Strategies for Network Cities
explained with the example of South Korea

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Preface

People and industries have concentrated to the big cities to achieve economies of scale. However the problems of this urban concentration become gradually obvious and have limited the development of the metropolises. They are hardly managed by current planning measures. In the diversifying social needs for heterogeneous life styles and sustainable mobility, now it is inevitable to adjust the sustainable space system. As an alternative answerable to this new demand here is suggested an approach of network cities. Even though strategies for network cities were proposed with an example of South Korea, the conceptual approaches can be applied to other countries, especially functionally centralized nations or developing countries which experience now rapid urbanization than any other times.

Until this concept of network cities was made concrete, however the direct and indirect contribution of several important persons was essential. They were willing to discuss with me and give me recommendations. Here I wish my deep appreciation for their kindness.

I thank Prof. Bernd Scholl for not only his scientific support and guidance throughout my works but also his tolerance and encouragement. He suggested me to investigate diverse spatial development plans for city networks in other countries and helped me to think of ideas on network cities. He gave me the opportunity to take part in the symposium on city networks held in Bern, Switzerland and exchange opinions with German and Swiss urban planners. He advised me to develop my concept not by simple and narrow approaches but in long-term and multi-layered perspectives.

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At last I give my thanks to my family, my parents, my younger brother and his family, and my grandmother in the heaven whom I can't ever forget in my heart. They cheered me up, prayed for me, and gave me lots of advice, even though they have scientifically different interest and experience.

Hyun-Suk Min
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Contents

List of Figures

List of Tables

Abstract

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explained with the example of South Korea

People and industries have concentrated to the big cities to achieve economies of scale. However the problems of this urban concentration become gradually obvious and have limited the development of the metropolises. This spatial bipolarization between the wealthy cities on the one hand and low-income rural areas on the other hand causes various problems, which are hardly managed by current planning measures. In the diversifying social needs for heterogeneous life styles and sustainable mobility it is inevitable to adjust the sustainable space system. An approach of network cities is here an alternative to the bipolarization, which can satisfy the today's demands for a balanced but a regionally identified- and sustainable spatial development. Thereby it is not substitutive but complementary to conventional planning methods.

Network cities consist of nodes and links. The cities as nodes supply marginal urban service to their hinterland and the links by transportation and communication connections promote diverse functional interchange between nodes. The establishment of network cities is consequently a central instrument of sustainable spatial development. The system of nods and links encourages the decentralization of metropolitan functions by functionally intensifying regions and peripheral areas. The approach of network cities that is integrated with spatial-, transportation- and ecological factors gives a chance to manage the increasing needs for land use development and contribute at last to the sustainable development. Such an urban network system is based on cooperation between constituent cities that have equal rights. In opposition to hierarchical top-down policies, it requires intensive inter-communal communication. City networks feature not hierarchical instructions but cooperation between autonomous communities by the bottom-up principle.

In this research the strategies for network cities were suggested with an example of South Korea. Thereby the importance of urban nodes in a network structure is identified by attracting industrial investment, revitalizing indigenous industrial heritages, and networking specialized competitive companies, universities and public institutes (industrial cluster). The links are classified with the connection between the agglomerations, between the major cities with regional importance, and inside an agglomeration region i.e. the connection between metropolis, its metropolitan region and rural areas. Hereby the road networks in a grid form should complement functionally the railway connections.

The concept of network cities with an example of South Korea was developed from national and regional requirements. The national approach of network cities encourages the interchange between agglomerations. Network cities in the regional context promote mutual complementation between urban and rural areas and allow though a specific management a compact and integrated land use development by which sustainability can be achieved and urban sprawl controlled. To investigate more exactly influences of the regional urban network system, its effects were separately represented at the micro- and macro-regional level.

Here were studied three scenarios of networked urban system, following this concept of network cities:

- Network cities for the decentralization of a consolidated area by a national access,
- Network cities for the urban growth management in the metropolitan region by a regional access, and
- Network cities for the development of structurally weak rural areas by an over-regional access.

In the establishment of network cities for South Korea, individual projects are tuned up with sectoral- and higher-order spatial plans and coordinated with partner cities in the consideration of their development capacity. This tuning process is accomplished by a development organization that ensures the inter-communal communication, coordination and cooperation for the implementation of network cities. This development organization consists of a planning board, a working-level conference, sectorial working groups, a planning advisory council, and a program monitoring committee. Here the rhythmical working process of this development organization ensures on the one hand a continuous project development and contribute to coordination of individual joint projects and experience and information exchange, on the other hand.

By the "Give and Take" principle urban functions are shared and complemented between the networked cities. Here is aimed that all participants can make profits from the joint projects and compensations for that. It is here a matter that partner cities that profit at expense of a certain city compensate that community with this profit.

In principle a Bottom-Up approach is more appropriate to the character of network cities. In the first phase of implementing a networked urban system however a Top-Down-mechanism is required. Particularly in case of projects of the incipient stage the state can stimulate inter-communal cooperation by financial supports and administrative advices and mediate conflicts between partners. A subvention can be provided for not only pilot projects initiated by the state but also voluntary initiatives. Thereby the feasibility of the voluntarily initiated development concept should be proven at the planning level and its development effects be analyzed. On the other hand, the progress of individual joint projects should be periodically monitored by a program monitoring committee and its assessments be reflected on the decisions of funding distribution and the modification of following programs.

As a networked urban system is satisfactorily implemented, the portion of public grants is to reduce step by step and regional authorities should involve themselves more actively in financing the joint projects for this urban system. Following the beneficiary principle, all participants have to share their administrative- and financial responsibility. The expected growth of tax revenues generated by development activities for network cities and a part of development benefits should ensure the bond to finance the very development projects and programs. Ensuring the marginal urban service in rural areas, a distribution mechanism should be introduced in the establishment of development fund. It is not based on criteria like such as the number of population, but aims at the levy of surplus profits from the joint projects.

Zusammenfassung

Strategien für vernetztes Städtesystem
verdeutlicht am Beispiel von Süd-Korea

Wirtschafskraft und Bevölkerung konzentrieren in den Metropolen, um Skaleneffekte (economies of scale) zu steigen. Zunehmend werden die Probleme dieser metropolitanen Konzentration – gerade auch vor dem Hinblick einer gegenläufigen Entwicklung im ländlichen Raum – jedoch offensichtlich und sind zu einem limitierenden Faktor der Entwicklung der Metropolen geworden. Diese räumliche Bipolarization zwischen den reichen Städten einerseits und den armen ländlichen Gebieten andererseits verursacht diverse Probleme, die mit den gängigen Planungsansätzen kaum zu bewältigen sind. Gerade vor dem Hintergrund der sich ausdifferenzierenden Gesellschaft, ihren heterogenen Lebensstilen und ihrer Nachfrage nach tragfähiger Mobilität, ist eine Ausrichtung auf ein nachhaltiges Raumsystem unumgänglich. Hier ist ein vernetztes Städtesystem eine Alternative zur Bipolarization, die die heutige Nachfrage nach ausgeglichenen und örtlich identifizierbaren nachhaltigen Raumentwicklungen befriedigen kann. Dabei ersetzt der Ansatz des vernetzten Städtesystems nicht das vorhandene raumordnerische Instrumentarium, sondern ergänzt es.

Ein vernetztes Städtesystem besteht aus Knoten und Kanten. Die Städte als Knoten in diesem System sichern die grundlegende Versorgungen (Daseinsvorsorge) des ländlichen Raumes. Die Kanten, also die Transport- und Kommunikationsverbindungen, gewährleisten den Austausch zwischen den Knoten. Der Aufbau eines vernetzten poly-zentrischen Städtesystems ist somit ein zentrales Instrument einer nachhaltigen Raumentwicklung. Das System aus Knoten und Kanten bewirkt die Dezentralisierung der metropolitanen Funktionen durch eine Stärkung der Regionen und des ländlichen Raums. Der Ansatz eines vernetzten Städtesystems, dass die räumlichen, verkehrlichen und ökologischen Faktoren integriert eröffnet die Chance, eine weitere Flächenanspruchnahme für Siedlungs- und Verkehrsflächen zu kontrollieren und trägt somit zur Nachhaltigkeit bei. Ein solches vernetztes Städtesystem basiert auf einer gleichberechtigten Zusammenarbeit der Partnerstädte. Im Gegensatz zu hierarchischen Top-Down-Modellen, erfordert dies eine intensive interkommunale Kommunikation. Somit zeichnet sich ein vernetztes Städtesystem nicht durch hierarchische Anweisungen, sondern durch die Zusammenarbeit autonomer Kommunen nach dem Bottom-Up-Prinzip aus.

In der vorliegenden Arbeit werden die Strategien für ein vernetztes Städtesystem auf das Beispiel Südkorea übertragen. Dabei wird die Bedeutung der städtischen Konten für das Städtesystem an Hand der folgenden Kriterien identifiziert: Neubau von Industriegebieten, Wiederaufbau des industriellen Erbes sowie Vernetzung von Technologiezentren, Industrie- und Handelskammern und regionalen Unternehmen (Industrial Cluster). Die Klassifizierung der Kanten erfolgt mittels der Betrachtung der Verbindungen zwischen Agglomerationen, zwischen Städten mit regionaler Bedeutung sowie innerhalb einer Agglomerationsregion (Verbindungen zwischen Agglomeration, ihrer Region und ländlichen Raum). Dabei sollen die Straßennetze in einer Rasterfeldform die Schienanschlüsse funktionell ergänzen.

Das Konzept des vernetzten Städtesystems am Beispiel von Südkorea wurde aus staatlichen und regionalen Ansprüchen entwickelt. Ein Städtesystem auf staatlicher Ebene forciert die Austausche zwischen den Agglomerationen. Ein vernetztes Städtesystem im regionalen Kontext befördert gegenseitige Ergänzungen des städtischen und des ländlichen Raums und erlaubt durch ein gezieltes Management eine kompakte und integrierte Raumentwicklung, die zur Nachhaltigkeit führt und einer Zersiedlung entgegenwirkt. Zur

genaueren Betrachtung der regionalen Wirkungen wurden die Effekte auf mikro- und makro-regionaler Ebene gesondert dargestellt.

Das vorliegende Konzept untersucht hierbei drei Szenarien eines vernetzten Städtesystems:

- Vernetztes Städtesystem zur Entlastung im verdichteten Gebiet auf staatlicher Ebene
- Vernetztes Städtesystem zur Wachstumssteuerung in Zwischenstadtregion auf der regionalen Ebene
- Vernetztes Städtesystem zur Entwicklung im strukturschwachen ländlichen Gebiet auf über-regionale Ebene

Bei der Umsetzung eines vernetzten Städtesystems für Süd-Korea werden Einzelprojekte mit Sektoren- und Raumordnungsplänen abgestimmt und mit den Partnerstädten im Hinblick auf ihre Entwicklungskapazität koordiniert. Dieser Abstimmungsprozess wird durch eine Matrix-Organisation durchgeführt, die die interkommunale Kommunikation, Koordination und Kooperation der Partner zur Verwirklichung des vernetzten Städtesystems gewährleistet. Diese Matrix-Organisation besteht aus Leitungsebene, zentralem Arbeitskreis, thematischen Arbeitsgruppen sowie einer Geschäftsstelle für Beratung, Moderation, und Evaluation. Die rhythmische Arbeitsweise dieser Matrix-Organisation gewährleistet einerseits eine kontinuierliche Projektabwicklung und schafft auf der anderen Seite Anlässe für die Koordination der jeweiligen Gemeinschaftsprojekte sowie den Erfahrungs- und Informationsaustausch.

Nach dem „Give and Take“ Prinzip erfolgt der funktionale Austausch beziehungsweise die Funktionsteilung zwischen den vernetzten Städten. Ziel hierbei ist es, alle Partnerstädte von den Gemeinschaftsprojekten profitieren zu lassen bzw. Kompensationen auszuhandeln. Es geht hierbei darum, dass Partnerstädte die auf Kosten einzelner Gemeinde profitieren, diesen Profit einsetzen, um den erwarteten Nachteil ausgleichen.

Grundsätzlich ist ein Bottom-Up-Ansatz dem Charakter des vernetzten Städtesystems angemessener. Jedoch bedarf es in der ersten Phase des Aufbaus eines Städtesystems eines Top-Down-Mechanismuses. Besonders bei den Projekten der Aufbau-Phase, kann der Staat durch finanzielle Unterstützungen und administrative Vorgaben interkommunale Kooperation anreizen und bei Konflikten zwischen den Partnern vermitteln. Eine Subvention für nicht nur die staatlich initiierten Pilotprojekte sondern auch die freiwillig engagierten Zusammenarbeiten zur Verfügung zu stellen. Dabei sollte die Realisierbarkeit des freiwillig initiierten Entwicklungskonzepts auf einer planerischen Ebene nachgewiesen und dessen Entwicklungseffekte analysiert werden. Auf der anderen Seite sollte der Fortschritt jedes Gemeinschaftsprojekts regelmäßig von der Geschäftsstelle für Beratung, Moderation, und Evaluation überwacht werden. Deren Einschätzungen sollten sich in der Verteilung der Finanzmittel und der Modifikation der zukünftigen Projekte widerspiegeln.

Im Verlauf der Einführung des Städtesystems ist bei einer zufriedenstellenden Entwicklung der Anteil der öffentlichen Förderungsmittel schrittweise zu reduzieren und die Städte stärker in die Finanzierung der Gemeinschaftsprojekte des Städtesystems einzubeziehen. Nach dem „Beneficiary Principle“ müssen dabei alle Teilnehmer ihre administrative und finanzielle Verantwortlichkeit teilen. Dabei könnte ein Entwicklungsfonds für die Gemeinschaftsprojekte auf Kreditbasis der zukünftigen Steuereinkommen für die Entwicklung des vernetzten Städtesystems eingerichtet werden. Bei der Errichtung der Entwicklungsfonds ist neben der Sicherung der Daseinsvorsorge gerade im ländlichen Raum auch ein Verteilmechanismus zu etablieren, der nicht auf Kriterien wie bspw. Bevölkerungszahl basiert, sondern eine Gewinnabschöpfung durch die Gemeinschaftsprojekte zum Ziel hat.

1 Introduction

1.1 Necessity of network cities and its definition

The cities existed previously, but the cities in the Western Europe since the industrial revolution and the cities in developing countries after the Second World War have grown more rapidly than any other times. Furthermore the development of transportation accelerates the migration of people from rural areas into the industrial cities. This tendency of urbanization will be more remarkable for years ahead in developing countries. According to the UN's reports, in 2015 17 mega-cities of 22 cities with over 10 million persons will be found out in developing countries.

The demographic and industrial concentration has contributed to regional economic development by exploiting out scale economy. Businesses are located in or near at the big cities which supply a wide range of different labor skills and specialized services as well as consuming markets. For the increase of products entrepreneurs reinvest their profits from the big city into neighboring areas along transportation corridors. In this cycle the metropolis has grown up and extends its economic scope to the metropolitan region and even to the whole nation. However this concentration on the other hand brought out national bipolarization between the wealthy cities and low-income rural areas and causes various urban problems; housing and traffic problems, pollution, crime, noise and insufficient energy supplies.

South Korea is also no exception. It has experienced the rapid urbanization since the 1960s and the growth of cities was affected by top-down economic policies concentrating people and industries in several economic centers, in particular Seoul. This biased spatial structure toward Seoul has deepened up on the basis of the strong tradition of centralization in Korean life. Despite of government's diverse trials since 1970s, they couldn't switch the demographic and industrial immigration backed up by the improvement of accessibility to Seoul and its hinterland. As of 2000, Seoul has grown up to the ten-million-metropolis. The reach of Seoul extends beyond its administrative boundary and over 28 million trips go through Seoul a day. The steeply increasing motorization on the other hand accelerates suburbanization in an automobile-oriented form. This urban expansion steps up the pressure on natural heritage in the region Seoul.

Now the advance of globalization and decentralization needs a new approach in the filed of spatial development. It is different from the demographic and industrial concentration to several agglomerations for economic growth, cumulatively in Asian and most of centralized European countries. As an alternative answerable to this new demand here is suggested an approach of network cities. By the cooperative mechanism between cities with different industrial, cultural and natural heritage, network cities achieve dynamic synergy effects. They are aided by fast and reliable inter-communal networks of transport and communication infrastructure. At that time the constituent cities of network cities work together like an urban organism.

Network cities consist of nodes and links. The cities as nodes supply marginal urban service to their hinterland and the links by transportation and communication connections promote diverse functional interchange between nodes. The establishment of network cities is consequently a central instrument of sustainable spatial development. The system of nods and links encourages the decentralization of metropolitan functions by functionally intensifying regions and peripheral areas. The approach of network cities that is integrated with spatial-, transportation- and ecological factors gives a chance to manage the increasing needs for land use development and contribute at last to the sustainable development. Such an urban network system is based on cooperation between constituent cities that have equal rights. In opposition to hierarchical top-down policies, it requires intensive inter-communal

communication. City networks feature not hierarchical instructions but cooperation between autonomous communities by the bottom-up principle.

Korean society has also perceived since the 1990s the necessity of new development paradigms, because the urban congestion is still problems to solve in the region Seoul and obstructs to use economic potentials based on high-quality but relatively inexpensive labor forces in the region Seoul. Even though the lowest fertility rate of South Korea in the World, 1.16 as of 2004, may relieve in the future the overpopulation problems in the region Seoul, but Korea national statistical office speculated the demographic weight of the region Seoul in the whole South Korea will increase from 46.3% in 2000 to 50.8% in 2030. The suburban region Seoul centering on the Gyeonggi province will accommodate most of demographic growth. Consequently the current participatory government tries to take decentralization policies more actively and enacted in 2004 three special laws: national balanced development, decentralization of authority, and construction of a new administrative town[1] which was passed despite of the strong resistance of Seoulites in March 2005.

An approach of network cities can be applied to South Korea to restructure the national territory in a poly-centric and sustainable way. Networking cities can be triggered by KTX (Korean Train eXpress) making now the whole South Korea half-day zone and express-public-transit-service in the region Seoul. Networked urban system may intensify the effectiveness of three decentralization laws by creating at the national level an urban organism composed with autonomous metropolitan regions, cities and town, and rural areas, of course, inclusive a new administrative town. It will satisfy the demands of diverse and more qualified life styles by sharing regionally identified natural and cultural heritage between constituents and promote mutual economic cooperation based on unique and intellect-intensive industries by exchanging persons, materials and information. Meanwhile the region Seoul supported in the form of network cities can relieve current congestion, manage urban growth in the sustainable way and exploit out the efficiency of existing infrastructure.

[1] Korean government plans to construct a new administrative town with a population of about 300-500 thousand in the Chungchoeng province which is easily accessible within the half-hour from any major Korean cities by the KTX (high-speed-railway). Now the site of this new town is determined and its construction will begin from 2007. All government offices except the Blue House (presidential residence), National Assembly, the Supreme Court, and six ministry departments of military, foreign and domestic affairs will move from 2012 up to 2014.

1.2 Aim and process of research for network cities

Strategies for network cities were suggested in this research with an example of South Korea. They will contribute to

- converting the current mono-centric structure of region Seoul,
- strengthening the functions of other metropolises as global gateways,
- making more attractive urban milieu by renewing functionally obsolete and disharmonious inner city areas, and
- protecting and restoring the natural environment

Networking Korean cities was suggested cumulatively in support of railway connections, which can reduce ecological impact and encourage the sustainability through intensive urban development on transportation nodes. The railway connections are complemented by road networks in a grid-form.

Even though strategies for network cities were proposed here with an example of South Korea, the conceptual approaches can be applied to other countries, especially functionally centralized nations or developing countries which experience now rapid urbanization than any other times.

To make strategies for network cities the research has proceeded through the following flowchart. (Fig. 1-1) In chapter 1, the necessity of network cities was underlined as a new land use paradigm to secure distinctive regional features with cultural and natural heritages and strengthen the regional competitiveness by complementing urban functions between these unique regions. Along with the definition of network cities, the aim and process of research for urban network strategies was also suggested, too.

To form the theoretical and practical bases for a concept of network cities diverse network-relevant theories and instruments were studied in chapter 2. First the main ideas of theories and concepts were analyzed focusing on not only inter-city connections as rods but also development of urban areas as nodes. They include transportation and ecological approaches as well as spatial planning schemes. Next policy- and financial instruments were studied centering on their effectiveness proved in land use, transportation and environment management.

UN estimates about 60 percent of world population will nest in the cities by 2030. However the urbanization causes urban congestion and sprawl. In chapter 3 the sustainable development is suggested as a solution to make a stable relationship between human activities and the nature. It can be realized in form of poly-centric urban networks. This new land use paradigm is reflected on the national- and regional land use approaches of other countries, no matters whose spatial structure is concentrated or decentralized. Here was studied Germany, Switzerland, U.K., France and Japan at the national level and the region Stuttgart, the region upper Rhine, the region London, the region Paris, and the region Tokyo at the regional level in order to understand diverse applications of these new approaches from different demands and perceive something in common, centering on European and Asian countries with long history of spatial planning.

To establish new land use strategies for network cities, in chapter 4 the urban development patterns in South Korea were analyzed at a national- and regional level focusing on the region Seoul. The urbanization of South Korea was investigated since 1876 and a current long-term perspective to make a decentralized network structure was argued, centering on the 4th comprehensive national territorial plan. In addition to regulative land use policies the spatial development patterns in the region Seoul were studied in particular by the statistical analysis. And the statistically analyzed data was simulated by a GIS-program.

Depending on the tendency of spatial development analyzed in chapter 4, strategies for network cities were suggested in chapter 5. First in the context of the whole South Korea, approaches for urban networks were suggested and detailed at the (over-) regional level, focusing on the region Seoul and a new administrative town in the Chungcheong province.

Reflecting the theoretical and practical studies with an example of South Korea, the development criteria for network cities and the development procedure were suggested in the chapter 6. Additionally implementation measures were proposed focusing organizational and financial points.

In chapter 7, the suggested approaches for network cities were briefly digested and several important organizational points for the implementation of concepts were emphasized.

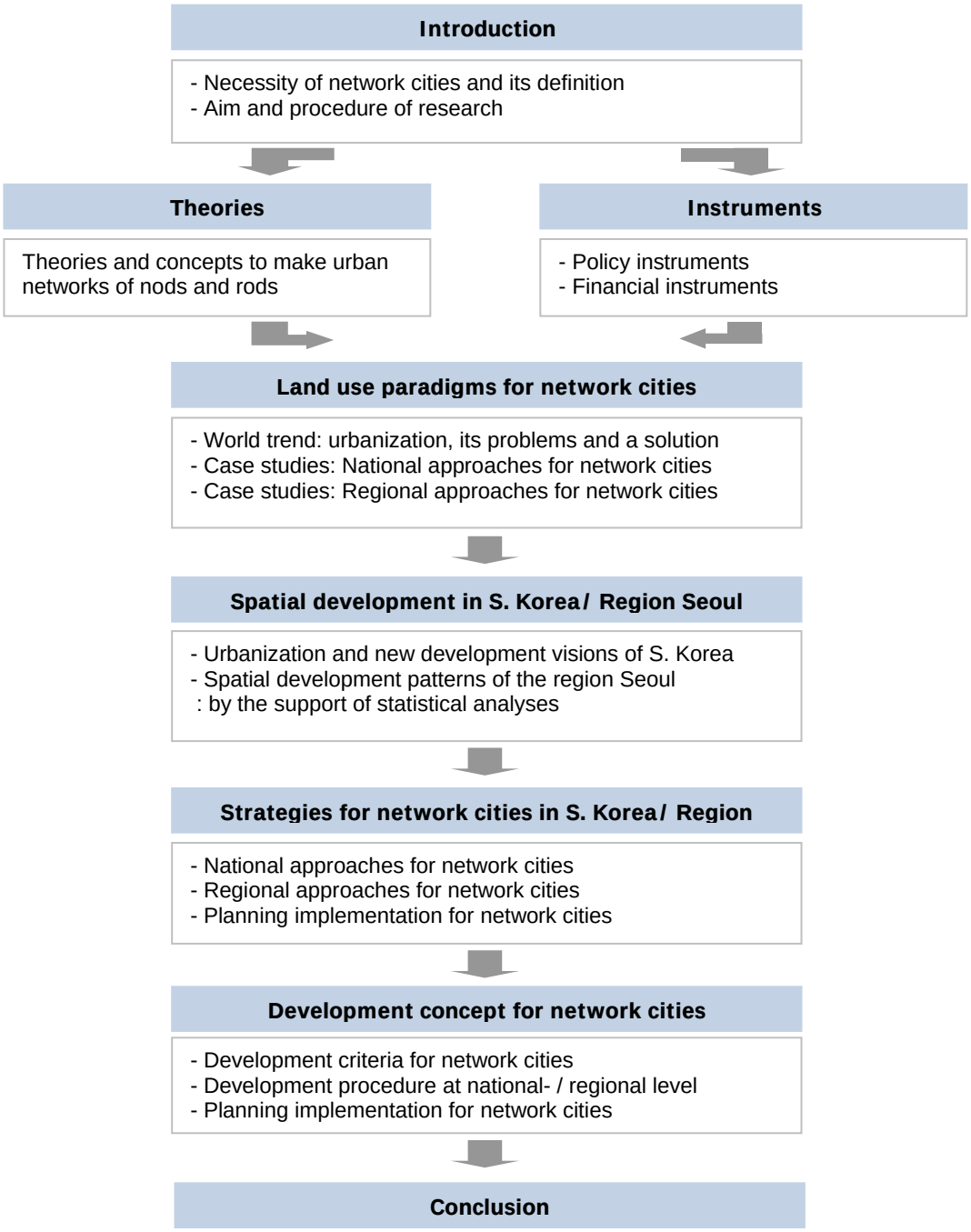


Fig.1-1 Procedure of study

2 Theoretical and instrumental background for network cities

The concept of network cites can't be mapped out by one theoretical approach and realized by a single policy- and financial instrument. It is an integrated approach with spatial-, transportation-, and ecological factors. Because network system is a complex configuration of diverse urban nodes and urban connections between them, network cities can't be also made simply focusing on either the development of urban nodes or the development of urban links by transportation and communication connections.

The network cities are not a theoretical concept but a practical approach for balanced and sustainable development which intensifies regional competitiveness and ensures the same satisfaction of qualified urban life between not only regions but also generations. The urban networks should be implemented in the tailored ways, following a development purpose, such as aiming at the development of urban networks for highly-congested city centers, sprawled suburban areas, or peripheral areas, and depending on an approaching level, i.e. designing city networks at the national level, macro-regional level, or micro-regional level.

