are the smallest amongst three countries, therefore as a sub-national unit seems comparably small. Above all, it is not appropriate to mapping and comparing the population scale according to these spatial units among three countries. However, these spatial units are important classification as a statistical framework to analyze the socio-economical situations of each country. Therefore the present spatial classification has to be subdivided or integrated into comparable spatial units based on
the character of the three countries for the future. To implement it each national governments or related organizations have to discuss carefully, furthermore the statistical classification also should be subdivided or integrated at the same way.

In this paper, to make mapping unit comparable, existing sub-national boundaries integrate into 10 blocks the case of Japan and 3 blocks the case of Korea as the results of the Table1 below. In Figure 3, we could map the comparable Regional GDP standard, (Index: GDP into 10 blocks the case of Japan and 3 blocks the case of Korea as the results of the Table1 should be subdivided or integrated at the same way.

Table1 Sub-national boundary and Block Areas of East Asian 4 Countries
and all areas of Japan are over the average, therefore there is a notable disparity among these countries. Also the map of 2005 shows that there are differences within each country, for example, among coastal, middle and western inland regions in China, and between central zone and other peripheral areas in Japan and Korea. In addition, comparing as of 1995 and 2005 in Figure 3, we can see the remarkable growth of GDP in coastal and inland areas of China, while Japan has been decreased at the same period. As everybody knows, recent noteworthy economic growth in China also accelerates competition among three countries, while it is strengthening economical, social and cultural relations among them. It is possible to some extent to compare or analyze according to the spatial indexes based on the unit population such as a population density, economical index, and the ratio of green space per person, etc. It is required that regional classification based on the general standard, setting of the statistical index, and other general data setting to analyze the deference of the development among the regions.

3.2 Regions information according to infrastructure development standard and quantity of usage

It is an effective analysis
method to use the statistics of the main institutions or main cities as different spatial information from the regions classification mentioned above. This time simple map conducted using the container traffic in the main international harbor and the passengers of the international airport that the statistical data could be taken (see Figure 4). Figure 4 shows that the airport passengers increases from 1990 to 2000 and the container traffic in the main harbor also trend to increase in five years. These statistical data based on main institutes are very likely to be the acquisition, but these are very expensive or the method of data collecting are different among the countries and there is the case that simple comparison has difficulty. If each country gathering their data under the same definition, and that integrating or updating those into the common seamless map, would be most useful and constructive. In this field, East Asian countries could cooperate and coordinate in the future.

3.3 Linear information like road and railway

Figure 5 shows the idea of the Trans Asian Railway and the Asian Highway. Here a seamless route of the transport in Asia is supposed. The existing or planned route, cut off route, the route with different standard, and not clearly decided route are exist, but this idea will strengthen the sense of Asia into unitary. Figure 6 shows the increasing rate of road development in this region. But, producing the route of transportation map of this region (including roads, railways and international transportation routes of each country) on the Global map or ADC world map are still got some task. Though the existing route data on these maps are not produced by the general information of the design standard of each route, hierarchy, accessibility, etc., therefore there are difficulties to identify certain routes. And to evaluate and assessment the amount of traffic movement, gathering and integrating the statistical data would be expected in the future.
4. CONCLUSIONS

The spatial infrastructure development states are usually in proportion to their economical situation; East Asian region have had big gap in the development condition according to GDP gap. Otherwise, the rapid economic growth in East Asian developing countries pushes up their national infrastructure development speedily. And for the result of this, they have extended their economic growth. The gap of the East Asian countries would be shrinking when the interdependent relationships gradually deepen and the flow of people, goods and information expanded. For the sustainable and balanced development in this region, it is necessary to coordinate with related countries, which can lead strengthening international competitiveness and correcting regional disparities.

As the first step for this consideration, to develop spatial indicator, to analysis trends and to show visually the research results, which are helping understand of East Asian region and each country’s situation, would basically needed. This progress would be helping following
activities, (1) the base for the regional cooperation in spatial development planning, (2) the visual indicator to show balanced development in their region, (3) the education material to bring up identity as an Asian and, (4) the assessment indicator for the concentrated investment to back-warded region.

In this report several maps are created, and discovered following task to set up East Asian Spatial Data Infrastructure, (1) to produce common seamless map from national to regional level for the basic condition, (2) to set comparable regional unit based on population and territory size, (3) to unify statistical unit and comparable regional unit, and data collecting under the same definition and, (4) to broaden common use as a global map integrated with regional statistical data. To implement these processes, cooperation and collaboration with related nations and institutes are necessary.

5. REFERENCES

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