To achieve the aforementioned objectives first several land use theories and concepts were studied. They include transportation and ecological approaches as well as spatial planning schemes and concern the functional interaction and mutual connections not only between spatial nodes which include metropolitan regions, metropolises, cities and towns, rural areas, and even transportation- and ecological hubs, but also in the inside of a spatial node.

Centering on their effectiveness proved in land use, transportation, and environment management, next some practical instruments in the policy- and financial points were investigated. They help to achieve a concept of network cities ensuring sustainable spatial development with functional diversity and reducing potential use of motorized vehicles as well as accommodating increase of mobility with public transits.

In particular the measures on how to finance urban services and particularly how to estimate the amount to be charged have an impact on urban growth patterns. They contribute to financing urban networks by public authorities who underlay now in investment constraints. So the financial tools should be interlocked with the planning objectives and their institutional measures.

2.1 Theories and concepts

2.1.1 Functional interchange and mutual connections between urban nodes

Network theory

Network theory is distinguished from conventional concepts cumulatively the central place theory. By the interactive mechanism between cities with different industrial, cultural and natural heritage, a selective urban coalition achieves dynamic synergy effects. This selective urban coalition is practically formed by a self-organized regional cooperation between in fact autonomous participants who have equal rights. Here a hierarchical spatial structure plays no longer its ruling roll. Namely, urban network system is a hybrid form or a symbiosis between diffusion (decentralization) and fusion, but metamorphic one under changing internal and external milieu. (Batten 1994, Sinz 1999: 23, Messner 1999: 15-16)

Central place system	Network system
- Centrality - Size dependency - Tendency towards primacy and sub-ordinance - Homogeneous goods and services - Vertical accessibility - One way flows	- Nodality - Size neutrality - Tendency towards flexibility and complementarity - Heterogeneous goods and services - Horizontal accessibility - Interactive flows

Source: Nahm, Kee-Bum 2002

Tab.2-1 Comparison between the central place system and the network system (David F. Batten)

City networks include at least two different connection types which are de facto integrated in them;

- Physical networks, i.e. the connections of goods and persons. Here correspond above all transportation- and telecommunication system, water- and the power supply connections, and sewage- and disposal facility networks.
- Organizational networks in a form of inter-communal cooperation. They are usually understood as control- and development instruments of physical networks. They are introduced to connect cities with a certain purpose and exploit out synergy effects.

Depending on the location of cities in a network city networks can be additionally divided with intra-regional city networks on the basis of spatial proximity and inter-regional city networks in the focus of functional specializations over a certain geographical distance. (Jurczek 2001:106)

What makes network cities different from a group of cities is that the cities are connected in some systematic ways. In other word, they form a network. The simplest form of a network may be though of as a configuration of nodes and links. Nodes are specialized functions with the need of interaction from which the potential synergy could be achieved. It can be commercial-, industrial-, and residential centers as well as urban service facilities, for example, university, hospital, parks, cleaning equipments, etc. Links are individual transport infrastructure such as canals, railways, and roads and the related modes, e.g. ships, trains, automobiles, bicycles and foot. (Batten, Casti & Thord (Eds.) 1995: vii, 195, Kim, Hyun-Soo et al. 2002)

Network cities evolve from two or more independent cities, aided by fast and reliable corridors of transportation- and communication infrastructure. But networked urban system is made not only between cities in the same size and spatial structure but also with partners categorized differently, as long as there are criteria of equality and common objectives by the support of consensus. (Bundesamt für Bauwesen und Raumordnung, 1999: 5) On the other hand, city networks are not regional connections based on the administrative units. The interregional relations that are dynamically weaved with each other change ceaselessly and that makes an administrative access useless. (Sinz 1999: 28-29)

Network cities solve their common problems and share the responsibility for them by discursive planning methods, so they are differentiated from the spatial dichotomization between the center and its periphery. Depending on functional cooperation which is not competitive but complementary, the networked cities supply more specialized services, cumulatively environment- and knowledge-based ones that a conventional hierarchies based on the central place theory did not offer due to the limitation of purchasing power supported just by its hinterland. Now these urban networks transcend national borders and the patchwork of creative urban agglomerations developing at key locations around the world becomes increasingly similar to the patchwork of dense production agglomerations, linked by an extensive system of inter-regional transactions. (Batten 1994)

The approach of network cities has several important features differentiated from conventional land use development models. It is an informal and supplementary instrument to the current spatial planning. Instead of a holistic plan, it is project-oriented one. Therefore it focuses on “process” (flexible) rather than “product” (concrete), but there is not always just progress. A setback or even the disintegration of urban network is possible, too. However it is not limited to a narrow and short-term measure. If the cities carry out this approach by mutual cooperation and with their own autonomy, the comprehensive and long-term development can be treated by networked urban system.

On the other hand, network cities prevent the polarization to several agglomerations and encourage the regional development in peripheral areas. They contribute to the sustainable development, too. Through city-networking cities coordinate their projects which can overlap or conflict with each other and manage the development activities considering their effects on all networks. (Kim, Hyun-Soo et al. 2002) At last they develop a net and mosaic urban structure which provides not a same physical urban milieu but a same satisfaction of urban life.

The formation of city networks is usually triggered by an initiative from bottom, but on an occasion it can be stimulated by the top-down process, when central- or local authorities grant subventions or mediate inter-communal conflicts, particularly in the first phase of an urban network. (Adam 1997, Priebs 2001: 126-127, Jurczek 2001: 107, Mehwald 1997: 477)

Even though the concept of network cities is endorsed by local- and central authorities, nevertheless its approach to individual projects should be made in tailored ways to the needs of respective project areas. Depending on the development aims the roles of network cities are differentiated: network cities for the decentralization of a consolidated area, network cities for the development of structurally weak rural areas, (Adam 1997) and network cities for the management of urban sprawl (Zwischenstadt).

Network cities exploit out the regional potentials by complementing urban functions with neighboring communities or regions, but they have some weak points:

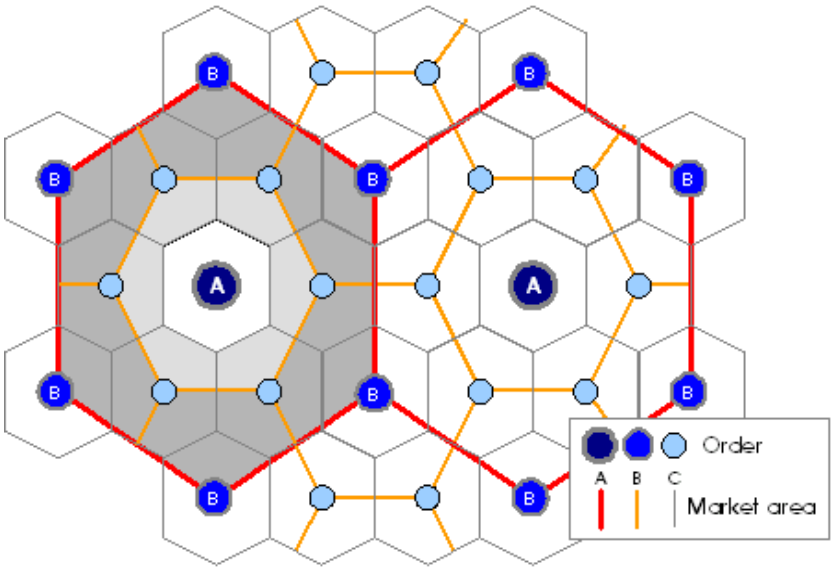
- Communities between urban meshes come into an offside situation.
- Lots of cooperation makes difficult to coordinate them. So an ad-hoc-organization, if necessary, should be introduced.
- Even though network system is formed on the basis of cooperation between communities with same problems or demands, the voices from small cities participating together in this urban coalition can be ignored. Therefore complementary measures should be taken, in order that no sanctions can exist particularly against those dissentient communities.
- Political- and legal problems arise from networking cities, in that urban networks are usually informal and introduced on the basis of consensus, and it has no authorization to make long-term decisions and take financial measures. Therefore it is particularly important that political representatives from communities participate in a network process, but urban networks must have still no formal competence.
- Land use planning involves intensively in a network process, but informal and ad-hoc approach of urban networks has no connection with this institutionalized land use planning at the regional or national/ federal level. (Priebs 2001: 124-128)

Central place theory

Central place theory takes its origin from the work of the German geographer Walter Christaller who studied the urban system of Southern Germany during the 1930s. He was mainly looking for a relationship between size, number and geographic distribution of cities. Although his work provided more than a theoretical framework, since he applied his theory to Southern Germany, the theoretical part had the most impacts on geography. His observation has been elaborated thereafter by researchers from urban, economic and transport fields.

Central place theory tries to explain the spatial distribution of urbanization. This pattern is best understood by a central place and its market area. The central place is specialized in supplying various goods and services to the surrounding population and the market area is a sphere of the settlement of consumers traveling to the central place which has the main function to supply goods and services. (Hofstra University 2004)

The central place model generates a hierarchical system of cities and it is in the sense that there are distinct types of cities and distinct patterns of trade dominance: The larger the city, the more diverse goods and services (inclusive of physical and social infrastructures). Each city imports goods from higher order cities and exports goods to lower order cities. Cities of the same order do not interact. (O'Sullivan 1995: 105-111)



Source: www.people.hofstra.edu/geotrans/eng/ch7en/conc7en/centralplacestheory.html

Fig.2-1 Concept of central place theory

In Germany the central place concept based on this theory is one of important instruments to make the equivalent living condition for all people by the support of basic urban facilities such as infrastructure, industry, cultural- and administrative services and reduce a floating population to the cities. Depending on the economical importance to the urban structure, the degree of centrality is determined. Based on the definition by MKRO (Ministerkonferenz für Raumordnung) in 1968 the central place concept is constituted with four-tier hierarchical system: high-order-center (Oberzentrum), intermediate center (Mittelzentrum), under-order-center (Unterzentrum), and small center (Kleinzentrum). However the regional planning in the most of German states regulates the land use development with three layered system: high-order-center, intermediate center, basic center (Grundzentrum). (Bundesamt für Bauwesen und Raumordnung 2005: 251)

Definition of urban center

- High-order center: a perceived cluster of high-grade, specialized cultural, social and political facilities of supra-regional significance with more than 100,000 inhabitants
- Intermediate-order center: a perceived cluster with 20,000-40,000 persons providing a broad range of infrastructure to serve residents and economic actors of regional significance
- Under-order-center: a perceived cluster with supply facilities and amenities capable of serving all the basic needs of the local population. Here lives at least 6,000-15,000 population and its development is important especially for rural areas
- Small center: a perceived cluster with at least 3,000-15,000 persons. It offers basic conditions for the commercial- and residential development in the periphery (Blotevogel (Hrsg.) (2002: LIV), Stiens & Pick (n.d: 5-7), http://www.umweltdatenbank.de/lexikon.htm)

Note: the definition of population size is different in each German state.

Instrumental significance for action areas

	instrumental significance of the central places concept for steering spatial development in key action areas			
	settlement structure	transport	supply	private industry
metropolitan region	very low	great	very low	great
high-order center	low	great	very low	considerable
intermediate-order center	great	considerable	great	low
under-order/ small center	great	considerable	great	low

Source: Blotevogel (Hrsg.) 2002: LIV (modified)

Note : Metropolitan region is a regional agglomeration of central facilities of international significance (corporate headquarters and services, financial sector, transport, science and research, culture and media)

Tab.2-2 Instrumental significance of central place tiers for key action areas

Tab.2-3 Definition of urban center in the central place concept

According to the hierarchical level of each place, the urban facilities are located, but all private or public facilities with central meaning need not be placed definitely in the corresponding hierarchical centers. They can be shared with several centers in the frame of central place theory (MKRO 2001). (Tab.2-4)

Furthermore the central place concept is applied to decide the subventions - particularly for under-order- and small centers - in the context of urban structure and location policies as well as the construction of transportation networks. (www.bbr.bund.de 2004b)

However the central place concept is now in the need of reversion. It doesn't control properly the urban sprawl. Its rigid hierarchical arrangement of urban facilities prevents the functional specialization and -sharing with other cities by the free market competition and leads to lose a regional affection as well as a regional identity, that make easy the exodus to the high-order centers. The current financial support in the frame of central place concept is just focused on the individual cities and communities, not on the urban consortium in the cooperation with cities and communities having a common goal.
(www.isl.uni-karlsruhe.de 2003)

Despite of the critiques the central place concept can contribute to sustainable development in the spheres of settlement structure, supply, transport and private industry. It can also provides a conceptual basis for the European leitbild referred to as “urban regions with short ways”, i.e. the planning paradigm oriented to poly-centrality, functional mix, minimization of traffic, and preservation of compact settlement structures as means of safeguarding open space.

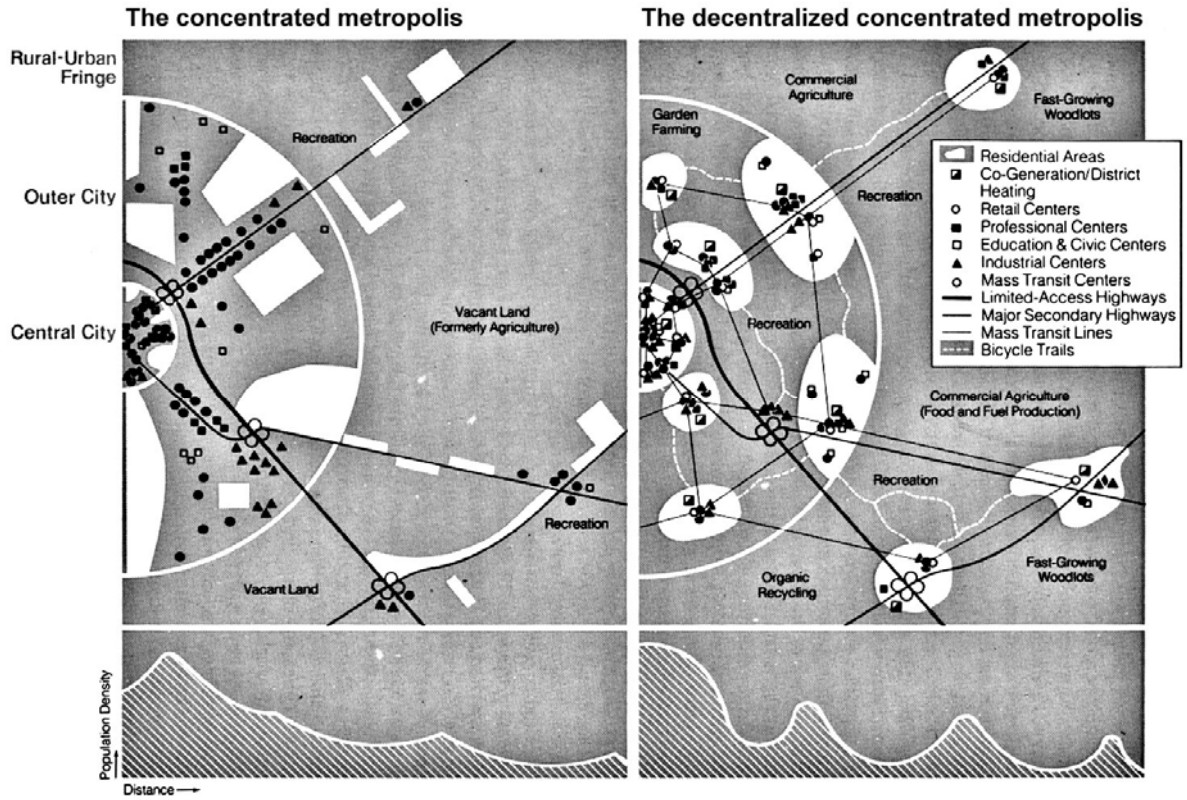
Centrality level	Strategic functional sizes (in the fields of urban facilities, transportation, residence, and economic)	Instrumental points/ Concrete examples
High-order centers (Oberzentrum)	- Institutional cluster with national and regional importance	- University, - Institutions for innovative transfer
	- Political- and economic functions for the specialized labor market with regional and national interchange	- Location of conglomerates - Specialized service companies - Location of regional governments
	- High-qualified cultural- and leisure services/ Agglomeration of various cultural functions	- Theater for permanent ensemble - Cultural- and meeting events hosting regularly in every season - Various forms of alternative culture
	- High-qualified transportation infrastructure	- Logistic- and distribution center, - High-speed railway station
	- Post sharing high-order functions in the polycentric spatial structure	- City center with department stores - New commercial centers such as shopping malls - Distinct centers with greater reaches
Intermediate centers (Mittelzentrum)	- Regional education and training function	- Schools at the secondary level - Special school - Public library
	- Central functions for culture and leisure	- Complex hall, public swimming pool, amusement areas near at home
	- Over-regional transportation connection	- Connection with long-distance railway service - Knot of public transit
	- Central retail- and service function	- City center with broadly based retail- and service functions, pedestrian zone
	- Facilities of welfare	- General hospital, special medical doctors
	- Compact city	- Containment of residential development activities supported by public transit and (inter)communal commercial services
Under-order and small centers (Unter- und Kleinzentrum)	- Communal (or basic) education and training function	- Education and training center for adults - Communal library
	- Communal (or basic) urban function for daily life	- groceries - Private practice, family physicians

Source: Gather (2003: 214), http://www.region-oberpfalz-nord.de/b_a03.htm

Tab.2-4 Strategic functional sizes and corresponding facilities for the central place system

Decentralized concentration

To control the urban sprawl over the administrative boundary of the city the decentralized concentration model suggests the additional construction be permitted only in the area aptitude to the sustainable development. The urban form of decentralized concentration creates better conditions for bundling traffic and infrastructure, and makes settlement units equipped with the mechanism of efficient urban services. If the other urban facilities support settlement units without functional conflicts, then they can be developed compactly. (Miosga 2004)



Source: S. Brown and J. Williams (1983)

Fig.2-2 Decentralized concentration

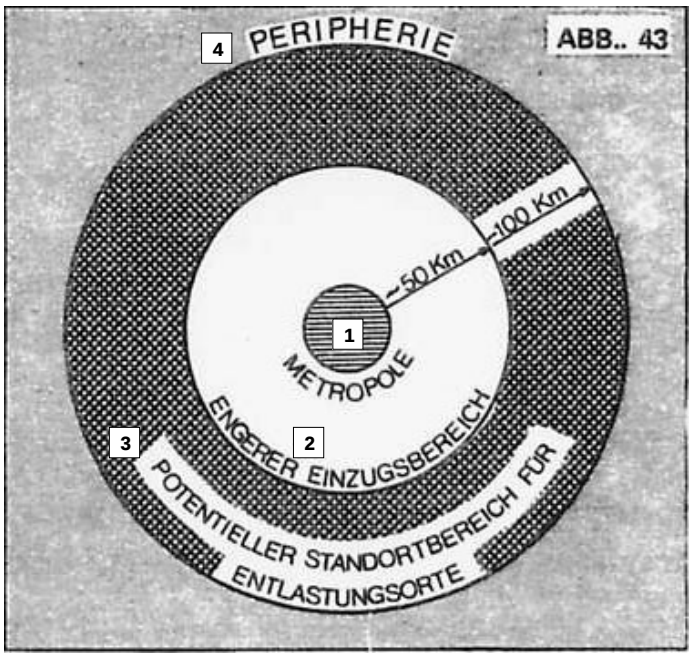
This model can be used for two different planning concepts:

- A development concept for a region in rural areas: regional potentials and development activities can be concentrated on regional centers in the countryside. They should be equipped among other things with high-level urban services and functions supporting a growth pole of a region.

- A spatial restructuring concept for the decentralization in the periphery surrounding the metropolis: a regional center for functional decentralization in periphery of the metropolis should be controlled to discharge the metropolitan functions and the principle of the use mixture must be introduced to prevent the dispersion of settlement development around this regional center in the future.
  (www.bbr.bund.de/raumordnung/raumentwicklung/inf_konzentration.htm)

Establishment of a new growth pole (Entlastungsort)

This is a strategy for allocating a part of development potentials in the metropolis into a new growth pole in its surroundings, but a new growth pole must be (relatively) autonomous. The new regional centre can accommodate migrants from rural areas and supply entrepreneurs with alternative locations, where unwanted urban congestion and its agglomerative disadvantages can be solved.



Concept of a new growth pole

Source: Hennings et al. (1980)

1 Metropolis
2 Direct reach of metropolis
3 Feasible zone of a new growth pole
4 Periphery

Fig.2-3 Concept of a new growth pole

Considering the development pattern of land use and infrastructure, a new growth pole has to be set up in the buffer zone between the metropolis and its periphery. The regional centre must be so far from the city core that it can achieve functional independence and encourage the development of its hinterland. It is recommendable to set in 50-100km radius zone from the central city.

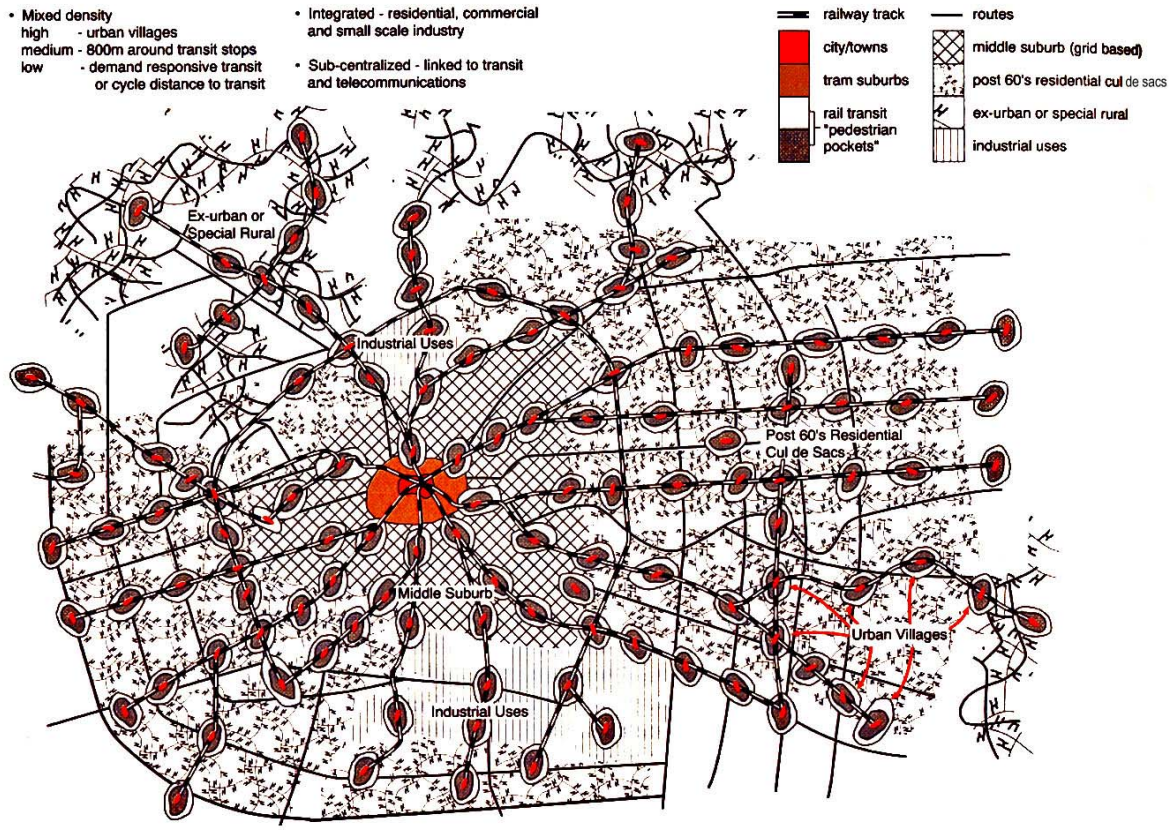
Meanwhile the restructuring of an existing regional core can revitalize its regional economy and utilize its local resources more properly. The determinants for that must be taken up and carried out on the basis of systematic subvention. Comparing with residential development on the green meadow, it is apparently advantageous.

The pulling effect of the metropolis is rather far noticeable particularly along the arterial roads. Along them smaller and larger activity centers are already rapidly urbanized. The connections of urban core will help taking advantages of a strategic concept, “release of urban congestion but proximity to the centre”. However the transport cost and the physical distance may not hinder interactions between the metropolis and its new growth pole.

In the planning of a new growth pole, the existing social communities should be identified, since their local meaning and their political influence affect development plans crucially. If it could be possible to attract political interests from residents, receive their support for planning of regional centers and cooperate with them, the first step is already taken for the strategy of a new growth pole. (Hennings et al. 1980: 77-115)

Transportation corridor design

The design of a metropolitan transportation corridor indicates a significant movement toward new corridor typologies that balance multiple travel modes and trip types, integrate transportation and land use planning, and identify new corridor design types that serve the diversifying needs of metropolitan regions and local communities. Creating unique areas with highest level of activity, diversity and complexity, transportation corridors can function as the critical connection points, where the greatest interaction occurs between transportation, urban form and natural systems that are three primary structural components of metropolitan transportation corridors.



Source: UN (1996)

Fig.2-4 Transportation corridor design

It integrates proactively the broader elements of corridors including

- travel route's capacity for multiple transportation modes,
- connections to adjacent movement,
- relationship to surrounding land use patterns and scale,
- local community character, and
- impacts on natural systems and landscapes.

Based upon the corridor typologies and the integrative approach to transportation, urban form and natural systems design, four metropolitan transportation corridor types are proposed: regional expressway, sub-regional exclusive transit ways, metropolitan arterial boulevards and urban connector streets. (Hubert H. Humphrey Institute of Public Affairs 2003)

	Function	Relation with transportation infrastructure, urban form and natural systems	Relation with mobility and accessibility	Responsibilities
Regional expressways	Principal arterial	Dominance of transportation infrastructure	Mobility over accessibility	State/federal gov.
Sub-regional exclusive transit way	Rapid transit with exclusive routes	Dominance of transportation infrastructure but integration desirable	Minimum access points	County/state/ federal gov.
Metropolitan arterial boulevards	Minor arterial	Balance	Favored movement, but more in balance	City/county/state
Urban connector streets	Minor arterial and collector	Integrated and compatible	Prioritization of access over movement	City/county

Tab.2-5 Hierarchy of transportation corridors

Green infrastructure

The green infrastructure is a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working lands with conservation, not only to restore and preserve the nature but also to promote the more efficient and sustainable land use development. However its systems do not require or even imply public ownership of all the land. Clearly the privately owned land, particularly working farms and forests can play an important role in any green space system.

At the parcel level the green infrastructure could mean designing homes and businesses around green space and at the community level creating greenways to link existing parks. At the state-wide level it might be protecting broad wildlife movement corridors to connect state and national forests.

The green infrastructure is a new term transforming open space from "nice to have" to "must have", but it’s not a new idea. Green infrastructure has its origin in two important concepts:

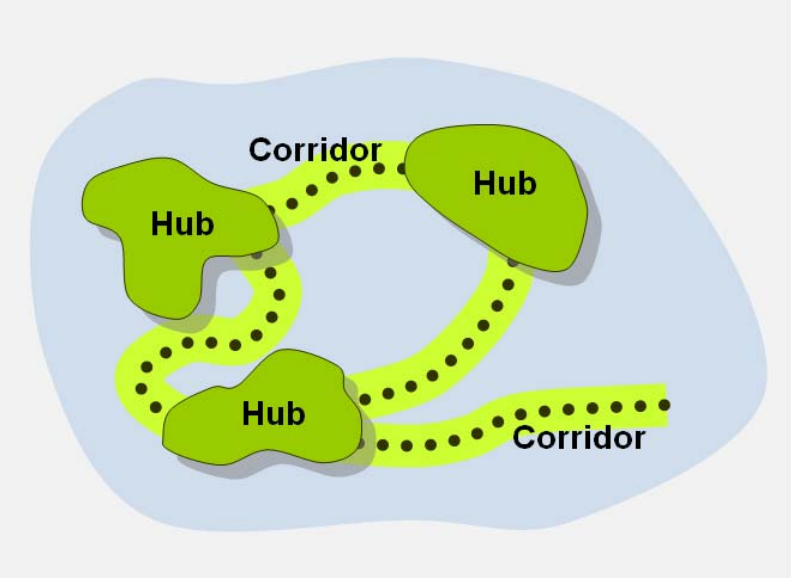
- Linking parks and other green spaces for the benefit of people, and
- Preserving and linking natural areas to benefit biodiversity and connect habitat fragment which is a key concept for the science of conservation biology and the practice of ecosystem management.

It is made up with hubs and links. Hubs anchor the green infrastructure network and provide an origin or a destination for wildlife. Hubs include reserves (national and state parks), managed native landscape (large publicly owned lands), working lands (private farms, forest, and ranches), regional parks and preserves, community parks and natural areas. Meanwhile links are the connections that tie the system together and enable green infrastructure networks to work: landscape linkages (large protected natural areas that connect existing parks, preserves or natural areas and provide sufficient space for native plants and animals to flourish, while serving as corridors connecting ecosystems and landscapes), conservation corridors (river and stream), greenways, greenbelts, and eco-belts (buffer zone of tension between urban and rural land use).

The green infrastructure can be designed to shape an urban form and provide a framework for growth. It works best when the framework pre-identifies both ecologically significant lands and suitable development areas. However the green infrastructure planning should be the first step in the land use planning and design process. It must be coordinated with programs that focus on growth and development. It requires cooperation across multiple jurisdictions with stakeholders such as different agencies, nongovernmental organizations and the private sector.

The green infrastructure should be:

- designed holistically,
- planned comprehensively,
- laid out strategically to cross multiple jurisdictions and incorporate green space elements at each level of government,
- planned and implemented publicly,
- grounded in the principles and practices of diverse professions such as landscape ecology, urban and regional planning, and landscape architecture, and
- funded as a primary public investment rather than with money that is left over, after all other services have been provided. (Benedict & McMahon 2001: 5-31)



Source: www.greeninfrastructure.net

Fig.2-5 Concept of green infrastructure

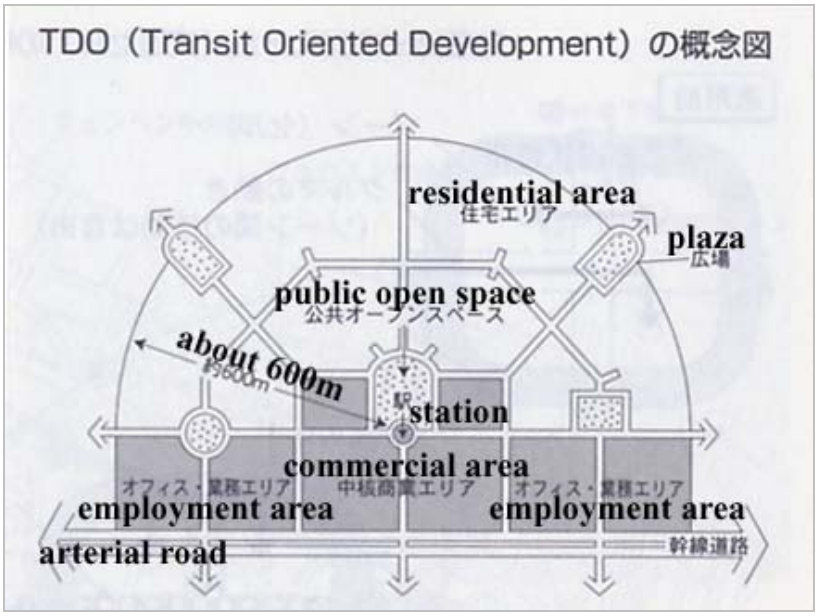
2.1.2 Functional interchange and mutual connections within urban nodes

TOD (Transit-Oriented-Development)

Peter Calthorpe proposed the famous TOD model. The TOD concept may be applied to infill sites, re-developable areas, and urban growth areas where new development is envisioned. The basic principles of TOD are to

- organize growth on a regional level to be compact and transit-supportive,
- place commerce, housing , jobs, parks, and civil uses within walking distance of a transit stop (a minimum average residential density of 12 units per acre, and commercial uses with a high level of pedestrian activity),
- create the pedestrian-friendly street network which directly connects a transit stop and the core area without use of an arterial,
- provide a mix of housing types, densities, and costs,
- preserve sensitive habitat, riparian zones, and high quality open space,
- make public space the focus of neighborhood activities, and
- encourage the urban infilling and redevelopment along transit corridors within existing neighborhoods.

The TOD site must be located either on an express transit system or on a feeder bus line network within 10 minutes transit travel time from the express transit system. Its site must be at least 40 acre and within one-quarter mile from a transit stop. The infill and redevelopment site in a viable TOD site has the advantages of adjacent development and existing infrastructure, but it can be at least 20 acres, of which 80% is vacant or developable land to allow TOD to function effectively. Meanwhile the greater the number of property owners, the more difficult it will be to reach consensus on plans. The cooperation with property owners and the jurisdiction therefore is required to formulate development plans and implement them for the entire site.



Source: Peter Calthope, *The Next American Metropolis*, 1993

Fig.2-6 Concept of TOD

Further, each TOD will have an adjacent secondary area that includes land in no further than one mile from a transit stop. It may have lower-density housing, public schools, community parks, and P+R lots. The secondary area is intended to provide for uses that are not appropriate to TOD because they are auto-oriented. (California department of transportation 2002: 1-3)

Compact city

The compact city is not a concept that indicates the scale of a city such as its population, built-up area, or open space. It refers to a state in which the density of the city functions is adequately constituted, with the environmental loads and the growth of the city being kept well balanced. (Harasawa)

As the crucial criteria for compact city policy, the following components are identified:

- Minimum densities that guarantee the viability of user-friendly public transit and of neighborhood retail and services within walking distance.
- Multi-functionality through integration of land uses.
- Concentration of development in nodes: the compact city structure is ideally envisioned as hierarchical with each node attempting to strike a balance of housing, employment and subsidiary functions in order to maximize the share of activities that can be pursued locally.
- Transformation of urban mobility: guided by the experience of low motorization in existing high-density, mixed-use districts in European cities, it is recommended that traffic be calmed by both speed and volume and parking provision be considerably reduced. This will deliver attractive street environments that encourage non-motorized mobility and preserve green spaces even at relatively high densities.
- Congruence of spatial-functional structure and public transit system.
- Station areas as catalysts for development. (Institute for Sustainability and Technology Policy 2001: 172-173)
- Self-containment. (Kaji 2003: 3)

For the compact city to be sustainable, however some conditions listed below is vitally needed.

- Slow growth of population: If the growth of city was rapid, then the development for renewing the existing city will not catch up with its growth.
- Preparation of sufficient development expense: The compact city does not match step-by-step development, as it dose not function until whole packages are ready. Therefore it will need quite large money for development.
- Strong leadership for policy implementation: For the compact city to be sustainable, the life style of residents also needs to be changed as such for saving resources, minimizing discharge, and enhancing recycling. Therefore it will need the powerful administrative guidance. (Kaji 2003: 3)

A sizeable body of research provides evidence to the notion that users of compact urban areas produce significantly less automobile travel than those in dispersed areas at a fixed point in time, but the issue becomes more complex in the context of long-term spatial development patterns which clearly move into the direction of ever increasing inter- and intra-regional interdependency. (Institute for Sustainability and Technology Policy 2001: 186)

Urban village

The urban village concept has emerged in response to the increasingly diffuse settlement patterns that have developed in North America as a result of a largely unconstrained land supply and the mobility afforded by universal car ownership. Urban villages reflect the characteristics of the historic settlements in the early twentieth century, which clustered around train or trolley stations and main streets.

An urban village is designed around a central communal area with a mix of uses and activities not to be dependent on car transport. A building is constructed along the street and its density is generally high. Streets provide the direct routes to houses, jobs and services. The community size is suggested to accommodate a diverse range of income levels and age groups within walking distance. Bicycle paths and direct footpaths encourage non-motorized transport.

The emphasis on transit, walking and cycling helps to reduce the use of fossil fuel and emissions resulting from it. An ample supply of open space, parks and green areas provides a pleasant natural environment. Land parcels may be smaller than the standard suburban subdivisions but energy and water use lower.

An urban village needs public center to anchor its central focus. It could be a community office, a fire station or a post office. The involvement of private sector can be considered to solve the financial shortage and achieve an efficient project operation.

However the most promising candidate for the urban village model is the area, where a central hub already exists, but its development density makes the potential of urban renewal in combination with a commercial node.

The urban village concept is valuable as it encourages human scale design features, higher densities, environmental improvements, mixed use and opportunities to use transits instead of cars. Developments based on the urban village concept offer a new choice of housing and lifestyle and potentially an improvement in quality of life. (Hingston 2003)

2.2 Policy instruments

2.2.1 Land use policies

Urban development priority

The designation of urban priority area makes development and infrastructure investment concentrated by support of cooperative partnerships with neighboring communes and promotes the urban regeneration. The diverse regeneration programs which are funded from a variety of sources and planed with their specific focuses and targets should be coordinated particularly through the community strategy to achieve fundamental improvements in social, economic and environmental conditions in the urban priority areas. Communes should cooperate to improve transport choices within the urban priority areas, in particular public transport, cycling and walking facilities, too. (Sefton council)

Urban renewal

As an essential first step towards a compact and sustainable city, it is important to revitalize an existing inner city area. In particular the residential component needs to be strengthened in the CBD which has commonly tended towards the retail- and office-dominated mono-structure in the past decades. An employment and commercial area in the city center should be easily accessed by the radial and orbital public transit routes. The taxation and housing subsidies might be altered to reflect this political preference by rewarding compact inner city development and penalizing activities inducing dispersion. (Institute for Sustainability and Technology Policy 2001: 173-174)

The main goals of urban renewal are to

- prevent green field development, revitalize obsolete and functionally disharmonious areas and exploit not-fully-utilized areas,
- improve insufficient and derelict infrastructure in the inner city area,
- strengthen and support the economic functions,
- create attractive living conditions, and
- ensure housing and social facilities.

Before the execution of urban renewal however the excessively intensive development by development liberalism must be controlled with a construction certification which is supported by the assessment of development effect, whereas the redevelopment should be considered within the context of neighboring areas and planed through the continuous negotiation with stakeholders patiently.

The methods for urban renewal include total redevelopment, physical renovation and functional renovation. The total redevelopment - often regarded as a "second destruction" – can improve physical conditions with ease and in a short time. However it is expensive and tears down unique urban characteristics. As consequence it can provoke gentrification process. Therefore this method is suitable to an area losing the attractiveness as a living and working place due to the physical deficit and the functional unbalance. On the contrary physical- and functional renovation methods need active residents' participation. Compared with total redevelopment they are not expensive but take more time if conflicts are expected with stakeholders. Because of that, these methods are recommendable to small scale development keeping existing urban features. (Min, Hyun-Suk 2001: 17-22)

MXD (MiXed use Development)

The integration of land uses which don't induce functional conflicts supports diverse urban functions and reduce the motorized trips. Diverse land uses in the close proximity attract walking or biking, and the MXD integrated with public transit and housing units for the diverse social demands can improve the patronage of public transit and enhance the vitality of community life.

However it is the mixed-use outcome (a richly textured area environment comprising a mix of uses and activities) rather than the mixed-use output (a discrete development incorporating a mix of uses) that underpins the general perception of the attractiveness of town centers and the resulting commitment to the principle of mixed-use development.

The successful realization of vibrant and attractive mixed-use environments in town centers can be achieved by emphasis on managing and enabling the mix of uses and activities on an area basis over time, rather than on the pursuit of discrete mixed-use schemes on individual sites.

The designation on plans of specific mixed use development sites could usefully be complemented by the designation of a mixed use development zone ('MXD zone') in and around town centers, subject to a policy that encourages mixed-use development. (Office of the deputy prime minister)

Leasing arrangement

Through the leasing arrangement, the public and private sector can lease the facilities or assets in the inner-city area to a third developer. The third developer can then operate the facilities or assets for the term of the lease. This mechanism encourages the efficient utilization of blighted facilities and assets in the inner city area, while third developer can discharge the financial burden from the higher land cost. (Toronto board of trade 2001: 73)

Urban growth boundary

To accommodate the city's sustainable development, the "urbanizable area" which a city expects to grow into and probably will be annexed to the city can be designated with UGB (urban growth boundary). And new urban development will spring up there and urban services like sewers and streets be installed, whereas the land outside the UGB will remain rural, where the zoning will prohibit urban development activities and the creation of small new lots. Most of the land outside the urban growth boundary will continue to be used for forestry, farming, or low-density farming houses.

The location of UGB focuses on three main issues: (1) efficient use of land, (2) protection of agricultural land at the city's edge, and (3) cost-effective public services. The amount of land to be included in UGB depends on the city's population projections and it must be consistent with those of other local governments in the area. Estimating the urbanizable land volume in the future planners should subtract the amount of vacant land that is already available within the current city limits.

The area of UGB can not always coincide with the city's limits, so drawing an urban growth boundary is a joint effort with the city and its adjoining counties which are responsible for planning and zoning in the area outside the city limits. Special districts can also participate, because they provide important services such as fire protection and water in the urbanizable area. Citizens of the area and other interested people and groups also help to determine where the UGB will be drawn. (DLCD 1995)

Urban growth management agreements

Cities and counties coordinate their planning and zoning in the urban growth area through the "UGMA (urban growth management agreements)" to

- clarify roles and responsibilities among local jurisdictions,
- reduce the fragmented growth management authorities,
- set the land use designations and zoning consistent with their own,
- resolve the issues regarding the provision of urban services to supply more than one jurisdiction, - UGMA can establish standards and financing mechanisms for urban services and these issues can be worked out in more detail through an Urban Service Agreement. - and
- apply any interim controls required to maintain the potentials for the urban development level in UGB.

UGMA can have different structures depending on the local customs and circumstances. The alternatives include:

- Single Jurisdiction: A city or county might be named as having the lead responsibility for urban growth management decisions. - If a city has the lead responsibility, the county might delegate its authority over the unincorporated areas to the city and could retain rights to a notice and review of development applications. They also might have standing to appeal or hear the appeals.
- Joint Board: Local jurisdictions can create a joint board or committee to deal with growth management issues. The board might be made up of elected officials or planning commissioners from the cities and counties. Such a joint board could be advisory or they could make the actual decisions.
- Cross-Acceptance: Cross-acceptance is a negotiation process to make state and local plans more consistent with each other. It is a technique that provides for the systematic review of plans by two or more jurisdictions. Each jurisdiction determines whether the other's plans are consistent or can be made compatible with its own. The process should provide for communication and negotiation, including a third party to resolve disputes.
- Combination of Approaches: the above approaches may be combined. (Oregon 2001)

Greenbelt

Greenbelt’s five purposes are to

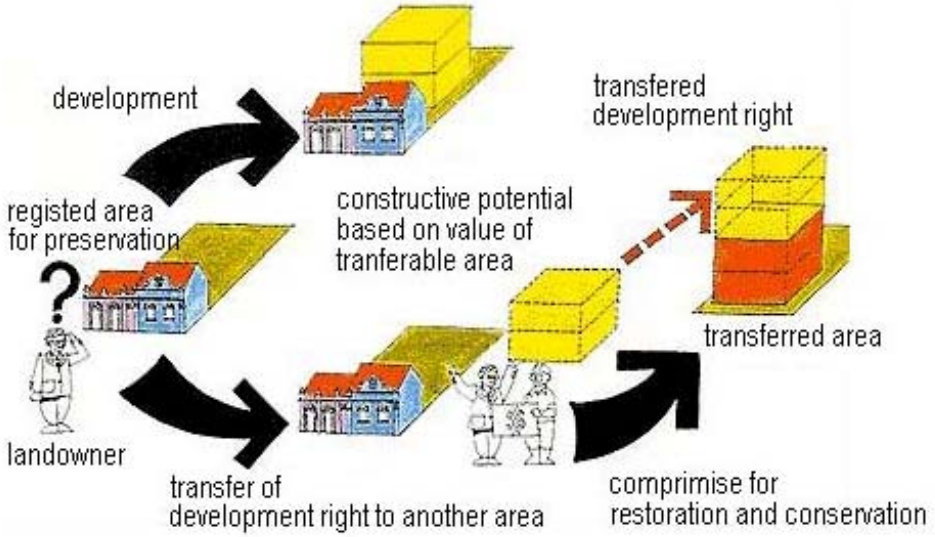
- check the unrestricted sprawl of a large built-up area
- prevent neighbouring towns from merging into one another
- assist in safeguarding the countryside from the urban encroachment
- preserve the setting and special character of historic towns, and
- assist in regenerating urbanity by encouraging the recycling of derelict urban land. (North mymms district green belt society 2004)

The greenbelt system of South Korea was introduced in 1971, following the UK’s. It accounts for 5.4 percent of South Korea’s land area inclusive of Seoul’s. It stopped successfully the immediate urban sprawl beyond the boundary of greenbelt and preserved environmentally sensitive lands and protected countryside in agricultural, forestry, or other use. However there have been some negative impacts: Escalating house price due to the deficit of housing supply, leap-fog development associated with long-distance commuters, the deprivation of the property right of greenbelt residents and landowners because of too restrict regulations. (Bae 2004: 17-21)

Transfer of development right

To preserve historical, cultural, and architectural heritages the transfer of development right was first introduced in the 1970s in New York, but this measure can be also applied to conserve the natural vegetation. It proposes that a land owner sell a critical land parcel to a public sector, transfer the development right to a neighboring developable area or exchange his with others, such as them on a development axis. At this time the mediating role of a local authority is important.

Through the transfer of development right a land owner can be stimulated to preserve historical- or green areas. Instead of suffering from development restrictions on his properties, a land owner can have opportunity simply to transfer his development right to others.



Source: IPPUC

Fig.2-7 Process of transferring development right

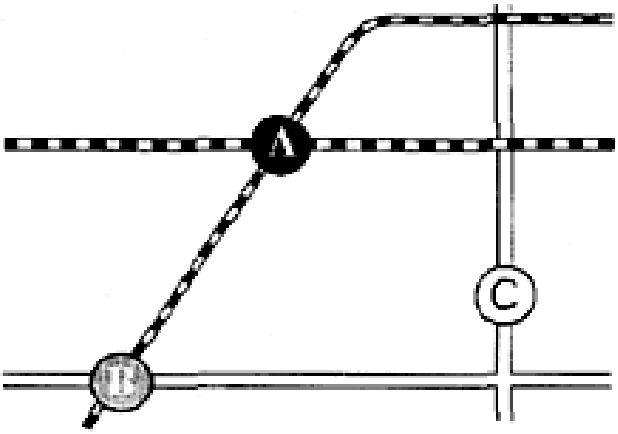
2.2.2 Transportation policies

ABC location policy

The ABC location policy in the Netherlands refers to a land use policy aimed at reducing the avoidable mobility by an automobile and ensuring the access to economic activity centers. It is first introduced in the 4th report on physical planning in 1988. The policy aims to match the mobility need of a business with the accessibility of a location: 'the right business in the right place'.

The core element of the ABC location policy is the classification of locations (accessibility profile) and the grouping of companies (mobility profile). First the locations are assorted with three types based on their accessibility by public and private transits. (Martens & Griethuysen 2000: 2)

- A-location: easily accessible by the local, regional and national public transits (an area around a public transport junction). The commutation by a car should be under 10-20%.
- B-location: easily accessible both by the local and regional public transits and a car (an area connecting the public transport routes with roads). The commutation by a car should be under 35%.
- C-location: accessible only by a car (an area on the highways). (EPE)



Source: www.epe.be/workbooks/tcui/example12.html

Fig. 2-8 Concept of ABC policy

Next, a mobility profile of companies is determined with comparable mobility characteristics. The main characteristics are: work density (the number of workers per an area), mobility of employees (the dependency on a car while doing business activities), the visitors' intensity (the number of visitors per an area) and the dependency on the transport of goods. (Martens & Griethuysen 2000: 2)

According to the standard matching two profiles, a company can be set up on a location with an accessibility profile in accordance with its mobility characteristics.

Mobility profile	Accessibility profile		
	A-location	B-location	C-location
Work density	High (under 40 m2/ pers.)	Average (40-100 m2/ pers.)	Low (over 100 m2/ pers.)
accessibility to public transport	Well	Well	Poor
car dependency	Low (20% of employees)	Average (20-30% of employees)	High (over 30% of employees)
visitors' intensity	Intensive (100 m2/ pers.)	Average (100 - 300m2/ pers.)	Incidental (over 300 m2/ pers.)
dependency on freight transport	Low	Average	High
suitable land use type	Retail, Office	Hospital	Manufacture, Wholesale, Freight business

Source: Martens & Griethuysen (2000: 3), Ichikawa (2002: 140-141)

Tab.2-6 Matching of accessibility- and mobility profile (ABC location policy)

To enlarge the mobility effect the ABC location policy is further enforced by limiting the number of parking lots on A and B-location, because not only the good accessibility by the public transits to a location but also the restriction of parking facilities can discourage the dependency on cars.

	Randstad and other urban regions	Other area
A-location	1 parking lot / 10 pers.	1 parking lot / 5 pers.
B-location	1 parking lot / 5 pers.	1 parking lot / 2.5 pers.
C-location	-	-

Source: Martens & Griethuysen (2000: 3)

Tab.2-7 Parking restriction per accessibility profile

Even though the ABC-location policy successfully regulates public and private investment and strengthens strongly the vitality of inner city area integrated with public transits, it is too strict and the mobility effects are not clear. In some cases the areas designated as A-location aren't better accessible by public transits or bicycles than by cars. (Martens & Griethuysen 2000: 8)

TDM (Transportation development management)

A strategy to manage transportation demands is more critical to operate the transportation than a strategy to increase the capacity (supply) of facilities. The expansion of infrastructure capacity is not effective to reduce the congestion and takes some time. So, managers and operators of transportation system pay more attention to managing demands, now.

The original concept of TDM (transportation demand management) took root in the US in the 1970s and the 1980s from the legitimate desires to provide the alternatives of commuting trips by single drivers for saving the energy, improving the air quality, and reducing the peak period congestion. Today it has broadened to encompass the desire to optimize transportation system performance not only for commute and non-commute trips but also for recurring as well as non-recurring events.

Now TDM does not only encourage travelers to change their travel mode from driving alone to choosing carpool, vanpool, public transit vehicle, or other alternatives, but it is also

providing all travelers, regardless of whether they drive alone, with diverse choices of location, route, and time, not just mode of travel.

The availability of information about transportation services and conditions has been shown to influence transportation demand. The information supported by ITS (intelligent transportation systems) affects decisions about how they travel (mode), when they travel (time), where and whether they travel (location), and which route they travel (path). (FHWA 2005)

The examples of TDM are

- carpool, van-pool, car-sharing, express and shuttle bus services
- flextime
- road pricing
- subsidy for public transport user and facilitation of public transports (bus, subway, LRT(light rail transit), etc.)
- bus and bike exclusive lane, PTPS (public transportation priority control) and transit mall
- HOV (high occupancy vehicle) lane
- zoning laws to facilitate demand management
- parking place management
- park and ride
- traveller information services, etc. (Ichikawa 2002: 9)

2.2.3 Environment policies

Conservation priority area

The conservation priority area is to protect an environmentally sensitive area, but the debate hinges on its definition. A common remedy is to release some of the land for development in return for funds from a developer to restore remainder: e.g. the Bolsa Chica and Balloona wetlands in Southern California. (Bae 2004: 10)

2.3 Financial instruments

2.3.1 Taxation

Property tax

The instruments which public authorities – they could be central or local governments - use to raise revenues affect the nature and location of development. The higher property taxes for example, provide an incentive for less-dense projects which make the city expand in a socially inefficient way, i.e. the lower taxes on single-family homes with low-density, discourages the investment in apartment buildings (other things being equal) and reduces the density of development. Moreover the property tax system without differentiation among types of single-family homes - generally so – can encourage undesirable sprawl. (C.D Howe Institute 2002: 8) The property tax therefore should be levied on the basis of the assessment on development effect and differentiated by the location and the types of development.

Site-value taxation

In general, the relatively heavy taxation for the improvement of a property discourages more intensive uses, while the relatively heavy taxation of the land value encourages them. By increasing holding costs and discouraging speculation, site-value taxation places pressure on owners of undeveloped property to put their land to a more profitable use.

If a municipality taxes land value whether the property is developed or not, the owner is unlikely to hold land for speculative purposes because doing so is relatively expensive. Thus, a site-value tax brings undeveloped land in inner cities into use and reduces pressure to develop more remote green field sites.

But the estimation of marginal site-value is difficult. To preserve farmland and open space under a regime of site-value taxes, a municipality must enforce other planning regulations. (C.D Howe Institute 2002: 17-18)

Land value capture taxes

Land value capture taxes (also called “land-value increment taxes“, “betterment levies”, or “valorization taxes”) are levied to capture the increase in commercial value created as a result of a major public investment infrastructure. This form of taxation is proposed in situations in which a municipality is contemplating a major infrastructure investment, such as a new subway. Other examples of possible uses include new highway exchanges, schools, parks, conservation areas, and any other public investment that increases the value of adjacent land. In all these cases, a tax or fee could be imposed on neighbouring properties.

However one of the main problems of land-value capture taxes is the difficulty of estimating the change in property values that arises from the public investment in infrastructure. In particular, it is necessary to isolate the impact of the public expenditure from other market forces that affect land prices. (C.D Howe Institute 2002: 19)

Fuel tax

The fuel tax, although not exactly like a user charge based on marginal cost, is generally viewed as a benefits-based tax. As for its impact on urban growth patterns, some analysts think that a tax on fuel discourages the use of automobiles, reduces the demand for commutation, and increase the demand for more compact development. (C.D Howe Institute 2002: 21) It can give cities sufficient funds to construct the roads and to provide a greater subsidy to public transit. It may also lower the capacity of road toward a more efficient level.

2.3.2 Developer contributions and exactions

They are up-front capital payments as contributions to the cost of urban infrastructure and may take the form of financial payments or of provision of infrastructure in kind. The latter is often preferred by land developers. Contributions are usually mandated in accordance with prescribed schedules, but alternatively or in addition, individual contributions may be negotiated with developers.

The system is most widely used in relation to new urban development which entails the conversion of land from non-urban use to urban use. But it is also used in cases of redevelopment. (OECD 1991: 60)

The contributions should be levied on the assessment of development impact, but usually be higher per unit for low-density developments than for high-density developments. Similarly, developments located close to existing services should be paid less than those further away. Higher charges for developing land on the outer edges of a community can stimulate development in the inner city and reduce urban sprawl. (C.D Howe Institute 2002: 17) Neutrality of exactions can generally be achieved through relating the payment to the benefits received from municipal services by type of property and by location. (C.D Howe Institute 2002: 22)

In the majority of countries developers are required to provide most of the immediately local infrastructure, including local streets, curbs and drainage, sewer and water reticulation and some open space, at their own expense. (OECD 1991: 60)

Development impact fee

Development impact fee can be imposed on the new development by the municipality in order to generate revenue for funding or recouping the costs of capital improvements or facility expansions necessitated by and attributable to the new development. (www.law.wustl.edu) However a fee can not be imposed to address existing deficiencies except where they are exacerbated by the new development and funds cannot be used to provide facilities which exceed the level of those available to the general public unless available public funds are designated to upgrade the non-impacted facilities. (Verber 2004)

The development impact fees can raise the cost of housing and depress housing demand by the price elasticity of supply and demand that determines how the burden of the fee is divided between developers and house buyers. (Bae 2004: 7) Nevertheless, it can be used as an alternative to prohibitive regulation for preventing the overburden of infrastructure resulting from highly densified development activities in an inner city or small-scale and sporadic development activities in a green field near at a built-up area, which impede now a sound and balanced urban development and degrade environment.

Land Dedication

Formal or informal land dedication from the developer may be part of the subdivision approval process. Developers are required to set aside land for roadways, other public works, school sites, or environmental reason. In some over-sizing cases, the municipality agrees to recover part of the exactions from future benefiting owners on behalf of the developer.

2.3.3 Grants-in-aid for development and conservation

Priority funding area

The PFA (priority funding area) reflected on Maryland's Smart growth programs is designated by the regional- and local governments to encourage and support economic development and new growth. The followings can be qualified as PFAs

- Every municipality,
- Areas already designated as enterprise zones,
- Neighborhood revitalization areas,
- Heritage areas, and
- Existing industrial land.

Here is recognized the important role which local governments play in managing growth and determining the locations most suitable for a project supported by public fund. Counties may designate an area as a PFA, if it meets guidelines for intended use, availability of plans for sewer and water systems, and permitted residential density. With PFAs listed in the legislation, the regions eligible for county designation are existing communities and areas where industrial or other economic development is desired. In addition, counties may designate areas planned for new residential communities which will be served by water and sewer systems and meet density standards. (Maryland Department of Natural Resources 2005)

Open space preservation fund

Like the program "preservation 2000" in Florida, the preservation funds can be made through the sale of state revenue bonds backed by receipts from the state's documentary stamp tax on real estate transfers. The Green Acres Funds in New Jersey (to date, more than 350,000 acres of state, county, municipal and non-profit-held open spaces have been preserved, and hundreds of public parks have been developed with Green Acres Funds. On November 1998, the legislature placed ballot at the $1 billion constitutional amendment and bond measure to protect half the state's remaining 2 million acres of undeveloped land over the next 10 years. The measure was approved with 66% of the vote.) were made from a part of the existing sate sales tax for acquisition and development of lands for conservation and recreation, as well as farmland and historic preservation. Maryland was one of the first to fund land conservation through a real estate transfer tax (Program Open Space). (David and Lucile Packard Foundation 2003)

Tax increment financing districts (TIFs)

This program is used by American cities to renovate blighted urban areas, generally in downtown areas that need revitalization, to remedy the brown fields, and to rehabilitate the deteriorating infrastructure. More than 40 US sates have TIF enabling legislation.

The expected growth of tax revenues in TIFs generated by an urban renewal activities and a part of development benefits through the varied incentives (e.g. up-zoning, FAR-bonus) are pledged to secure bonds to finance projects and programs within that district. Funds generated within each district must be spent within that district and are not available to finance other projects outside the district.

Projects for TIFs should be consistent with the regional development plan and focused on the affordable housing, the expansion and improvement of infrastructure inclusive of transportation facilities and the preservation and restoration of environment encroached by intensive development activities. (C.D Howe Institute 2002: 20, City of Portland 2005: Ch14-7)

Space specific mortgage

The lack of developable land stocks in the metropolitan region pushes people to the outskirts areas. At that time, depending on the traditional bid-rent theory, people decide the location within their financial feasibility. “Even though a tenant can purchase a more spacious house with a distance to the city center (a work place), he should spend more money for a transportation cost.” Meanwhile the development of transportation makes a physical distance factor substituted with one relevant to time, so this hypothesis can be modified, again. “A house with qualified access to a work place can save more the commuting time, - to say nothing of the cost for gasoline - but a tenant has to pay more for a space to live.”

To encourage the residential development integrated with transportation a specialized financial support is required to help a tenant to pay for an expensive house near at a pubic transit station. However this notion is not reflected on the current mortgage service in South Korea.

In the real estate market, the better accessibility, particularly by public transits, affects to the land price. That is, a house near at a station has more economic potential than a pendant. So, the increase of property value near at a public transportation station can reduce the financial risk of a bank which gives a tenant a loan and a tenant may be able to pay back as soon as possible from the saving a transportation time and cost.

2.4 Remarks

Despite of different conceptual approaches, the land use theories and measures that form a basic concept of network cities commonly aim at the poly-centric and sustainable urban development which can ensure the provision of minimal urban services to support human settlement and preserve the natural and cultural heritage.

To manage urban polarization dichotomizing agglomerations and their periphery and achieve development sustainability, urban restructuring in the form of network cities should progress compactly within developable capacity and diverse land uses have to be mixed in the boundary not causing potential functional conflicts. Integrated land use with transportation planning, cumulatively oriented to public transportation, is to reduce travel distance and accommodate efficiently increasing mobility with public transits. And an environment planning approach should no longer conserve isolated open space but connect small and large parks ecologically and this green networks are to encourage systematic management of natural resources.

Financial measures based on the free-market competition can contribute to making spatial structure in the balance between the development for human activities and the preservation of natural resources and ecosystem. They include taxation, developer contributions and exactions, grants-in-aid for development and conservation, etc.

On the other hand the expected growth of tax revenues generated by development activities and a part of development benefits should ensure the bond to finance the very development projects and programs. Along with the involvement of private sector in the implementation of urban network programs, those can help public authorities to overcome their financing constraints for spatial restructuring in the form of network cities.

3 Land use paradigms and case studies for network cities

Cities existed with civilization, but the urbanity has developed fundamentally since the industrial revolution in the Western Europe and after the World War II in developing countries. UN estimates about 60 percent of world population will nest in the cities by 2030. The urbanization polarizes people and industries into the big cities and the development of motorization extends the residential areas to the nature-rich periphery in scattered and sporadic forms. Urban congestion and sprawl drains the non-reusable natural resources and destructs eco-systems.

Now the sustainable development of Brundtland report is suggested as a solution to make a stable relationship between human activities and the nature. The sustainability can be realized through the construction of poly-centric urban networks to secure distinctive regional features with cultural and natural heritages and offer diversity by competition and cooperation between these unique regions.

This changing idea demands to revise the conventional land use policies based on the demographic and industrial concentration for national economic growth, cumulatively in Asian and most of centralized European countries. New land use paradigms in the gist of regional diversity and mutual cooperation can be found out easily in land use approaches of neighboring countries, even in those of federalized countries as well as concentrated nations'.

To understand diverse applications of these new approaches from different demands and perceive something in common two federalized nations and three countries with strong tradition of centralization were studied in this research, centering on European and Asian countries with long history of spatial planning: Germany, Switzerland, U.K., France and Japan. It was approached by two layered access, national level and regional level; cumulatively the region Stuttgart, the region upper Rhine, the region London, the region Paris, and the region Tokyo.

Germany and Switzerland keeping up decentralized spatial structures were here studied on their current spatial structures and efforts to maintain the poly-centric spatial structures complementing between urban and rural areas in the danger of functional polarization to several agglomerations due to the development of transportation and economic liberalization. At the regional level two regions were investigated focusing on their poly-centricity: the region Stuttgart with historical heritage of poly-centric development and the region upper Rhine functioning as the European metropolis in the form of trans-bordering urban networks.

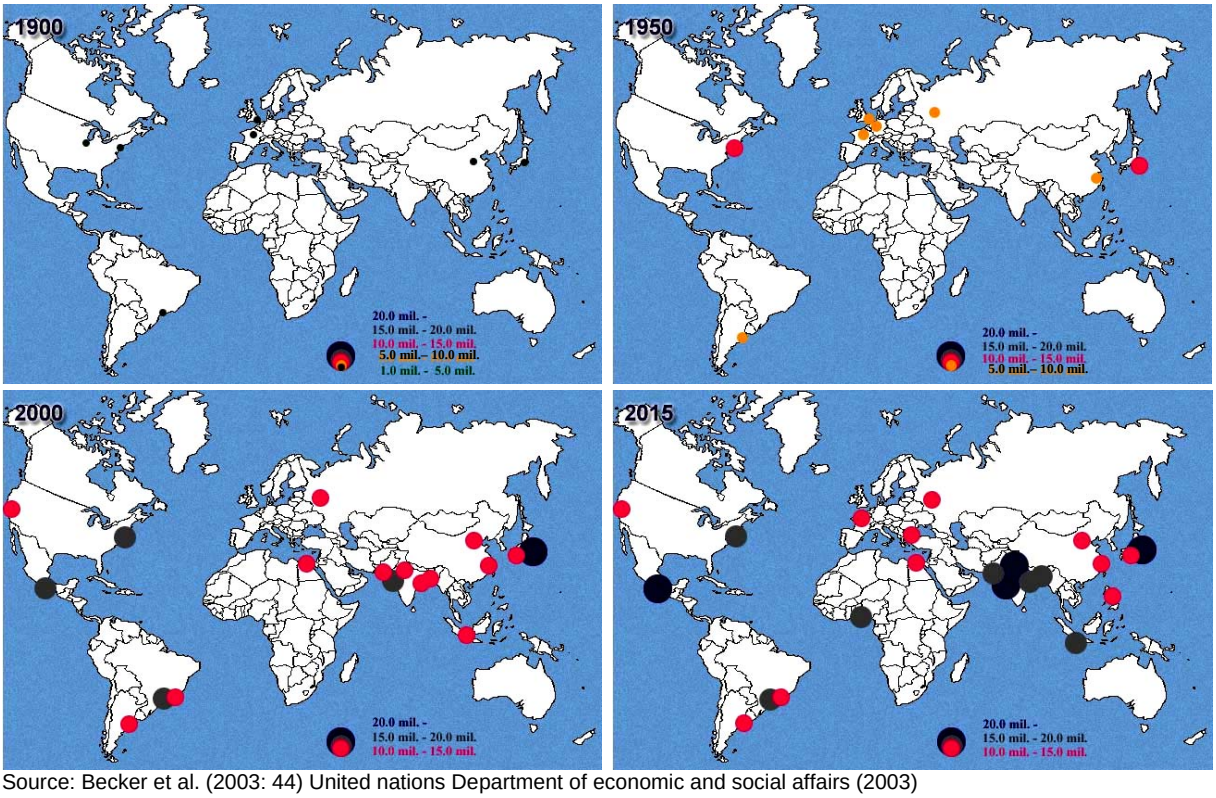
The studies of three nations with the strong tradition of concentration, U.K., France and Japan gave a glance at their trials to rearrange their mono-centric national territorial structures into diverse and dynamic ones, which consist of regions identified with their own cultural and national heritage and whose mutual interchange and cooperation is supported by transportation and communication connections. Regionally focusing on their capital regions, the region London, the region Pairs and the region Tokyo, on the other hand, their own attempts were investigated to revitalize the functionally obsolete and disharmonious city centers and intensify them as international strategic posts corresponding to the globalization of economy. By urban networks three case-studied nations have already taken some effects and anticipate more to reduce congestion in the capital cities and decentralize and complement metropolitan functions with existing and new regional centers in the capital regions.

3.1 Land use paradigms

3.1.1 World trend: Urbanization

Through most of history, the human population has lived a rural lifestyle, dependent on agriculture and hunting for survival. In 1800, only 3 percent of the world's population lived in urban areas. By 1900, almost 14 percent were urbanites, although only 12 cities had 1 million or more inhabitants. In 1950, 30 percent of the world's population resided in urban centers. The number of cities with over 1 million people had grown to 83. (Population reference bureau 2005)

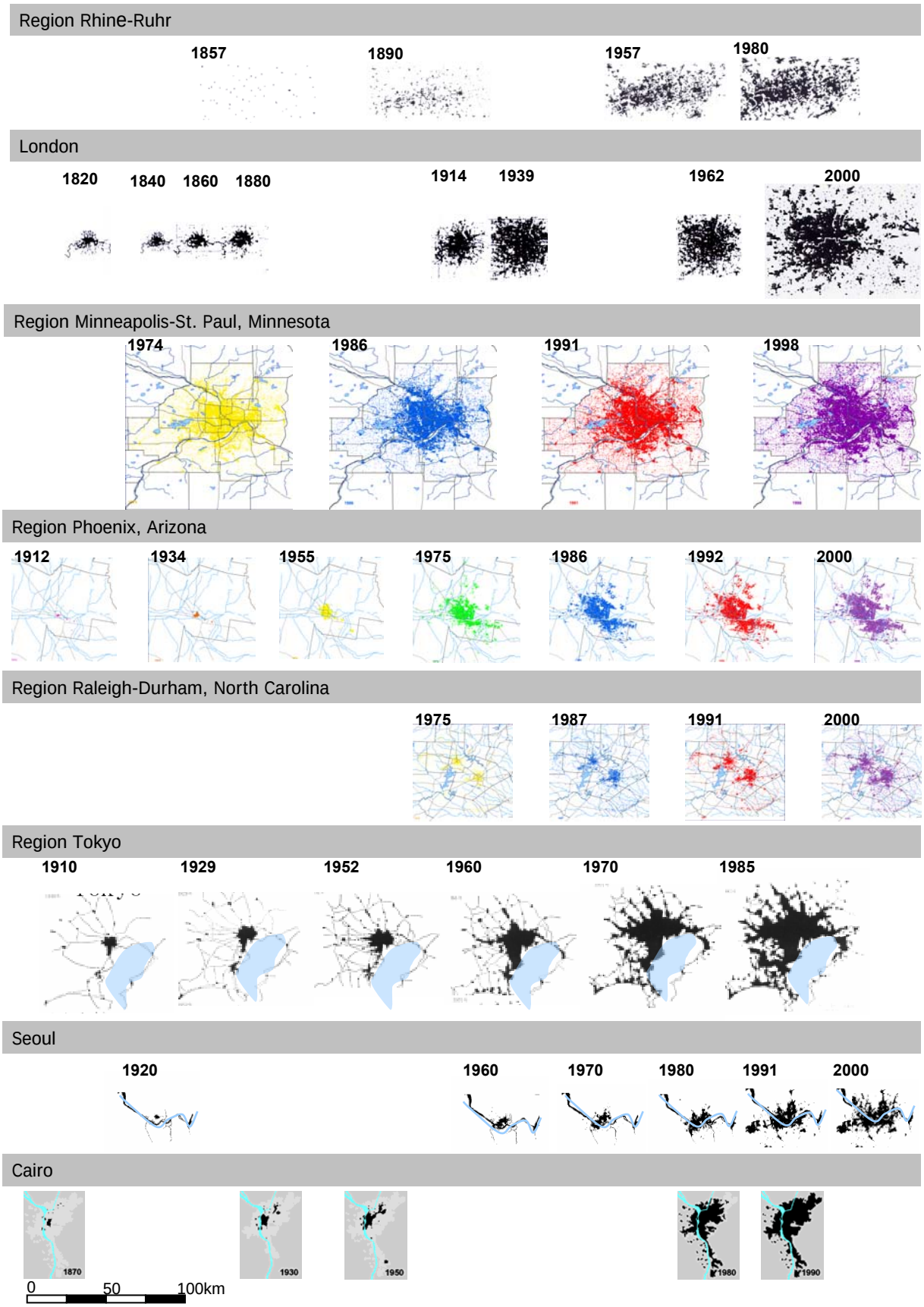
However the world has experienced the unprecedented urban growth after World War II. As of 2000, about 47 percent of the world's population (about 2.8 billion) lives in urban areas. There are 411 cities over 1 million. Even though the urbanized areas can be found now in the western countries, it is expected that most urban growth will occur in less developed countries by 2030. At that time about 60 percent of the world population will be urban. (Population reference bureau 2005)



Source: Becker et al. (2003: 44) United nations Department of economic and social affairs (2003)

Fig.3-1 Growth of mega-cities (1900-2015)

An urban area may be defined by the number of residents, the population density, the percent of people not dependent upon agriculture, or the provision of public utilities and services, such as electricity and education. However there is no universal standard and generally each country develops its own set of criteria for distinguishing urban areas. For instance in South Korea the urbanized area is defined as an area with more than 20,000 inhabitants and the United States defines an urbanized area as a city, town, or village with a minimum population of 2,500 people. The scope of an American metropolitan area includes both urban areas as well as rural areas that are socially and economically integrated with a particular city. (Population reference bureau 2005)



Source: Humpert (1992: 15, 45-46), Landeshauptstadt Stuttgart (2003: 15), Albers (2004), EPA (2004), Yoshida (2003: 40), Elgendy (2004)

Fig.3-2 Urban expansion

What make people migrate to the cities? Large numbers of people are flocking to cities in search of works. The medical development makes demographic pressure on the rural economy and the limited agricultural land is not feasible to the burgeoning rural population. Furthermore the mechanization of farming is reducing the demand for labour in the countryside. In particular the young are encouraged by the opportunities in the cities to socialize and enjoy the modernized urban lives differentiated from poor and tedious ones in the countryside. China has a "floating population" of 80 million rural people who have moved to the cities in recent years. Between a third and a fifth of the residents of its two largest cities, Shanghai and Beijing, are those migrants. (AAAS 2005)

However the cities do not grow continuously, if and when the problems of congestion and pollution overwhelm the benefits, the cities become inefficient as well as unpleasant. Smoggy and congested Mexico City was once expected to grow to more than 30 million people by the year 2000, but was at around half of that in 1996 and is not expected to be above 20 million in 2015. And even while cities are still growing rapidly in the developing world, the growth rates themselves are on a downward trend. (AAAS 2005)

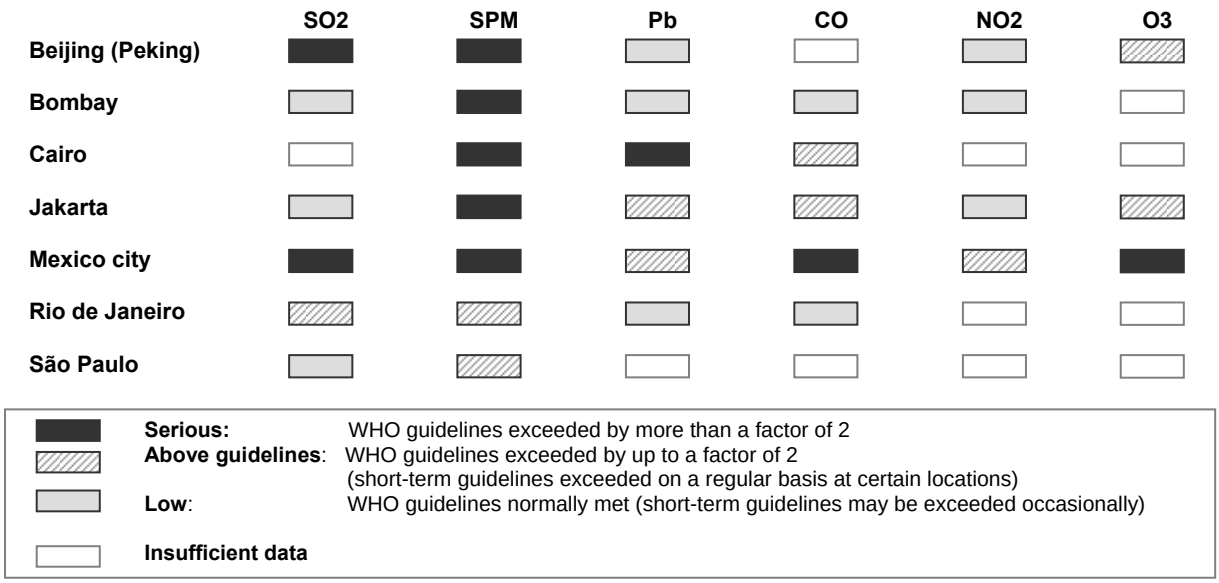
In the developed world, meanwhile many cities are losing population as the birth rate fall and inhabitants leave for more attractive suburbs or rural areas. Good transportation systems and electronic communications accelerate this trend. Due to that large peri-urban zones with low-density have formed and they sometimes embrace several cities, such as the Japanese urban heartland between Tokyo and Osaka, the Rhine-Ruhr region of Europe and the east coast of the United States from Boston via New York to Washington DC. (AAAS 2005)

3.1.2 Problems: urban congestion

Cities represent, for many, the good life. On average, urban dwellers have higher incomes and live more comfortably and sanitarily than their rural counterparts. And cities are undoubtedly economic powerhouses. The World Bank estimates that urban areas in the developing world account for 65-80% of a nation’s GDP. - Sao Paulo alone contributes 40% of Brazil's GDP. (AAAS 2005)

But there aren’t just benefits in the cities. Most of the world's cities fail to provide decent living conditions for millions of people and impose a huge burden on the environment. Now urban authorities are striving to provide not only infrastructure but also basic social services, coping with negative externalities from the urban expansion. The challenges they face are often compounded by the large numbers of the urban poor living in slums and unplanned settlements. (AAAS 2005)

Even though urban residents have greater access to clean water and sanitation than their rural counterparts, 25-50% of urban inhabitants in developing countries live in slums and squatter settlements with extremely limited services. Such overcrowding causes epidemics of tuberculosis, diarrhea and other communicable diseases. In Karachi, a 10 million-population city growing by half a million a year, 40% of the population lives in squatter colonies and one in five babies do not reach their first birthday. Worldwide, more than a billion people live in urban areas where air pollution exceeds acceptable levels. The death toll from lung disease caused by urban air pollution could be half a million a year in China alone. The notorious traffic congestion in Bangkok costs an estimated 2% of Thailand's GDP. Cities can also be violent. The greatest causes of death among young people in Sao Paulo are traffic accidents and homicide. (AAAS 2005)



Source: UNCHS (1996)

Fig.3-3 Air pollution

Cities also have a large ecological "footprint". They call on resources over a wide area to provide food and raw materials. Vancouver's half a million people consume resources from an estimated 2 million hectares which is 200 times as large as the area of the city itself. The area of London's hinterland is 120 times greater than that of the city, drawing on resources from the wheat prairies of Kansas, the tea gardens of Assam and the copper mines of Zambia among other places. Cities also put huge strains on the local natural ecosystem, polluting rivers and coastal waters, consuming forests and water, degrading soils, disrupting drainage and stunting crops. For example, the urban smog and acid deposition in China are estimated to be reducing crop yields up to a third. (AAAS 2005)

Now the critical question which cities encounter is how to maximize their wealth, while reducing the urban congestion and the ecological damages from urbanization. Though the urban congestion produces nuisances of urban lives, the densification of cities can also help minimize resource consumption for example through introducing mass transit systems to supplement car use, or recycling and composting the huge amount of urban waste daily from urban inhabitants. (AAAS 2005)

3.1.3 a Solution: Sustainable development

According to the Brundtland Report, sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It respects the limited capacity of an ecosystem to absorb the impact of human activities. However sustainable development concerns not the protection of environment for flora and fauna but balance between the development for human activities and the preservation of natural resources and ecosystems. This stable relationship between human activities and the natural world does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own.
(http://en.wikipedia.org, http://www.gdrc.org/sustdev/definitions.html)

Sustainability, in many cases, is not so much dependent on appropriate planning, but rather on good management. The natural heritage needs effective management to safeguard the potentials for ecological and economical development in the regions. While non-renewable natural resources should be used wisely and efficiently, attention needs to be paid to energy conservation besides the development of renewable energy resources. Recycling the large amounts of domestic and industrial waste is a measure for sustainability.

Urban regions are vital places for residential, business and other activities. Manifold activities and demands in urban areas have negative effects on the environment. The urban expansion that often penetrates valuable natural areas and destroys green structures should be controlled and redirected to take away pressure on the valuable natural and cultural landscapes, if expansion is unavoidable. The resource-efficient settlement patterns can be promoted by the planning approaches integrated with spatial, transportation and environment factors.

Besides the management of urban sprawl in the agglomerations, economic prosperity and cultural diversity of small towns and cities should be promoted by a sustainable urban network approach. As centers of regional economic growth small towns and cities has to provide periphery with basic services, in relation to employment, education and training, health, energy, transport and communication, etc. The mutual networks support a polycentric, balanced urban system and inter-urban cooperation.

Through emphasis on human capital, innovation, entrepreneurship and development of small and medium enterprises inclusive of tourism, a diverse, flexible and competitive urban economy can be promoted. Local capacities responding to the specific needs and potential of communities in deprived urban areas should be strengthened by cooperation with neighborhoods. Pathways to a sustainable society based on employability and social integration are to suggest the long-term perspective for unemployed, young drop-outs, lone parent families and ethnic or racial minorities, and others who are economically or socially excluded, too.

The mobility management is needed to reduce the traffic congestion by better utilization of existing infrastructure and by the limitation of demand for vehicular traffic. Decent service supply and change of awareness is necessary to shift demand from private to public transport. It may be also supported by adequate urban structures encouraging the use of more environmentally sustainable transport.

In the point of administration, good urban governance and bottom-up initiatives contribute to make sustainability into action. To involve towns and cities more fully in implementation of development policies, lots of information on the development is to provide planning’s actors and diverse dialog channels should be offered to them. The participation of local authorities and exchange of best practice between different levels will ensure to increase the quality and effectiveness of urban governance. On the other hand, diverse development polices have to be integrated to maximize the synergy and reduce the financial burdens. (Planco (n.d))

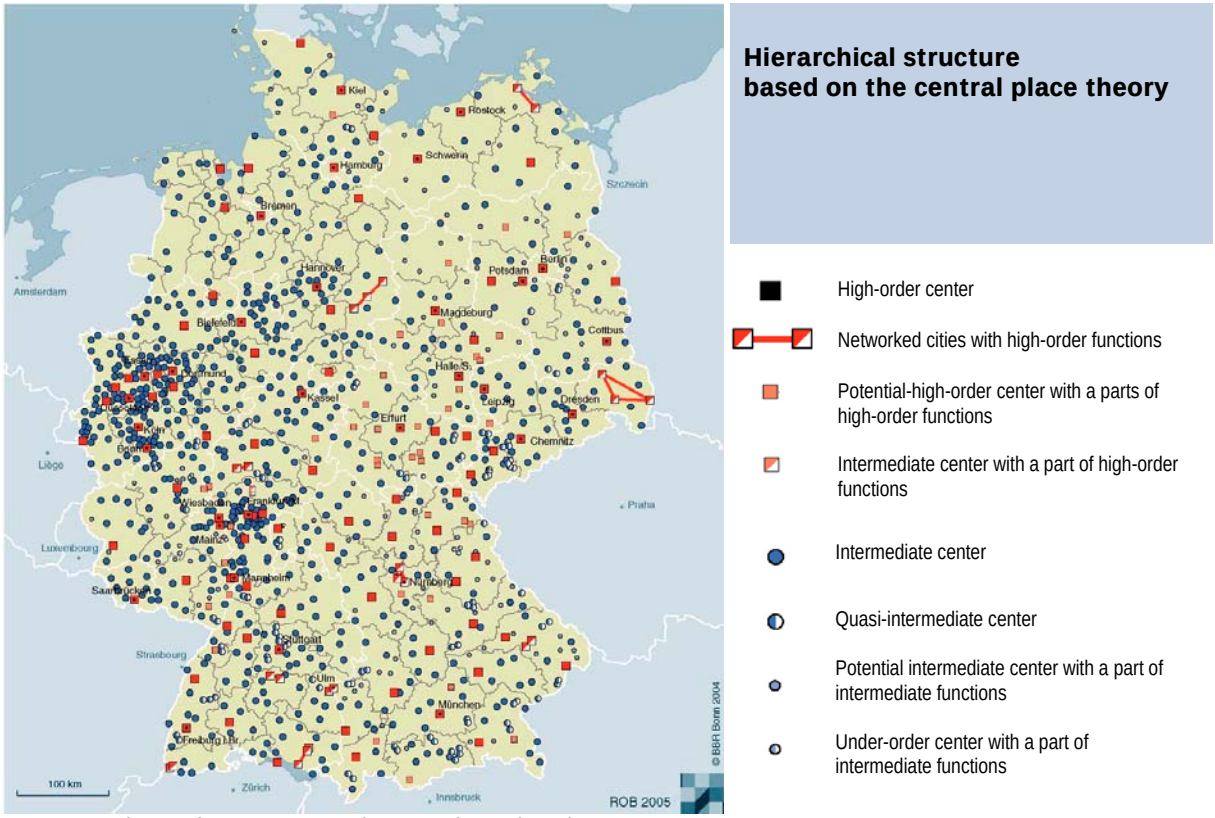
3.2 Case studies: National approaches for network cities

3.2.1 Germany

The population living in the large concentrations rose from 1/2 million in 1870 to nearly 20 million in 1970, when one third of the population of the federal republic was living in only 3 per cent of its area. Taking in the wider spheres of influence, 13 per cent of total area accommodated 43 per cent of the population, 51 per cent of the industrial employment and 62 per cent of the industrial production. However Germany's urban areas are much smaller than London or Paris, and so do not have the same problems of congestion and overloaded services. (Hall 1992:179-185)

The central place theory is the basis of German urban system. Since the 1960s it has been systematically arranged and developed in support of regional planning to secure the equivalent urban life to all German. The central place theory contributes inhabitants to supplying goods and services, jobs, and infrastructures. It makes concrete so-called the decentralized concentration in the spatial structure and ensures the appropriate accessibility to the centers by the maintenance and development of network between central places. (Bundesamt für Bauwesen und Raumordnung (n.d.): 13, Bundesamt für Bauwesen und Raumordnung 2005: 250, www.bbr.bund.de 2004b)

The high-order center in Germany is an area with more than 100,000 inhabitants that has the regional importance as the commercial- and employment center. Now 154 high-order centers are distributed in all Germany, so that people can arrive at them within one hour by cars, whereas the number of intermediate center with at least 20,000-40,000 persons amounts over 1,000. In the periphery this hierarchical system is supported by the under- and small centers that ensure the minimum standards of urban facilities and trigger the regional development. (Bundesamt für Bauwesen und Raumordnung (n.d.): 14)

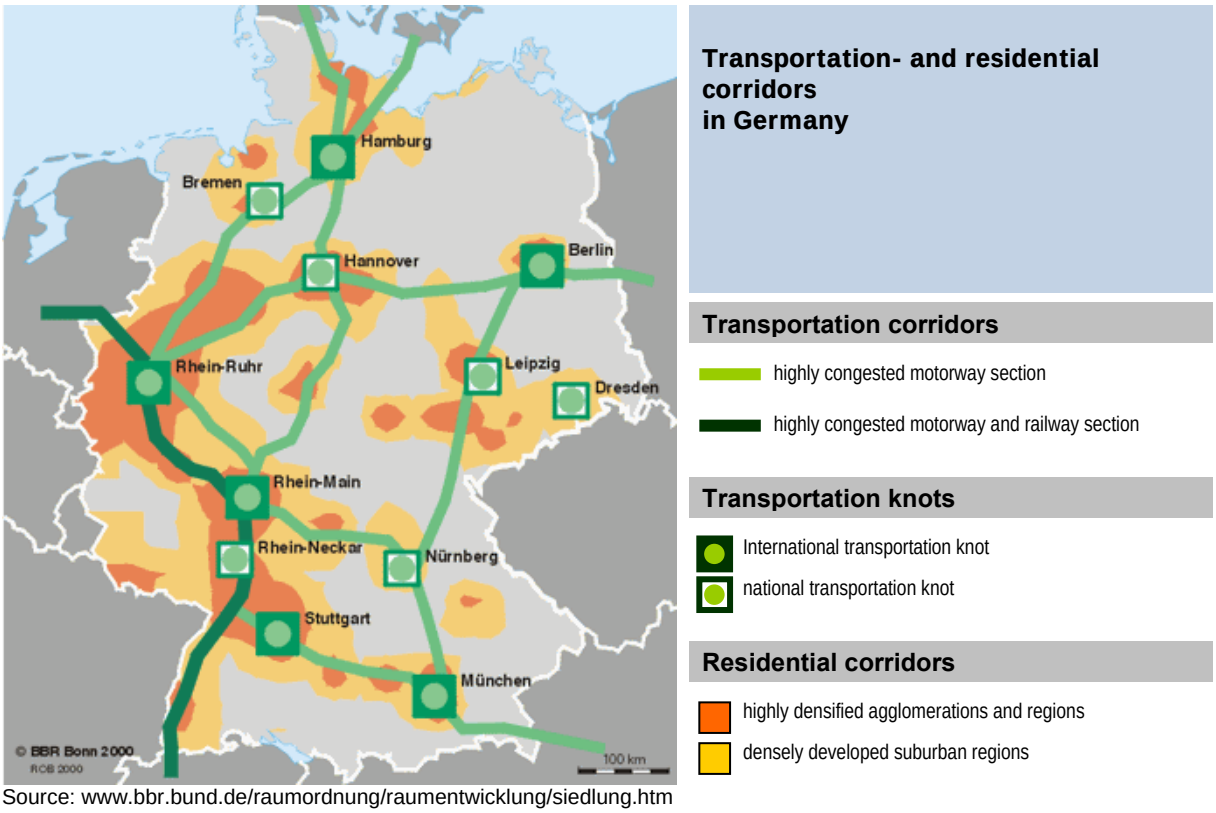


Source: Bundesamt für Bauwesen und Raumordnung (2005)

Fig.3-4 Hierarchical structure based on the central place theory

The central place theory controls above all the suburbanization processes and guides local-, sectionally detailed- and individual construction plans for the sustainable development, so to make better use of insufficient finance and preserve natural resources. It is also applied to decide the subvention in the context of land use planning and transportation network planning. However the location of massive shopping malls in the periphery brings now under pressure the traditional centers cumulatively in the high-order- and intermediate centers. (Bundesamt für Bauwesen und Raumordnung 2005: 251, www.bbr.bund.de 2004b)

Germany is a country affected particularly by the transportation for economic trade. Its spatial development spreads out along transportation corridors, because the accessibility to the markets is one of the most important factors that many enterprises choose their posts, and the well-equipped transportation connections make areas on the transportation corridors attractive to live in. A good example is the Rhine-corridor from Rotterdam over the region Rhine-Ruhr, the region Rhine-Main, the region Rhine-Neckar to Basel.



Source: www.bbr.bund.de/raumordnung/raumentwicklung/siedlung.htm

Fig.3-5 Transportation- and residential corridors in Germany

The urban development along transportation corridors is considered positively in the spatial planning, because it concentrates construction activities on the developable areas and preserves open space, even though this concentration brings over-loads to living milieu on the corridors. However in Germany there is so far no standard process for the development on the transportation corridors and the different and sometimes incompatible development philosophies can be met between states. Even some states have no regulation on the development of transportation corridors. (www.bbr.bund.de 2005b, Bundesamt für Bauwesen und Raumordnung 2005: 253-254)

Unlike many countries dominated by only one metropolis meanwhile Germany has developed the polycentric spatial structure due to the historical reasons. On the regards of the population density and the accessibility to the centers German spatial structure can be categorized with three regional development types which help to make differentiated space analyses and regional development concepts: urban center, peripheral area and intermediate area (Zwischenraum). (www.bbr.bund.de 2004c, Adam & Göddecke-Stellmann 2002: 513)

Urban center: 49% of the population and 57% of all socially-secured employees concentrate on only eleven percent of total German territory. Here the average population density amounts to approx. 1,000 inhabitants per km2.

Peripheral area: it takes 58% of Germany. Despite of the low population density here lives a quarter of all population.

Intermediate area: it develops more or less in the point-axial forms between the urban center and regional centers. Intermediate area compasses the 30% of the German territory and here lives more than one quarter of the population.

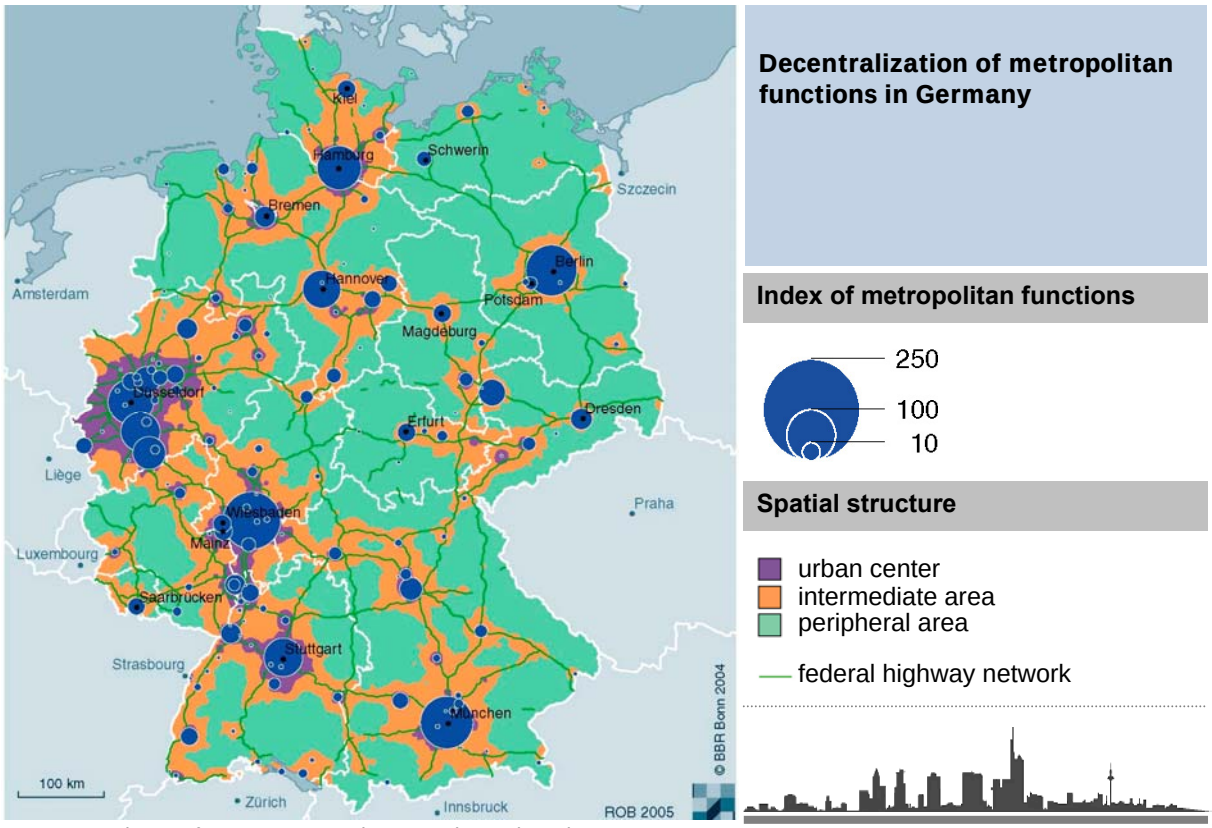
Source: Bundesamt für Bauwesen und Raumordnung (2005: 19, 21)

Tab.3-1 Regional development types

Among urban centers the metropolis is most suitable to accommodate metropolitan functions: International exhibition; economic centers for commerce, trade, banks, and insurance; high-ranked cultural- and educational bases of press, film and television and manufacturing plants. The metropolitan region is composed with the internationally well-connected city center, and large and small-sized cities and rural area connected with the central city. It takes the superior post in the hierarchal urban system and is differentiated from other urban area in its size, its closer integration into the global city system and its highest-order functions in the national context. (Bundesamt für Bauwesen und Raumordnung 2005: 184, Bundesamt für Bauwesen und Raumordnung (n.d): 13, Adam & Göddecke-Stellmann 2002: 513-514)

Whereas a uniform approach for same metropolitan functions brings an overheated competitiveness to attract potential companies or to locate urban facilities, a decentralized development policy is focused on sharing and supplementation of diverse urban functions with other metropolitan regions. It contributes to intensifying the locational attractiveness and international competitiveness of metropolitan regions. (Adam & Göddecke-Stellmann 2002: 514-515) On the other hand, peripheral area should be functionally connected with metropolitan regions to intensify economic activities and impulse regional development. At the same time a more intensive intra-regional cooperation must be made to solve the regional problems and strengthen the competitiveness of a whole region. (www.bbr.bund.de 2005a, Adam & Göddecke-Stellmann 2002: 524)

Unlike Great Britain or France there is no dominating metropolitan region in Germany. This decentralization of high-ranked centers results from the polycentric spatial structure of Germany. However the role of metropolis as a motor of economic-, social-, and cultural development can't be overlooked. Therefore the German minister council for spatial planning (Deutschen Ministerkonferenz für Raumordnung) has designated seven metropolitan regions (the region Hamburg, the region Berlin, the region Rhine-Ruhr, the region Rhine-Main, the region Stuttgart, the region Munich, and the Saxon triangles) as initiative regions for the construction of European metropolitan regions in Germany and develops model projects in the context of network regions of the future to improve the competitiveness against other European metropolitan regions. (Bundesamt für Bauwesen und Raumordnung 2005: 184, Bundesamt für Bauwesen und Raumordnung (n.d): 13, Adam & Göddecke-Stellmann 2002: 517)



Source: Bundesamt für Bauwesen und Raumordnung (2005)

Fig.3-6 Decentralization of metropolitan functions in Germany

Now Frankfurt am Main, Munich, Berlin, Düsseldorf and Hamburg are placed on the high-level of the German hierarchical urban system and take the high-order functions usually in over all scopes. Nevertheless a structural hierarchy also exists among them. Frankfurt am Main is on the tip of parades of the German city system, followed by Munich, Berlin, Düsseldorf and Hamburg. (Bundesamt für Bauwesen und Raumordnung 2005: 184, www.bbr.bund.de 2004a)

The federal structure of Germany makes the metropolitan functions decentralized all over the country. With the federal capital city Berlin (Bundeshauptstadt Berlin), the federal city Bonn (Bundesstadt) where the first or secondary bureaus of federal government are located plays a special role for the political decisions and controls. Other German cities also take the important posts in the European and international mechanism, for instance the European central bank in Frankfurt am Main, the international maritime court yard in Hamburg, the European patent office in Munich and numerous UN agencies in Bonn. (Bundesamt für Bauwesen und Raumordnung 2005: 181)

Meanwhile the political decisions can influence on the location of some metropolitan functions such as R&D (research and development) facilities in the high-order and intermediate centers as well as in the metropolitan regions. Here is important the role of public sector that makes a strategy where to post important research centers. It contributes to controlling the functional concentration on a few metropolitan regions and making the balance of national territorial structure. With Berlin, Munich, Dresden, Stuttgart, Heidelberg, Düsseldorf, and Aachen a number of classical university cities such as Freiburg, Göttingen or Jena are very attractive areas for institutional facilities. (Bundesamt für Bauwesen und Raumordnung 2005: 181)

The metropolis connects closely with other metropolitan regions intra- and internationally by airports, high-speed railway networks, and motorway connections. These transportation systems help not only to improve a good accessibility but also to share diverse metropolitan

functions with German and European cities. In particular the expansion and development of railway networks keeps the well-qualified connections between the agglomerations continuously. The accessibility from the German agglomerations to the whole Europe will be improved by initiatives and measures for the development of a European high-speed transportation network that needs highly qualified railway facilities. (Bundesamt für Bauwesen und Raumordnung 2005: 179, 181)

To ensure the minimum quality of public transportation service in the whole Germany, on the other hand, the transportation planning is focused with priority on the improvement of current railway system for the passenger- and freight transportation. The network design integrated with public transportation connections should satisfy actually the minimum standard for the accessibility to centers that take their own functions based on the central place theory. It stresses relatively more the role of railway transportation to take advantage against the road system. Here can be considered the bus connections integrated with railway service as an alternative against the motorized individual transportation, too. (Bundesamt für Bauwesen und Raumordnung 2005: 329, 330)

Although Germany has a well-developed rail transportation network, its shadow zones are concentrated mostly on the former border region between two Germans and the areas neighboring with foreign countries as well as the peripheral coastal- and mountainous regions, cumulatively the central mountain areas topographically difficult to access. (Bundesamt für Bauwesen und Raumordnung 2005: 331)

Under the strategy Net 21 (Strategie Netz 21) the German railway (Deutsche Bahn) will restructure rail networks by separating the passenger- and the freight transportation and improving the travel time. This rearrangement of railway system is approached on the three different levels: the priority to the connection between metropolitan regions, the integration of transportation services, and the improvement of regional connections. (Bundesamt für Bauwesen und Raumordnung 2005: 329)

3.2.2 Switzerland

Urbanization progress develops irresistibly and five metropolitan areas, Zurich, Berne, Basel, Geneva-Lausanne and the Tessin are made up. The development of S-Bahn system (rapid-transit railway system) has accelerated the annexation process of small- and middle sized cities to the direct reach of the neighboring large agglomeration. Now approximately 75 per cent of Swiss population lives in the cities and agglomerations. They are generating the important impulses in economic, social, cultural and political fields.

The S-Bahn-Perimeters of the Swiss big cities define the daily life scope for work, shopping, education, recreation and sports. Actually attracting employment and commercial functions, the traffic knots integrated with public and private transits make clear the boundary between the city and its suburbia. The open space for recreation, sports and even resort can be easily accessible from these nods as well.

IC (high-speed railway) connections and motorway networks canalize personal- and freight transportation and the time distance between city centers affects the functional specialization which founds the complementary urban system. Logistic centers are located in the close of motorway interchanges as well as important motorway entrances, which support the decentralized structures in Switzerland. And another important axes spread out from the agglomerations into the neighboring mountain areas, where holyday cottages are built up for the recreation on weekend and increasingly even during workdays. For example, in Davos changing to a resort area of the agglomeration Zurich, already 25% of the villas are possessed by the Zurich and remains not-leased. (Messerli 2001: 79)

On the other hand the cross-bordering urban- and communication system develops and grows up rapidly on the basis of new high-speed connections. Important transportation- and communication knots form the new dynamic marketing centers, where various industry clusters are located. Above all the big cities can exploit out their own development potentials with internationalized industrial clusters, specialized labors, well-equipped infrastructure as well as easy access to the World. The Swiss big cities, cumulatively Zurich (business and finance), Basel (high tech. industry esp. pharmacy and fair center) and Geneva (international organization), possess such international location profiles. (Messerli 2001: 82)

The emergence of the metropolitan areas is a sign for a progressive polarization of Swiss urban system, but the small- and middle cities outside of the metropolitan areas profit only limitedly from the impulses of large economic centers with the international importance. (ARE 2005) In order to enforce the international competitiveness and the welfare of whole country, therefore Bundesrat (federal council) commits itself to mutual networks between urban- and rural areas. This “concept of networked urban system[2]” is to develop in Switzerland as a living- and economic post. It contributes Swiss land use development to being sustainable and politically compatible. On the other hand cities should manage newly and robustly their expansion and restructure spatially themselves. Furthermore the Bundesrat aims to integrate Switzerland more actively into Europe, for example, by promotion of the cooperation with bordering cities and regions. (Flueckiger 2001: 29-30)

[2] The participative growth is however necessary for a region which has neither a larger urban center nor an industrial or tourism-oriented export basis. Messerli (2001: 82) suggested that the participative growth can secure the economical prosperity to this region between the agglomerations and areas with export basis. If peripheral regions can meet flexibly with the demands of agglomerations and tourist markets and improve accessibility to those centers, they will be able to make the regional prosperity through this participative growth. Therefore the large-scaled approaches are necessary to make cooperation between communities and cantons for common goals and not to abandon the regional diversity.

To guide the sustainable development in Switzerland, now ARE set up “land use concept of Switzerland (Raumkonzept Schweiz)”[3] and made it public for the discussion. Here ARE suggested "networked urban system (vernetztes Städtesystem)" as one of four development scenarios and measured its effects. This scenario aims at the status of Switzerland in 2031.

Scenario <polycentric Switzerland - networked urban system>

Time: 2031

Motto: dynamic and balanced Switzerland

Economic policy: dynamic growth

Domestic policy: strong urban development, increasing mutual complementation between urban- and rural areas Through the incentives the communities (Gemeinde) in the agglomeration have cooperated each other. Thereby they get gradually the political weight necessary to treat the problems over their administrative boundary (transportation, social inequity, infrastructure, residential development, etc.) and to play their roles as important development actors. By the development of international regulations the cross-bordering agglomerations (Basel, Geneva, east Switzerland, Tessin) are formed. The small- and meddle cities which closely connect each other in the urban system and have paved out a milieu for the development of supplementary functions to the agglomerations profited from the cross-bordering agglomerations. Meanwhile each city tries to be specialized in certain fields.

Key factor: Connection of urban agglomerations Owing to the mutual complementation, Swiss cities work together like a large metropolis. The construction of partnerships helps, as the time goes by, cities to consolidate more strongly their own competence. On the contrary to the colorless urbanity each city in Switzerland makes its characterized atmosphere and gives specific employment chances as well as recreation or cultural facilities. Among other things the specific conditions, such as spatial, climatic and architectural milieu, are made use of favorably.

Spatial development: encouragement of inner-city development, improvement of settlement quality, management of urban sprawl With strict control of development activity the functional improvement and specialization of the individual cities makes Switzerland in 2031 a well-networked urban constellation. Agricultural areas and green space lie between cities with different size.

Transportation: higher mobility, efficient public transportation The increasing traffic volume led to the clear mobility growth both between individual cities and within agglomerations. This increased mobility is accommodated primarily by the efficient public transportation system. Through the compact development in the near at rail stations and bus stops a large number of travelers can profit from favorable transportation services.

The commuting trips between the city center and its suburban areas did not increase continuously. However the transportation service was worse in the periphery, because the regional trains and -buses are not well used and can be operated further only by a subsidy from the federal government.

Tourism: Image upgrade of all Switzerland

Source: ARE Raumentwicklungsbericht 2005: 78-81

Tab.3-2 Scenario “networked urban system” from the land use concept of Switzerland

Depending on the results from this scenario, urban network will make it possible to bring economic dynamics, social solidarity and ecological equilibrium into balance, although

[3] The „land use concept of Switzerland" suggests the strategic points for the whole country as well as the specific points for the urban- and rural areas. But the sustainable development can not be achieved automatically. To implement the "land use concept of Switzerland" ARE approached with four principles:

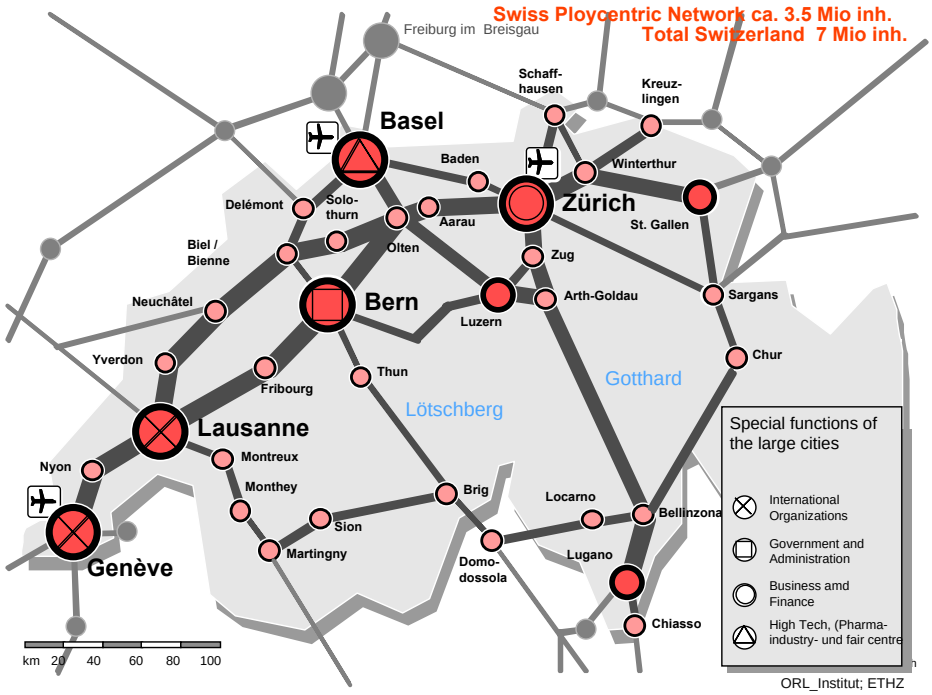
- Intensification of cooperation between participants (communities, cantons, federal government etc.),
- Improvement of coordination between the diverse land use policies (consistency between the sectoral policies),
- Introduction of financial and market-oriented instruments to make incentives for the sustainable development,
- Juridical amendment, in particular a revision of the space planning law (Raumplanungsgesetz).

Like the "Tripartite agglomeration conference (Tripartite Agglomerationkonferenz)" in which federal government, cantons, cities and communities of the agglomeration find out solutions together, the current forms of cooperation should be strengthened and applied to other ranges. The introduction of financial and market-oriented instruments makes it possible to support the inner-city development and control land use development based on the criteria for the sustainable development. (ARE 2005)

peripheral areas that lie outside of this urban network can not profit from that development dynamism and they might not maintain the living standard comparable to the Swiss average without public support. The green space in the highly populated urban areas will be preserved. (ARE 2005: 15)

However the development of networked urban system would be impossible without a clear policy of the federal government. First the federal government contributes itself to the harmonization of basic conditions to reduce the mismatches between cantons and facilitate the cooperation between cities. On the other hand - among other things through transportation connections, introduction of partnerships, and promotion of innovation – it paves out the milieu for the cities to play successfully their roles within city networks. Consequently the role of cantons and communities (Gemeinde) is strengthened and extended into various different fields, too. Cantons are responsible for the intermediation between urban- and rural areas, while communities make efforts to stabilize the democracy at the local level. (ARE Raumentwicklungsbericht 2005: 79)

Therewith not only the inter-regional connections but also the intra-regional urban networks particularly between communities in the agglomeration should be taken in mind. Today communities of agglomeration frequently cooperate with each other but in just several limited sections. A comprehensive coordination including all parts does not take place. On this way it is not possible to solve urban problems efficiently and effectively. So, the agglomeration program is to approach the development of agglomeration neither in some sections nor within the administrative borders but from a total view and even on the international level. Its goal is to secure the coordinated development of agglomeration and therewith to make the institutional basis for the intensified cooperation of communities in the agglomeration. (ARE 2003: 3) This agglomeration program can be treated by a canton as either a part of Richtplan (regional plan on the cantonal level) or a separate instrument. The federal government can manage it exclusively in the frame of canton's Richtplan. So the agglomeration program needs not the permission of federal government. (ARE 2003: 5)



Source: ORL institute; ETHZ

Fig.3-7 Networked urban system in Switzerland

The transportation concept of Switzerland is to

- integrate big cities and major tourist designations into high-speed transportation networks of Europe
- connect important railway stations at the 30 minute intervals by the project Bahn 2000, and
- support intra-metropolitan connections by public transit with S-Bahn-concept.

This approach can help Swiss urban system to cohere multilaterally. At last Switzerland can be understood as neither an urban constellation nor an idyllic country, but a decentralized and harmonized country with urbanity and rusticity. Switzerland can develop further her comparative locational advantage. (Karel 2000: 42, Messerli 2001: 88-89)

① Bahn 2000 – an integrated public transit system

The gist of project Bahn 2000 is to connect the big cites at the 30 minute intervals, because the frequency is a critical criterion to increase the patronage of public transportation. And the investment is intended to develop transportation wagons as well as Infrastructure. At last this project will be able to improve the integration of transport chains and reduce the travel time.

With the operation of new section between Olten and Bern in 2005, so-called the first stage of this project will be completely accomplished. The second stage should deal with the rest projects shelved due to the financial reasons.

However two points must be kept in mind, when making an approach to the cross-bordering transportation in the project Bahn 2000

- First residential areas over the national border line must be integrated with transportation network. It should apply for example to the agglomerations, Basel and Geneva, or to the region Bodensee and the region Tessin as well.
- On the other hand the European long-distance transportation network must be integrated with the national public transportation system. (Füglistaler 1999: 59-60)

② NEAT: construction of two tunnels through the Alps to 2016

The project NEAT is related with nearly all European TEN net plans. Now two alpine tunnels construction (Lötschberg tunnel, Gotthard tunnel) is financed under the name of NEAT and they will encourage the external traffic flows through the Alps to be made by rail as much as possible. Owing to Open Access foreign freight trains will be able to pass through the new flat railway sections without problems. For the passenger transportation the construction of new railway sections opens a new perspective to connect Germany and Italy by the high-speed railway systems. (Füglistaler 1999: 60-61)

③ Projects for the high-speed railway connections to 2012

The improvement of railway connections with neighbors can help to reduce the travel time. Swiss investment fund should be made use of in order to link the east- and the west Switzerland with the European high-speed railway network. (Füglistaler 1999: 62-63)

3.2.3 United Kingdom

As the U.K began to emerge from the trough of Great depression during 1932-1936, the old industries such as coal, steel, ship and heavy engineering had become extremely vulnerable to changes in the world economy; weakening demand of industrial goods, technological substitution and new competing industrial powers. Meanwhile the new industries growing rapidly in both production and employment were developed in the quit different location from the old ones. Electrical engineering, motor vehicles, aircraft, precision engineering, pharmaceuticals, processed foodstuffs, rubber, cement and a host of others grew around London, in towns like Slough, and in the West Midlands (Birmingham and the associated conurbation) and East Midlands (Leicester, Nottingham, Derby and the area around).

In 1934, the growing realization of this problem compelled the government to take actions. The depressed areas were designated 'special areas' and commissioners to spend public money to help invigorate the economy. The Barlow Commission in 1937 understood the national- and regional problem, and pointed out relatively higher employment rate in London-Home Countries and Midlands in spite of the striking concentration and its disadvantages, as two faces of a coin. They thought the growth of most prosperous areas could be explained in terms of their more favorable industrial structure and otherwise the areas would be depressed further[4]. On the remedies, however commissioners split between the moderate majority and the radical minority. The majority suggested that in the first places there should be controls on the location of new industry only in and around London by a Board. The minority including the influential Professor Abercrombie recommended more general controls on the location of industry throughout the whole country by new government department set up for the purpose. At last the government accepted a modified version of radical variant. The Barlow recommendations on industrial location controls affected many follow-up studies, cumulatively the Distribution of Industry Act in 1945 as well as Great London Plan in 1944[5]. In order to steer industry away from London and the Midlands towards the former special areas, on the other hand since 1945 any new industrial plant or any factory extension over a certain size (which was originally fixed at 10,000 feet and 10 percent, but which was varied somewhat subsequently) had to have an Industrial Development Certificate (IDC) from the Board of Trade (its successor, the Department of Trade and Industry). (Hall 1992)

The increase of office workers since 1950s induced another concentration problem in South East region and the Office and Industrial Development Act was set up in 1965 to control office development in and around London and other big cities. However the 1970s' structural economic changes, notably the loss of manufacturing industries and of port and other good-handling functions had made not workable the Industrial Development Certificate (IDC) and the Office Development Permit (ODP). Therefore ODP in 1979 and IDC in 1981 were abolished by Thatcher government, following free market economic principle and reducing government's roll in spatial development control. (Bae, Cheong 1996a: 259-260) To encourage industrial and commercial activity, usually in economically-depressed areas, even in the central areas of London, Enterprise zone (EZ) was introduced in the UK in 1980 and designated by government. The development project of east London is one of successful

[4] The Barlow Commission could find no good cause why the pattern of forces should start working in a different direction. While the 19th century industry was diverted toward fuel and raw material, the 20th century industry gravitated to its main markets with a wide range of different labor skills and specialized services which smaller industrial towns lack. It was led also to wrong direction due to the lack of tool for analyzing disadvantages; very few urban economists and the threat of imminent war. (Hall 1992)

[5] To barrier effectively an urban expansion and offer a valuable recreational tract for Londoners, a green belt of 5 mile (8km) width around London was drawn. The overspill could be affected by construction of self-contained communities for living and working beyond the normal outer limit of commuting to London, which was intended by Ebenezer Howard nearly half a century before. Abercrombie therefore proposed that about 400,000 people be accommodated in eight more or less completely new towns with average size of about 50,000 populations between 20 and 35 miles (35-60km) from London. Another 600,000-population towns should go to expansions of existing small country towns, mainly between 30 and 50 miles (50-80km) from London, but some more distant. (Hall 1992: 74-76)

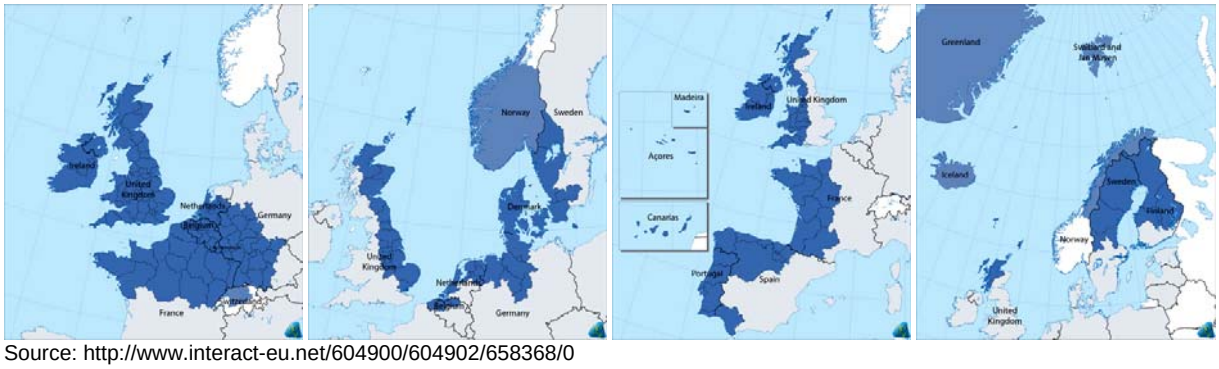
example introducing EZ. To attract private investment there were no planning controls (with minor exceptions), rates (property taxes) were paid by Government and capital investments could be written off against a company's tax liability. (tiscali.reference 2005, LDDD 2003)

Now globalization and European integration have reinforced the interdependencies between the countries and regions in the Europe. The networks can benefit as one integrated entity the specialized economic and political strength that individual cities could not otherwise have developed on their own. The increasing movement of people and goods across national and regional borders demands cooperation on transport axes and development corridors.

The global economic command functions concentrate in London, one of the world' international trade and communication gateways but South Wales, the Midlands and North of England, and Central Scotland where established industrial areas are concentrated need now economic restructuring. The congestion problems in metropolitan areas also stimulate the growth of alternative economic centers such as Edinburgh and Bristol. However these centers needs to capitalize on several factors such as the presence of skilled labor, adequate technical availability, the quality of the environment, the innovative capacity of firms, and the ease of communication with major centers.

In order to maintain and improve economic prosperity and competitiveness, especially through promoting links to major international gateways, the capacity of alternative modes develops for congestion reduction and the inter-operability of transportation system is improved so as to provide the best possible access to high-speed transit modes. Now TEN-T project renews and upgrades Britain's main west coast railway line which runs from Glasgow through Liverpool and Manchester to Birmingham and London covering 850 km. This improved line will connect to the Channel Tunnel Rail Link in London, providing a high-speed service all the way from Scotland to continental Europe. Passenger service will be able to achieve maximum speeds of 200km/h. To relieve current road traffic bottlenecks connecting UK/ Ireland and mainland Europe the A 14 and M6 roads and ferry ports of Felixstowe and Harwich are upgraded. (European communities 2002)

The INTERREG Community Initiative, which was adopted in 1990, is intended to prepare border areas for a community without internal frontiers. Between 2000-2006 INTERREG III program is designed to strengthen economic and social cohesion throughout the EU, by fostering the balanced development of the Europe through cross-border, transnational and interregional cooperation. It is financed under the European Regional Development Fund (ERDF). (European Union On-line 2004) For improvement of territorial development and cohesion in the European Union, UK is dealt with by four programs of INTERREG III strand B, North-West Europe, North Sea, Atlantic area and Northern Periphery.

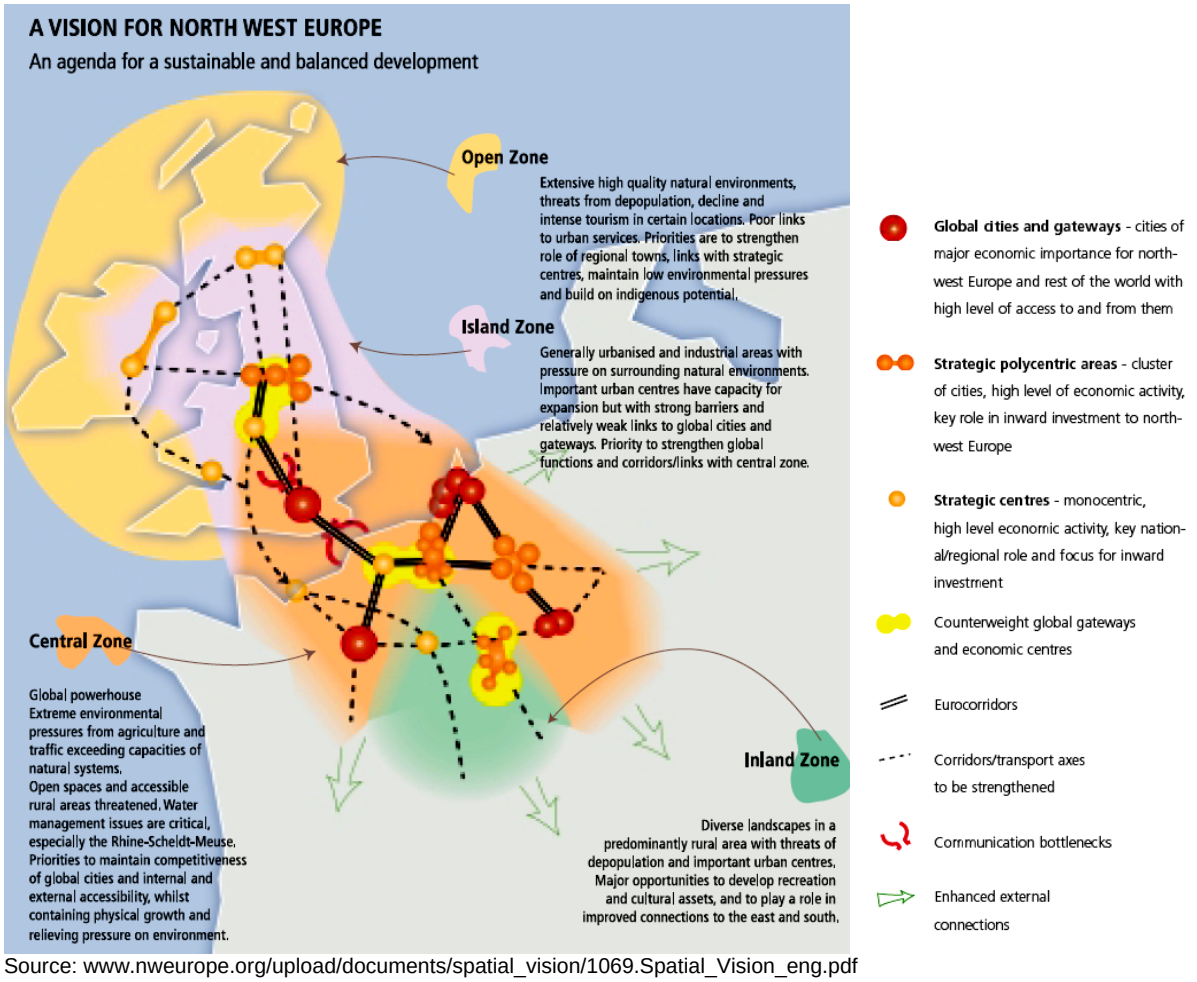


Source: http://www.interact-eu.net/604900/604902/658368/0
Note: from left: INTERREG III North-West Europe, North Sea, Atlantic area, and Northern periphery

Fig.3-8 INTERREG III strand B relevant with UK

INTERREG IIIB North-West Europe

The whole UK is treated by this program identifying North-West Europe with four zones; open zone, island zone, central zone and inland zone and UK belongs to three zones except inland zone.



Source: www.nweurope.org/upload/documents/spatial_vision/1069.Spatial_Vision_eng.pdf

Fig.3-9 Vision for North-West Europe

Open zone: the open zone is relatively sparsely populated and has high quality natural environments, but there is a threat of depopulation and decline together with more intense pressure from tourism in several locations. The priority is to create more balanced development with the neighboring zones and better connections into the central area of Europe without jeopardizing the quality of the natural environment. Cooperation is needed to confirm the status of small number of regional hubs and to maximize linkages within the area. To counter the growing pull of the center the development of indigenous potential is to be given high priority.

Island zone: the weak physical connections with the global cities along with the barrier effect of London need to be overcome. Cooperation should concentrate on a common strategy to establish physical and economic links with the global cities and to promote the zone's role as an alternative international gateway and economic center. This will require agreements amongst networks of regions and cities about where development should be concentrated, ensuring development of alternative corridors to continental Europe. However attention also needs to be given to connections to and through London which will remain the main link with the other central cities. Industrial heritage is widespread and the proximity of this zone to the center gives opportunities for use of existing assets for leisure and tourism.

Central zone: the task is to maintain the international competitiveness of the cities whilst controlling their further development. The balanced development might be best achieved by encouraging new development activities in other locations. Open areas should be protected and enhanced through the creation of open corridors linked trans-nationally across regions. (European community initiative INTERREG III B 2000)

INTERREG IIIB North Sea

Including one million cities Bradford and Doncaster, several urban agglomerations of regional importance are located at the different scales on the North Sea region, such as Leeds, Sheffield, Barnsley, New castle, Edinburgh, Aberdeen, and Dundee. But in national terms the North Sea region of UK is sparsely populated and has undergone a process of reverting dependency on agriculture and sea-oriented activities (port functions, fishery, ship-building).

Small towns have been traditionally a focus for local trade and services across a large rural area. However increasing dis-economies of scale in retail, financial services and healthcare provision and the growth of better equipped and more modern facilities in larger centers now threatens their existing service base. Therefore old, derelict urban structure should be regenerated and transformed to attract business development and provide qualified life. Regional centers are to make effective use of their potential for new economic activities by urban network sharing complementary services and ensuring social diversity and integration.

Inter-and intra-regional networks should be bolstered by transport infrastructure and information technology with a focus on the sustainability. The improvement of regional accessibility supported by inter-modality plays important role for economic development and contributes to sharing the benefits to all part of regions participated in the networks.

Now the highly developed port systems as well as existing rail, road and air links provide a solid physical basis for interregional integration. Nevertheless transport links must be further improved with neighboring regions Birmingham, Liverpool, Manchester, Glasgow as well as London on the macro-regional level. In particular port cities on the North Sea, like Felixstowe, Tees and Harlepool, functioning as transshipment points between land and maritime transport should pay more attention to the improvement of port-hinterland links.

On the North Sea there are large unspoilt natural areas with high concentration of tourist facilities and a rich and colorful cultural heritage of Scottish and English Monarchs. Considering the impact on the North Sea therefore the land use pressure on these valuable areas has to be minimized. Spatial policy tools should be carefully introduced and contribute to the protection of ecological and cultural heritage by controlling the urban expansion and reducing the disadvantages of motorization. (Planco (n.d))

INTERREG IIIB Atlantic area

Atlantic area of UK demonstrates a poly-centric rural region influenced by towns inclusive of Birmingham, Manchester, Glasgow and the demographic development is in decline or stagnated. Traditional industrial towns related with heavy- and maritime industry confront to the needs of sectoral restructuring by the globalization of economy, the urban renewal in industrial wasteland, and the reduction of serious social disparities, even though administrative and tertiary towns in southern England have frequently benefited from the industrial relocation and the investment of state and the host of research centers and high-tech-industry demonstrates the synergy with universities along the M4 corridor from London to Bristol, now.

The network of towns and the development of interrelation between urban and rural areas will make it possible to give a boost to the rural areas. The strategic role of gateway towns including towns without ports should be reinforced and the small- and medium towns in rural

areas are to function as focal points for regional development and promote their networks. The regional competitiveness can also be improved by the construction of research towns targeted to socio-economic and environmental requirements, such as the prevention of coastal pollution, the maritime industry, etc. and their networks. These innovative towns can offer not only the locational advantage but also the attractive image as a basis of new technologies.

The improvement of regional accessibility by multi-modal transport development plays a key role to reduce the economic disparities resulting from the poor interurban connections rather than those with London. To meet the logistic changes the links between ports and their hinterlands should be promoted and the interregional maritime short connections for freight and passengers, so-called “motorways of the sea” contribute to developing coastal economy and reducing the detrimental environmental impact. The improvement of air links of regional airports will help to reduce the congestion of major international air ports, too.

The integrated management of coastal areas and the promotion of inter-regional initiatives are fundamental to protect the natural eco-system and improve the coastal tourism. The concerted development of cultural heritage, such as urban culture with maritime characters, Celtic roots, industrial heritage, etc. can enhance the regional identity by tourism.
(Interreg Espace Atlantique 2001)

INTERREG IIIB Northern Periphery

Most of regions suffer from out-migration. Low population density is the most outstanding characteristic and has resulted in a sparse settlement structure. A lack of significant population centers raises the cost to provide service for public- and private sectors.

Most of the land area is subject to low intensity land uses. The environmental quality of the land is high but the potential for agriculture and forestry is limited by the terrain and climate. Even though air quality in Highlands and Islands is generally of a high standard, the growth in the use of transport mainly increases air pollution.

Distinctive Gaelic, Norse and Scots traditions and environmental features as a tourism speciality in the Highlands and Islands are considerable potential for further environmentally sustainable development as the basis of an economic advantage

To reduce the negative consequences of sparse population and encourage the business development at sustainability of communities an efficient and effective transport network should be made whilst maximising environmental benefit. The car will continue to provide flexibility in remote areas, but people may have the choice to transfer between transport modes without having to resort to car usage. Integration between ferry, train and bus needs to be adopted more widely. With a need to enhance the roles of regional centres there is a demand to support smaller settlements by dispersing employment and services where appropriate.

On the other hand the active involvement of citizens is necessary for successful community development and better planning tools are required to inform and implement spatial development strategies, related to the joint management of natural resources, regional development, and problem solving pollution. (Interact 2001)

3.2.4 France

In the 19th century France never experienced the rapid population growth like that of other advanced countries. Because of the strong tradition of centralization in French life Paris grew up apace, while other parts of the country were stagnated and even declined. At last Paris came to dominate the economic and social life of the country to an unusual degree. Since the 2nd world war the population has rapidly grown but in the process it has concentrated further to the urban areas, above all to Paris.

During the postwar reconstruction period, the problem "Paris et le désert françias" was drawn to the attention[6]. In the early 1950s the special state funds were created for the regional development, though these were outside the planning process. From 1955 the central plan agency (the Commissariat général au plan) was given regional responsibilities. In the same year, a decree established that government approval would be necessary for new factory building or reconstruction in the region Paris. Thereafter the capital's proportion of new industrial building did fall. A 1960 plan for Paris (the so called PADOG) proposed a stop on the further physical growth of the agglomeration at the scale of city region.

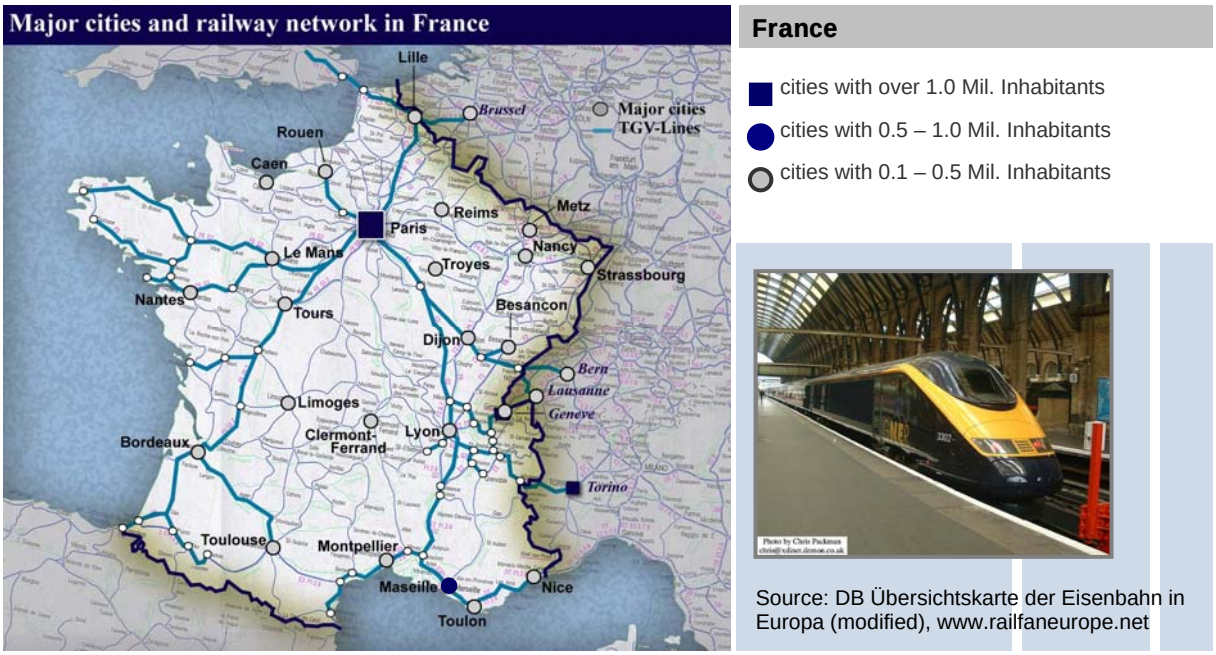
However it was questioned critically what this system has achieved. Even though the policy trying to restrict the growth of Paris has been retained at the major scale of the relationship of the regions to the national economy, it has been modified. In the contrast to the 1960 plan which tried to pit an absolute stop on the physical growth of Paris, but a later 1965 plan (so called Schéma directeur) assumed the growth of population. The objective was to slow down the rate of migration to the region Paris, first by the careful localization of government investment and then by guiding the private investment through the provision of public infrastructure, especially in eight métropoles d'équilibre (balancing metropolitan areas), designed as counterweights against the capital in 1963. Carefully selected on the basis of the major provincial centers, they are designated to act as centers of economic development for their respective regions. They are Roubaix and Tourcoing, Nancy-Metz, Strasbourg, Lyon-Saint Etienne, Marseille-Aix, Toulouse, Bordeaux and Nantes-Saint Nazaire.

Since the late 1960s, successive French governments have systematically sought to divert public investment into these poles, thus strengthening their economic potential and utilizing them as a device to attract private capital. Besides the relocation of government's offices and higher educational institutions in these metropolises, the motorway system developed between the 1960s and 1970s and the TGV (Train à grande vitesse) [7] system constructed in the period 1980s-1990s have functioned as connectors between Paris and eight métropoles.

Yet there are two snags, even though this policy corresponds fairly well to the French geography: outside the region Paris, France is less urbanized than Britain or Germany and the urban population is heavy concentrated into the eight regional centers. One is that all the regions contain large rural areas which are outside the sphere of influence of métropoles and to support this periphery, additional small regional centers would be necessary. However it could run the risk of spreading investment too thinly. The other problem is that the investment in the eight regional centers also has to compete with the investment in Paris. (Hall 1992: 172-173)

[6] This remarkable book published in 1947 by a young geographer Jean-François Gravier argued that the contrast was rooted in an accident of history and not in economics. However technological innovations, such as widespread electric power and motor vehicles could promote dispersed industrial development in the countryside and reverse the trend. (recited from Hall 1992: 168)

[7] In 1981 TGV Sud-Est linked Paris, Lyon-St Etienne and Marseille-Aix; the Atlantique in 1989-90 connected Paris, Nante-Saint Nazaire, Bordeaux and Toulouse; the Nord in 1993 Lille-Roubaix-Tourcoinig; in 2006 the Est will hook in Nacy-Metz and Strasbourg. (www.railfaneurope.net)



Source: DB Übersichtskarte der Eisenbahn in Europa (modified), www.railfaneurope.net

Fig.3-10 Railway network and settlement structure in France

Now DATAR has compiled the long-term report "planning the space of France for 2020" in its own initiative. This future-scientific study following the opinion of DATAR clarifies what are the substantial cornerstones for spatial planning and development, i.e. the well-planned spatial structuring and the development of purposeful policy actions. After questioning important factors of the future the actual or potential risks resulting from them were outlined and finally four contrasting and explorative scenarios were introduced.

First the facets which seem to be important for the spatial development in the future were enumerated thematically.

- Dialectics between global and local factors,
- Paradox of technology and environment,
- Individual behavior and collective expectations, and
- Approach of European context and forms of the social adjustment between protection and differentiation

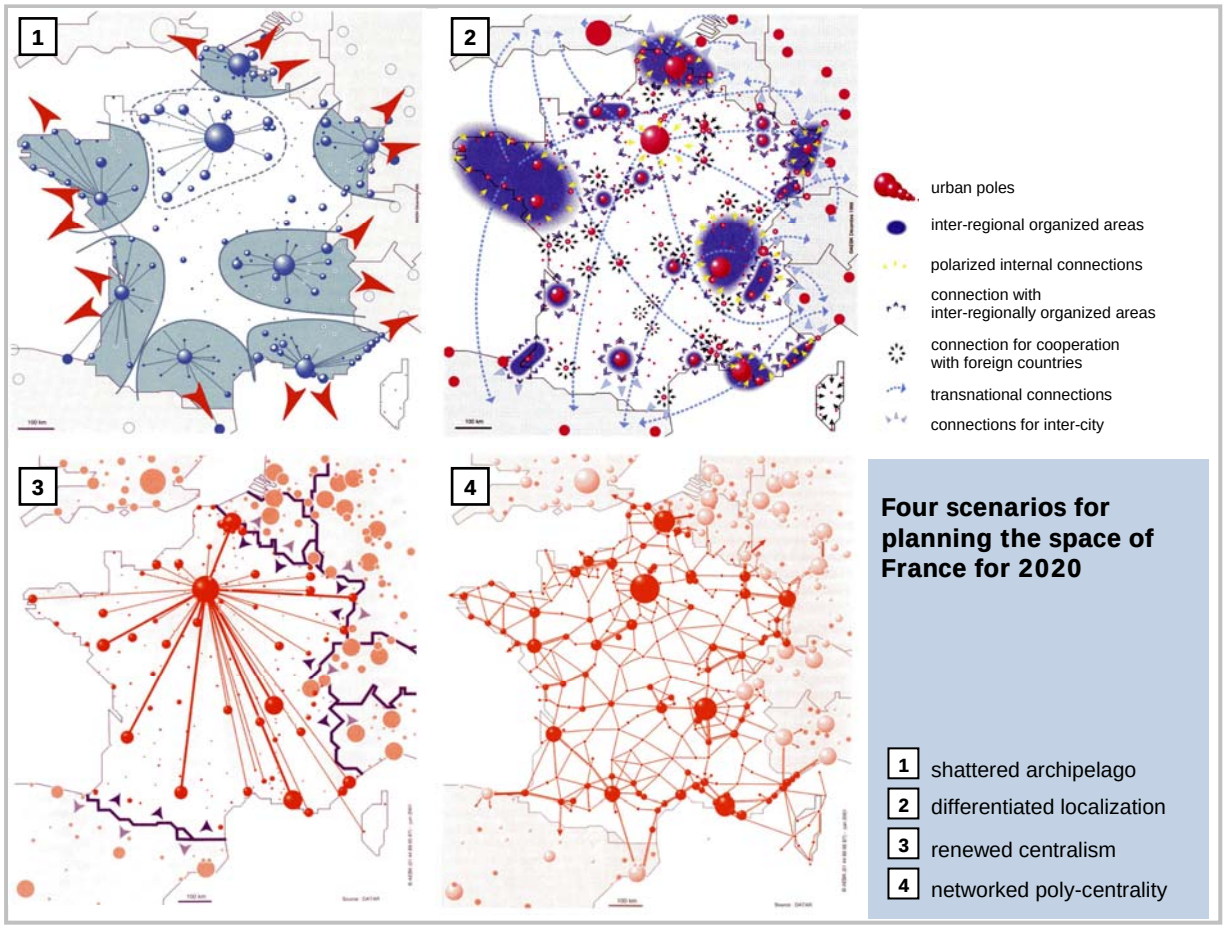
Depending on them DATAR determined the risks whose spatial effects could be crucial:

- Risks for the inter- and intraregional segmentation and segregation which solidifies the social and cultural divisions,
  - Enlargement of differences between the capital region and remaining areas,
  - Declination of central areas and formation of depressed regions,
  - Off-splitting of the external areas of the axis Lille-Paris-Lyon-Marseille, and
  - Isolation of regional identities,
- Risks of public financial resources and national sovereignty as well as cohesion between constituents due to the globalization of economic sector, and
- Risks for environment

Considering substantial needs and risks in the future four scenarios were represented. They were based essentially on two contrasting factors, the already existing tension between globalization and localization and the conflict between jacobinic- and girondinic approach in institutional organization and political reactions.
The globalization reflected on a scenario 1 "shattered archipelago" is affected by four characteristics: the extreme mobility of elites and their concentration in the mega-cities, the

standardization of products and markets, the triumph of speed, and the features resulted from the globalization. In the contrast to scenario 1, the local dimension in a scenario 2 "differentiated localization" is characterized through the maintenance of demographic structure and spatial connections and the uniqueness and identity of products as well as the production of recognized and distinguished factors.

The neo-jacobinic vision in a scenario 3 "renewed centralism" is featured by a strict top-down hierarchy and the retreat to the isolated national territory as well as a continuous suppression of the spatial breakup in authoritarian way by central government. On the contrary the neo-girondic vision suggested in a scenario 4 "networked poly-centrality" emphasizes the interconnection with areas and institutions, an opening to Europe, and the political will for the restructuring of the national territory.



Source: (Guigou & Peyrony, 2004: 6-14)

Fig.3-11 Four scenarios for planning the space of France for 2020

Among these four scenarios DATAR considers the scenario of the networked poly-centrality desirable, because it seems appropriate to following three requirements, solidarity and social cooperation, economic efficiency, and sustainment of ecological equilibrium. The scenario of the networked poly-centrality is suitable for a common mobilization developing now effectively in the spatial dynamics. It answers to the expected changes in the society and politics both on the local- and national level and admits the increasing complexity of the tasks of spatial planning. The inter-communal cooperation triggers to accomplish the reform of state and the social restructuring and encourages neighbors to participate in the local development.

In order to set a spatial restructuring in form of inter-regional ensembles DATAR decided to support an inter-regional organization in six units and each unit will be structured by a consolidated urban system in the process. The six units are the grand east, the grand

southeast, the grand southwest, the Atlantic west, the north and Parisian basin. Cooperation and partnerships in the six units are formed in different way and intensity. Public policies aiming to implement a scenario “the networked poly-centrality” are varied, according to the different situation of regions. The application of a non-uniform development model is to facilitate and accompany a function of polycentric but heterogeneous networks. (Guigou & Peyrony, 2004: 1-19)

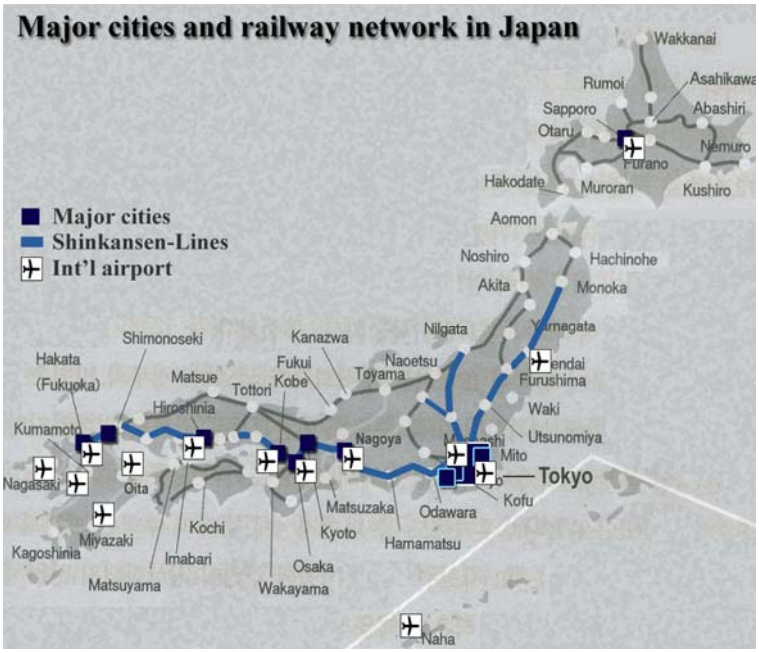
3.2.5 Japan

So far, Japan has been structured in a way concentrating population and function in the Pacific belt and emanating from a pole Tokyo. This structure reflects economic development in last 20th century to catch up with Europe and the US within the shortest period. Now this structure causes numerous problems, such as the declination of comfortable urban life and the lack of vitality in rural communities, the destruction of beautiful scenery and natural resources, and the country's vulnerability to local disasters.

The mono-polar, mono-axial land structure of today's Japan was initially formed under the supervision of the pre-war centralized government to build up heavy chemical industries for the production of materials for the war. Because the Pacific coastal areas provided good locations to import resources, factories and infrastructures for industries were constructed in those areas. With the build-up of industrial plants in these areas more and more people moved there searching for jobs after war and the urbanization developed eventually forming the "Pacific belt." This region led Japan's high economic growth, but also suffered from the overpopulation causing disqualification of living standard, traffic jams, ecological impairment, overloaded supplies of resources. On the other hand areas outside the Pacific belt showed serious depopulation. As developing service economy, the central managerial functions of companies and financial sectors have been more and more concentrated in Tokyo. This polarization of all important functions along with the “Pacific belt” led Japan into its mono-axial national land structure and intensified the disparity between regions.

Japan

12 cities with over 0.8 Mil. inhabitants including Tokyo



Source: Photo on the left from Fossett (2005)/ Picture on the right from Seo, Sun-Duk et al. (2001: 183) (modified)

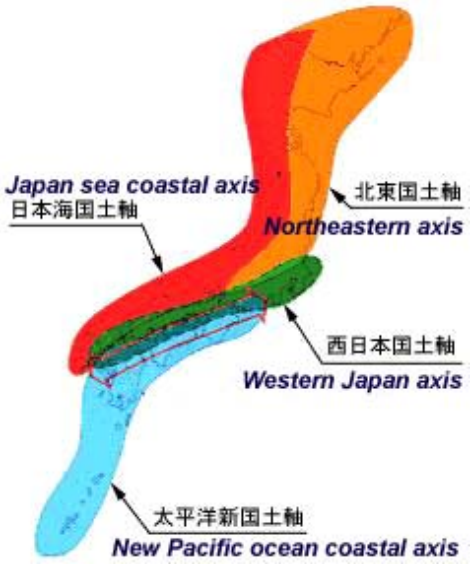
Fig.3-12 Railway network and settlement structure in Japan

Recently however the mono-axial national land structure which is one of the nation's biggest problems seems to change by the construction of high-speed traffic networks including expressways and shinkansen lines[8] in rural areas. As reducing the time and physical distance between the capital region and its periphery the provincial center cities function much better as hubs and supply the qualified urban services to surrounding communities. However concentration on Tokyo metropolitan area is still high.

[8] Shinkansen, Tokaido line linked Tokyo, Yokohama, Nagoya, Hiroshima, Kyoto, and Osaka in 1964 and extended to Hakata in 1975 through Sanyo line. Tohoku line which has been built since 1982 and completed in 1991 connects Tokyo and Morioka and Jyoetsu line, Tokyo and Niigata. Hokuriku line, so called Nagano line hooks up between Takashiki and Niigata. (www.knr-daechang.go.kr/data/others/highr/japan.com)

No progress has been made in solving the overpopulation problem, while in the centers of large cities including Tokyo, the population is decreasing[9] and communities of the areas are being destroyed. Due to the changes of industrial structure and logistics, vacant lots in the industrial zones are sometimes left unused or are not used fully.

In March 1998 the ministry of land, infrastructure and transport reflected demands of new decentralized land structure on the 5th comprehensive national development plan, “Grand design for 21st century”. Considering climate (basic conditions determining culture and lifestyle), natural environment network including ecological and water systems, exchange of historical experience and cultural heritage, and geographical features, the following concept will be realized. First, the hierarchical inter-city structure with Tokyo at the top created a "hub and dependent satellites" relationship. This hierarchical system need convert to an urban structure by the support of wide cooperation between autonomous cities. Second, comfortable living conditions must be secured by creating new cultures and lifestyles as well as protecting and restoring the natural environment. Third, each region should provide the most advanced urban functions, not only depending on their role within the regional structure of Japan, but also as a member of the Asian Pacific region and of the global society.



Four axial zones in Japan

- **North-Eastern National Axial Zone**, which covers the central highlands, the north part of the Kanto area, the Pacific side of the Tohoku area and Hokkaido, and their peripheral areas
- **Japan Sea Coastal National Axial Zone**, which covers the north part of Kyushu, the Japan Sea side of Honshu, the Japan Sea side of Hokkaido and their peripheral areas
- **New Pacific Ocean Coastal National Axial Zone**, which covers Okinawa, central and south parts of Kyushu, Shikoku, the Kii Peninsula, coastal areas around Ise Bay and their peripheral areas
- **Western Japan National Axial Zone**, which is expected to share roles and compete with Asian Pacific region

Source: www.mlit.go.jp/kokudokeikaku/zs5/index.html

Fig.3-13 Four axial zones in Japan

According to this new restructuring concept, now Japan takes efforts to form a multi-axial national land structure. It consists of several zones with their own regional characteristics. By mutual interchange and wide cooperation between these unique regions the country will be able to enjoy regional differences and diversity.

[9] Tokyo's population which was about 12,060,000 in 2000 will hit a peak at 12,260,000 in 2010 and then begin to decline to about 12,220,000 in 2015. However the workforce in Tokyo will stay at the present level as a result of an increase in the number of working women and the increased hiring of the elderly.(Bureau of city planning Tokyo metropolitan government)

In the national axial zones outside Pacific belt, small but well-organized urban communities will flourish based on two different networks:

- a network of multiple urban communities linked by information and communications systems as well as efficient and environmental-friendly transportation and
- a nature network.

Individually attractive urban- and rural communities within the zones will cooperate, so that residents will be able to enjoy their comfortable and convenient lives. Each zone will develop new cultures and lifestyles based on its historic and climatic characteristics and will build unique and intellect-intensive value-added industries. In order to respond to increasing exchanges of people, materials and information, it will be necessary to develop new and highly flexible transportation systems and information and communications systems, considering regional characteristics. In the Pacific belt, on the other hand, the current decrease in population growth will give an opportunity to solve the problems related to overpopulation in the large cities. At the same time, the Pacific belt will be made a more attractive place to live by restructuring industries and protecting and restoring the natural environment. Renovating the Pacific belt and peripheral areas, and promoting mutual support and cooperation between the new national axial zones, will transform Japan into a “garden island” that provides its citizens with diversified opportunities to live and work comfortably regardless of gender or age.

Transportation system connecting areas domestically and internationally plays an important role in converting current mono-axial national land use structure to multi-axial system. It is more important now due to the national policies to provide each region with equal opportunities to become functionally independent and develop itself autonomously through interregional cooperation. But here are considered harmony with nature, safety and the environment, based on suitable role-sharing between the public and private sectors as well as between the national and local governments.

The transportation will be improved with basic goals:

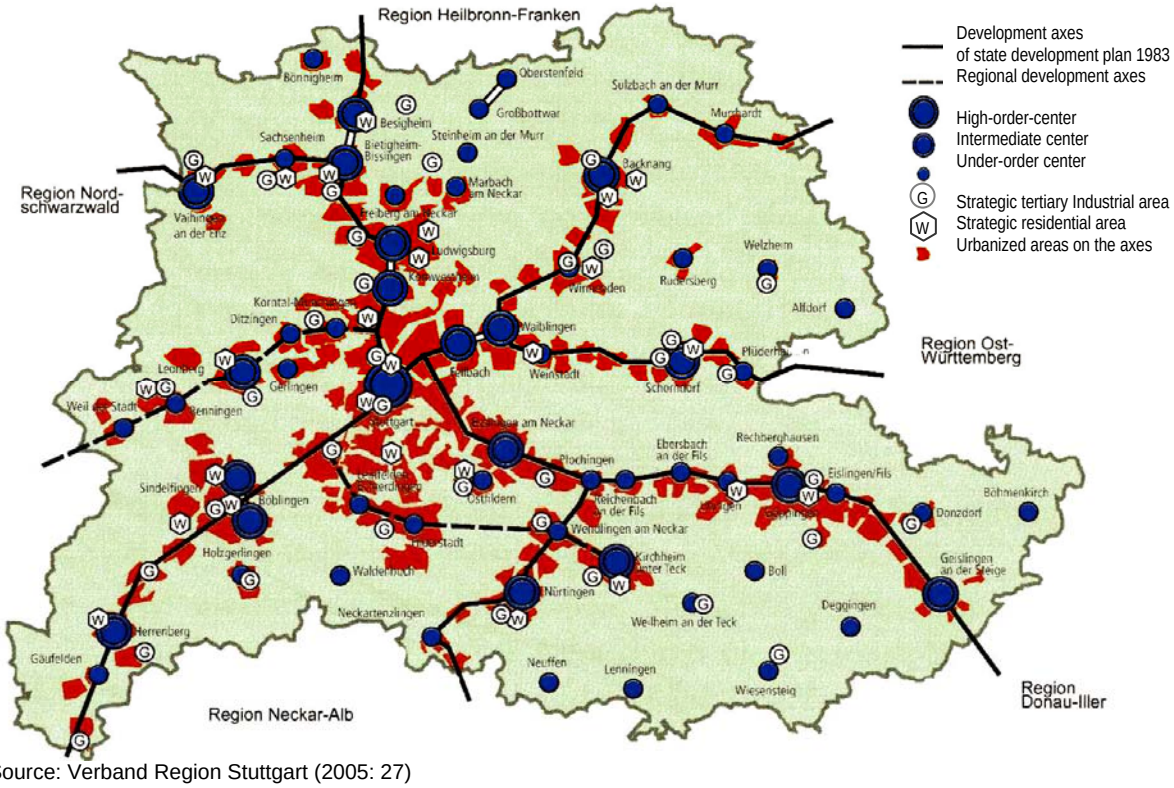
- Ensured access to international services by the support of high-speed transportation systems, so to make an East-Asian one-day zone
- More convenient and fast transportation networks by directly connecting regional feeder lines with national trunk lines: On the national level, it will make one-day trips between the major cities possible and create "nation wide one-day traffic ranges". On the regional level, "regional half-day trip zones" will be formed in line with the proper establishment of urban functions. People will be able to travel from their towns to the prefectural hub cities within about one hour and to the major core city areas and the major distribution terminals within about two hours.
- Safe and convenient transportation network resistant to natural disasters and harmonized with cultural- and natural heritages by combining the transportation facilities according to their characteristics and coordinating the service diagrams as well as by implementing countermeasures against natural disasters. (Ministry of Land Infrastructure and Transport, 1998)

3.3 Case studies: Regional approaches for network cities

3.3.1 Region Stuttgart

The region Stuttgart is one of 12 regions in Baden-Württemberg and located in the center of this state. Through the administrative reform in 1973 the region Stuttgart belonged to Regionalverband Mittlerer Neckar but from 1994 the Verband Region Stuttgart is independent from it. As developing the European integration the German minister conference for spatial planning (die deutsche Ministerkonferenz für Raumordnung (MKRO)) that perceived the important role of metropolitan region in the filed of spatial development designated in 1997 the region Stuttgart as one of European metropolitan regions in Germany. (Wilske 2002: 11-12)

The area of region Stuttgart is 3,654 km2, accounting for approximately 10% of Baden-Württemberg and there lives 2.65 million people (as of 2004), 25% of total population in this south-western state of Germany. Its population density (725 inhabitants/ km2) is higher than those of region Frankfurt, Hamburg, Cologne and Munich. Region Stuttgart includes state capital Stuttgart, Ludwigsburg, Bölingen, Esslingen, Göppingen and Rem-Murr-Kreis and there are 179 cities and communities with 800 - 570,000 habitants. Unlike mono-centralized Munich and Hamburg, the region Stuttgart has developed poly-centrically and the city Stuttgart is closely connected with regional centers around it.



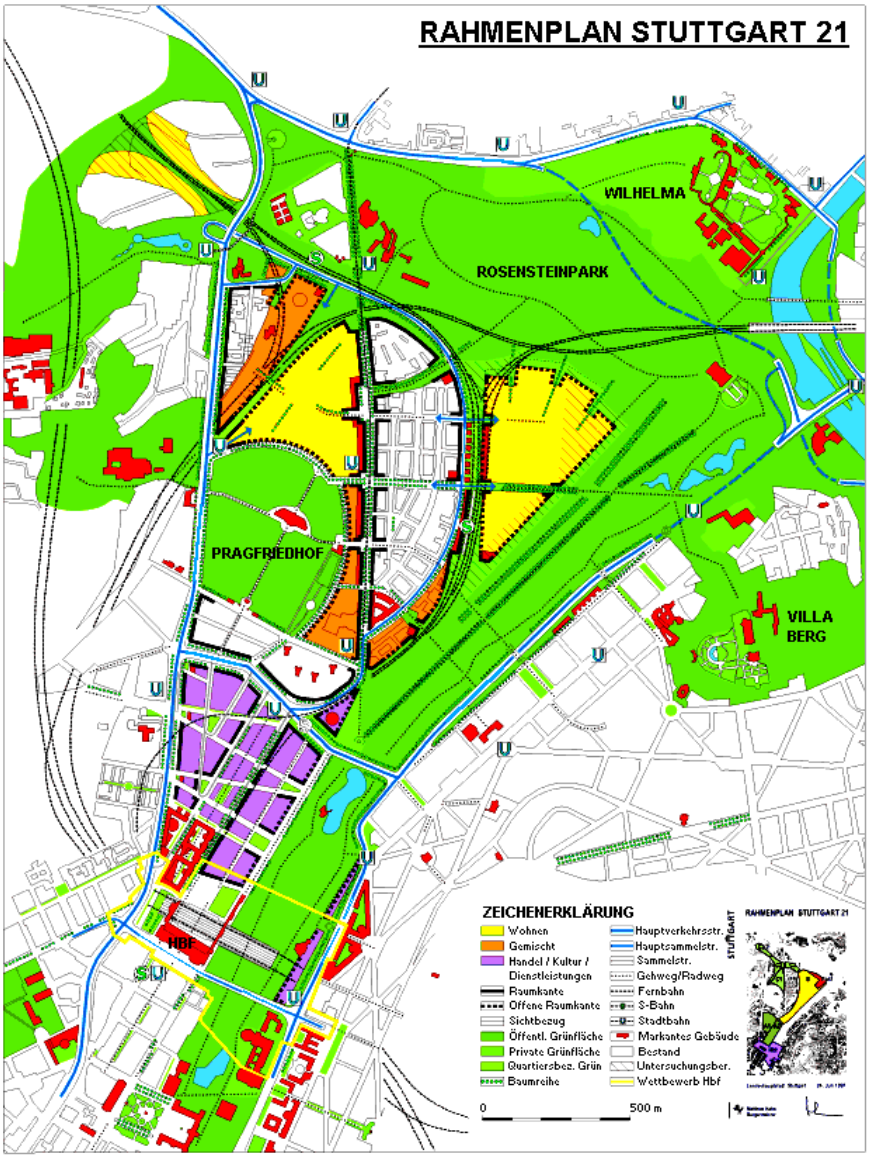
Source: Verband Region Stuttgart (2005: 27)

Fig.3-14 Spatial structure of the region Stuttgart

Now, with increasing household incomes, the living area per capita steps up between 1970 and 2000 from 26.2 m2 to 40 m2 in Baden-Wuertemberg and the increase of land use demands exceeds over-proportionally to the population growth in the region Stuttgart. From 1974 to 2004 the population increased to 12.6%, but in the same period the built-up areas grew up by 44%. The mobility in the region is also active. The 2/3 of workers commutes out over the administrative boundary of their communities. (Verband Region Stuttgart, 2005: 27-32)

To control and guide increasing development pressure in the sustainable way and accommodate growing inter-regional mobility therefore the regional plan approved by regional parliament in 1998 designated 26 residential areas and 36 manufacturing- and service industry centers as strategic development places along the development axes in the region Stuttgart. Verband Region Stuttgart issues development certificates and controls the development density of certificated areas depending on central place concept.

The developable density in a certificated residential area on a development axis is differentiated following the urban hierarchy: High-order center (Oberzentrum): 90 inhabitants/ km2; intermediate-order center (Intermediate-order center): 80 inhabitants/ km2; others: 60 inhabitants/ km2. If a community is certificated as a community where the additional urban expansion is not allowed (Gemeinde mit Eigenentwicklung), the development density can not be over 50 inhabitants/ km2. (www.urban21.de 2002)



Source: www.stadtklima.de/stuttgart/s21/s21_k251.htm

Fig.3-15 Stuttgart 21

Stuttgart 21 is a project on the construction of a new subterranean station in conjunction with the urban renewal of disposable track areas and marshalling yards that amount for about 100ha. The development in rail yards will contribute to absorbing the development pressure in suburban areas and revitalizing the depressed inner city area. With this urban renewal plan this project includes the integration of rail service that makes Stuttgart not only a

regional center but also one of major transportation nodes in the Europe. Three ICE-lines and an ECE-line will intensify the long-distance connections. ICE connecting Hamburg-Munich, Münster-Munich, and Berlin-Munich will make a stop in Stuttgart at one-hour-intervals and in every two hours ECE will link between Paris and Munich via Stuttgart. At the same time 5 Interregio-Netz will connect Stuttgart with its neighboring regions at two-hour-intervals. Heidelberg-Tübingen, Saarbrücken-Lindau, Karlsruhe-Bruchsal-Aalen-Nurnberg, Karlsruhe-Pforzheim-Salzburg, Nurnberg-Schwäbisch Hall-Zurich. This integration of regional rail service will make possible the access to Stuttgart in maximum 45 minutes from neighboring regions by rail roads and also extend the facility capacity of railway up to 60,000 trips/ day more than today's volume. (Stadt Stuttgart, (n.d))

Stuttgart is not only the center of region Stuttgart but also the capital city of state Baden-Württemberg. Its development pattern has been affected by its topographical situations. First along the valley Neckar, Fils and Rems residential areas developed, but not until long the narrow valley areas were at bedrock. The hill areas and hinterland of Stuttgart therefore had to be developed to solve the increasing land demands. The development of motorization after World War II encouraged more rapidly to the suburbanization of west- and southwest regions, cumulatively Landkreis Böblingen and now the urban sprawl erodes remarkably areas between development axes of Stuttgart along which the urbanity of Stuttgart has developed in the finger form. (Wilske 2002: 12-14)

50% of the administrative area (207km2) is already developed whereas 25% of total area accounts for agricultural area and 24% forestry. It indicates the developable land stocks arrive at the margin. The shortage of developable land stocks reflects on the expensive land prices in comparison with other German big cities. (Landeshauptstadt Stuttgart (herg.) 2000: 9) Due to the well-equipped subway (U-Bahn) and regional railway (S-Bahn) networks the modal split of public transportation is now over half of private vehicles'. However this index was calculated only from trip patterns in the administrative boundary of Stuttgart. (Landeshauptstadt Stuttgart (herg.) 1999)

Considering the increasing development pressure to the periphery and the growing inter-regional mobility a land use plan (Flächennutzungsplan 2010) was set up in January 1999 and it focuses on

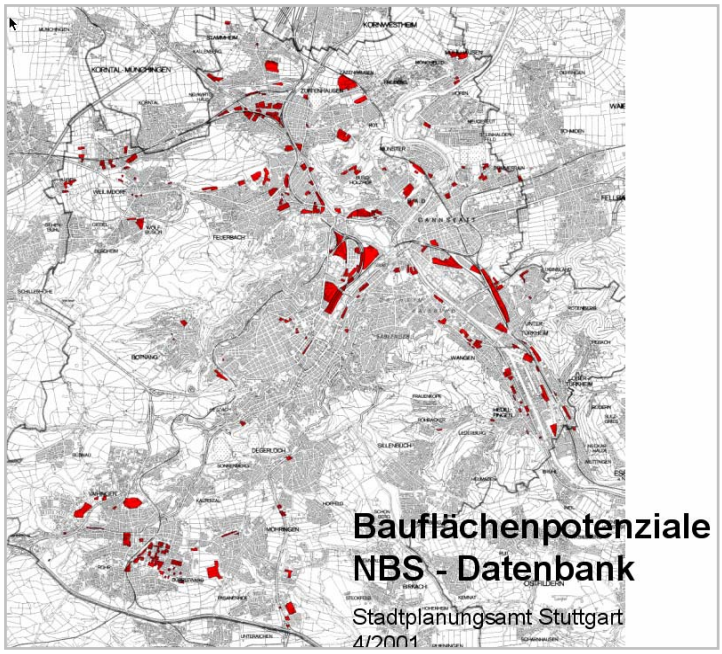
- inner development prior to outer development,
- comprehensive development integrated with Stuttgart and its suburban areas, and
- transportation adaptable to Stuttgart. (Landeshauptstadt Stuttgart (herg.) 1999)

To set up the effective strategies for the inner city development in the region Stuttgart, the project "sustainable land use management Stuttgart (Nachhaltiges Bauflächenmanagement Stuttgart: NBS)" was executed from March 2001 to March 2003 by the institute for urban and regional planning, university Karlsruhe by support of the environment and transportation ministry of state Baden-Württemberg. Three main purposes of this project are to

- find out and classify developable land stocks in the inner city area,
- establish land use information system based on GIS, so-called Informationsplattform and
- suggest the solutions for the problems confronted in the planning process:
  - communication, co-ordination and co-operation with participants,
  - transparency of planning process and establishment of a marketing plan,
  - observation to explore and manage developable land stocks,
  - effective revolution of real properties to trigger the inner city development, and
  - preparation of subsidies for the redevelopment on contaminated areas.

Through this project, over 300 reserve areas with more than 500 hectares could be explored in Stuttgart, the state capital of Baden-Württemberg, but most of developable parcels are under 5 hectares which has no relation with a large development plans. For the sustainable

development in these small scaled land stocks, the development activities should be watched and controlled continuously. (Landeshauptstadt Stuttgart 2003)



Nachhaltiges Bauflächemanagement Stuttgart (03.2001-03.2003)

- about 300 developable land stocks with over 500ha
- internet-based overseeing system was devised and up-graded in the decentralized form by co-workers of municipality
- detailed information service on each area
- potential investors and developers can access to land use information through internet

Source: Landeshauptstadt Stuttgart (2003) (Picture on the left)

Fig.3-16 Sustainable land use management, Stuttgart

3.3.2 Region upper Rhine

On the 17th triennial Milan in 1988, the upper Rhine region was regarded as the metropolis, but the region upper Rhine needs to be first defined. In the context of transnational cooperation the upper Rhine area is generally understood as the international upper Rhine, i.e. the area mandated in 1975 by exchanging notes between Germany, France and Switzerland. This upper Rhine region extends from Basel in the south up to the height of Germersheim/ Philippsburg in the north. However this demarcation does not correspond to the geographical scope of the upper Rhine area, which ranges over the area Frankfurt/Mainz in the north. (Saalbach 1998: 43, Renner 1998: 55)

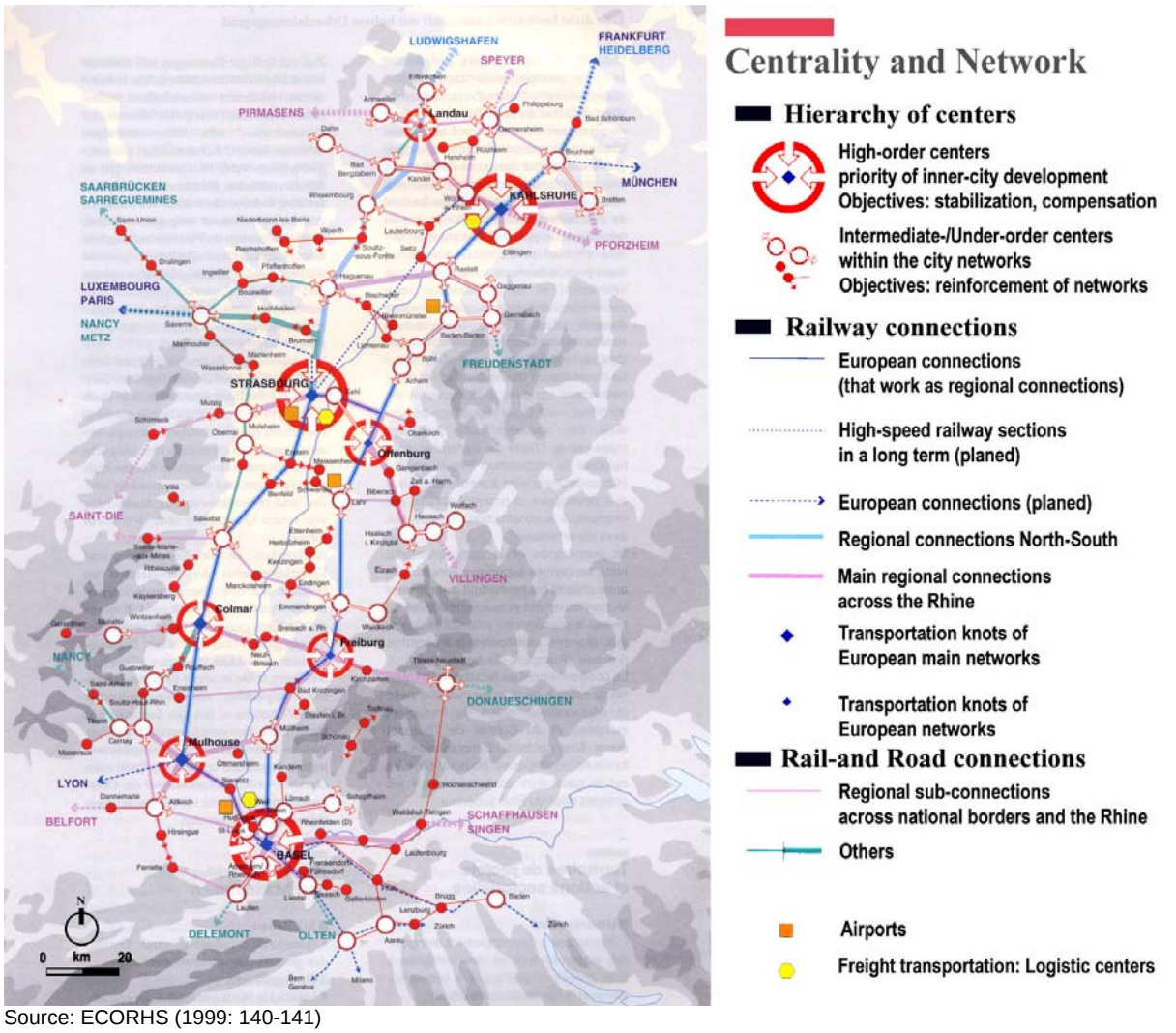
The narrowly defined upper Rhine region reaches to 300km in the north-south and to 30-50km in the west-east. Its surface amounts to 16.000 km2 and there live 4.8 million-inhabitants; approximately 55% of them are allotted to the German side, 35% to the Elsass and 10% to the Swiss. Here are located not only internationally active conglomerates - cumulatively in Basel and Karlsruhe - but also important universities and research centers. Moreover this region is characterized by its beautiful scenery, therapeutic baths and health resorts. Its gross national product amounts sums up to approximately 111 billion Euros, which corresponds to that of Norway. (Saalbach 1998: 46, Finkenbeiner 2000: 7, 115)

The urban structure is featured by the absence of a metropolis but the existence of a network of high-order centers, so a poly-centric development model has been introduced for the upper Rhine area. However a danger of urban sprawl, if the urban functions of high-order centers would not be strengthen, could not be looked over. (Hahn 2000: 117-118)

On the November 26th 1999 in the three-land congress which was held as the 7th biannual upper Rhine conference, the representatives from central- and local authorities of France including two departments of the Elsass; Swiss cantons of the municipality Basel, the region Basel (Basel-Landschaft), and Aargau; as well as German states, Baden-Württemberg and Rhineland-Palatinate had signed up a land use planning charter for the region upper Rhine, “Raumordnungscharta Oberrhein 21” to make the political- and strategic integration in the transnational land use planning policy. This land use planning charter is based upon four principles:

- sustainable development,
- coordination of regional planning policy,
- foundation of the common understanding and,
- integration with the European land use planning policy.

From these principles specific goals for the upper Rhine area are derived. First of all the urban structure of the upper Rhine region should be kept and strengthened to secure the qualified urban life. In the region upper Rhine there is no central metropolis but networks with large, middle and smaller cities. Nevertheless this region has potentials as one of European metropolitan regions. Secondly the transportation- and communication policies should be integrated to come over inter-regional gaps caused by the administrative segregation. The open space in the upper region has to be conserved and revaluated and finally the information should be exchanged mutually and the dialogue between planners intensified to coordinate development activities.



Source: ECORHS (1999: 140-141)

Fig.3-17 Centrality and network in the region upper Rhine

In 1997 the upper Rhine conference commissioned an INTEREG-project. Here was aimed to make a framework for the development of the upper Rhine region as a European central area. In 1999 the land use planning congress took up the guidance of this project and developed it further. As a result six strategic points are set up.

- The hinge function of the upper Rhine region in the economic- and transportation parts should be strengthened and be extended to other fields such as culture, language and education.
- The transnational urban networks should be developed and strengthened by "bridging" over the Rhine.
- The Rhine should be used as "backbone of metropolitan- and regional parks".
- Under the slogan "Technology Valley upper Rhine", a comprehensive economic concept should encourage clustering the function of education, research and enterprise.
- An integrated and environment-friendly transportation policy should make it possible that the upper Rhine region can be arrived at within one-hour from any euro-region.
- Communities must be connected and cooperated institutionally with neighbors. (Hahn 2000: 23-26, 30)

For only sixteen years from 1839 the rail system on the right side of the upper Rhine had been constructed and its length was 268km-long: Heidelberg (1840), Karlsruhe (1843), Offenburg (1844), Freiburg (1845), Istein (1847) and finally Basel (1855). (Fuesslin 1999: 80)

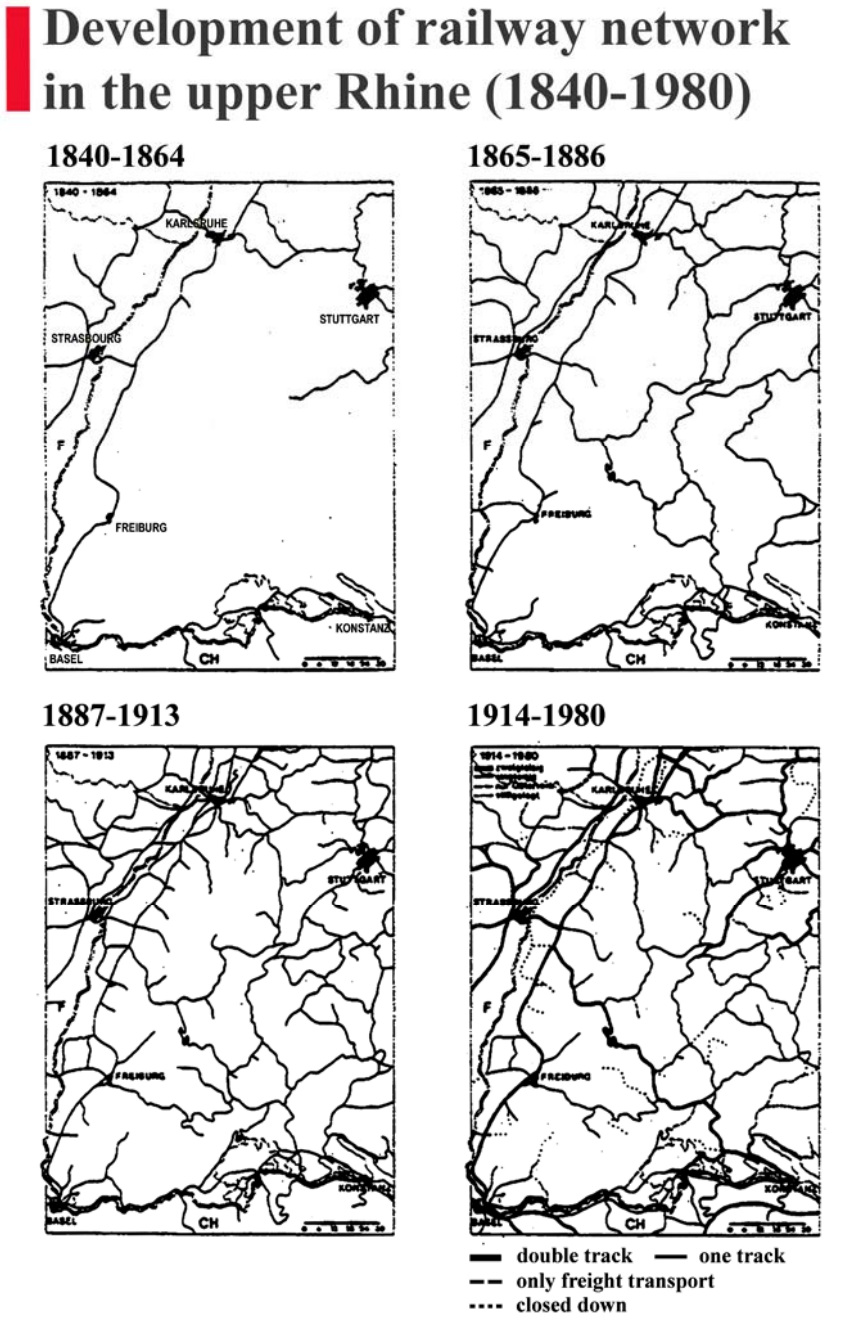


Fig.3-18 Development of railway network in the region upper Rhine

Now the growth of trading volume between the north and the south brings an exorbitant increase of freight traffic. The substantial demands of personal transportation can increase as well, because the volume of tourist and long-distance trips grows up over the upper Rhine. The topographic- and settlement structure on the upper Rhine forces nevertheless to operate the short- and long-distance trips along the narrow corridor and even on the same lanes. (Hahn 2000: 31-33, 115)

The improvement of accessibility to the high-order centers can help to retain the poly-centralized urban structure connecting Basel, Colmar, Freiburg, Karlsruhe, Mulhouse, Offenburg and Strasbourg. Diverse transit services must be coordinated across borders and a number of multi-modal transit nodes should be set up to make possible the transfer between transit-modes. (Finkenbeiner 2000: 9-10)

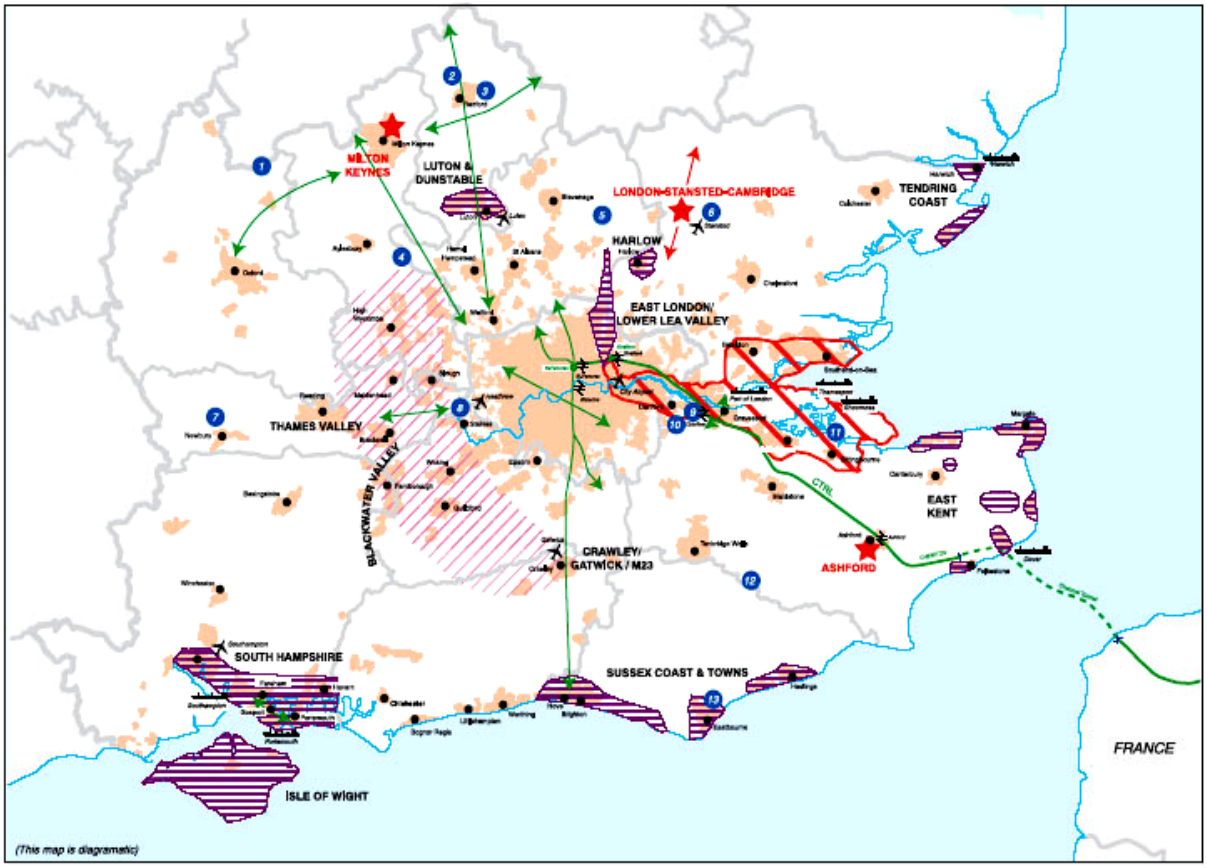
In particular from ecological points rail nets have a greater optimization potential than road connections, so they should take over a larger traffic portion. In the region upper Rhine are three European magisterial lines: the Rhine-Valley line (Karlsruhe-Basel), the TGV EST (Paris-East France-South Germany) as well as the TGV Rhine-Rhône toward Southern France and Spain. (Finkenbeiner 2000: 10, 31-33)

On the other hand the cross-bordering trips to France and Switzerland rose around 26% in the period 1990-1998. For the improvement of long-distance transportation the state Baden-Württemberg has started a street-widening project of A5 (Karlsruhe-Basel) to a six-lane road and the section between Karlsruhe and Badenbaden is in operation from 1997. This project should develop step by step to Basel. But in the long-term the capacity of German side will be hardly possible to accommodate the increasing north-south traffic volume. Therefore it is welcomed for France to endeavor the development of a road connection on the left side of the Rhine (Basel-Lauterberg in Rhineland-Palatinate). This route on the left side of the Rhine must be connected as soon as possible with the German motorway net. (Finkenbeiner 2000: 16)

Meanwhile the east-west connection should supplement the development of the North-South axis. It concerns to connect the transportation gaps, coordinate a modernization on the two sides of the Rhine, and find out synergy potentials. Otherwise the traffic volumes on the upper Rhine will lead to collapse all system or load the sustainable development in this region. (Hahn 2000: 33-34)

3.3.3 Region London

The united European market was achieved in 1992, but the unemployment rate in London meanwhile was higher than the national average. The former restriction policies against the growth in the capital region were not necessary and the diversion of policies was reflected in the Regional Planning Guidance in 1994 (RPG9)[10].



Source: Gov. office for the southeast, Gov. office for east of England & Gov. office for London 2001

Fig.3-19 Regional planning guidance for the southeast

The RPG 9 provides a frame work for the spatial development plans and strategies in south east region[11] which refers to the Great London area and its surroundings; Bedfordshire, Berkshire, Buckinghamshire, East Sussex, Essex, Hampshire, Hertfordshire, the Isle of Wight, Kent, Oxford Shire, Surrey and West Sussex. This guidance was formulated in the contexts of

[10] RPG9 is issued by the Secretary of State for the Environment, Transport and the Regions in March 1994. The RPG9 which partially reissued after consultation and public examination in March, 2001 covers now the period up to 2016, setting the framework for the longer term future. (followings are modified: Chapter 9 - Regional Transport Strategy and Chapter 12 - In relation to Ashford, Chapter 10 - Energy Efficiency and Renewable Energy and Chapter 14 - Tourism and Related Sport and Recreation)

[11] Even though 50% of all the land is covered by national and international designations, including 24% by Green belts, around 18,1million people live in the south east region and at its heart is London, a world city with a population of some 7million. The south east region functions as the gateway to U.K. and 6 major international airports, 5 international railway stations, 6 major ports as well as extensive railway and motorway are facilitated.

- sustainable development focused on the urban renewal
- regionalization and cooperation with neighboring communities and other relevant organizations
- regionally balanced development in the European perspective
- international and global developments affected by the liberalization of world trade and the development of communication and information industry, and
- climate change.

To take advantage of the project of Channel tunnel[12] and to enhance the growth in the metropolitan region, RPG9 subdivides the south east region with London, Thames gateway stretching eastward from Deptford and Stratford, and the rest of south east region (ROSE) and indicates the directions for the development in each area.

However some regions designated as a development area were environmentally sensitive and until now large development has been prohibited by the environmental protective regional policies. To develop these areas therefore the approaches for sustainability were introduced and they were to harmonize and balance the development activities with the environment conservation. (Bae, Cheong 1996b: 63-67)

To support and develop London as a center of international and national importance and regenerate the deprived inner city area, the balanced and mixed land use for provision of new housing and employment, and the efficient and sustainable public transport networks between London and its hinterland play a crucial role.

Offering a comprehensive transport system and a qualified environment for new business and homes, the opportunities presented by Thames gate way should be maximized, such as extensive areas of derelict land, the availability of surplus labor and the proximity to Central London, international transport hubs and continental Europe.

To make the specialized approaches the ROSE was divided with three development areas: Priority Areas for Economic Regeneration, Western policy area, and Potential growth area.

Priority Areas for Economic Regeneration (PAERs): Even though each PEAR has its own distinctive set of problems and requires individually tailored strategies, its planning policies are focused on the designation of employment sites, reuse of brown-field land, transport access, and urban renewal and intensification. The criteria for PEARs include above average unemployment rates, high levels of social deprivation, low skill levels, dependence on declining industries, derelict urban fabric, peripherality, and insularity.

Western policy area: The western policy area in the west and south of London is economically very buoyant, based on a range of high-tech industries and a clustering of important economic activities. There are, however higher development pressures and tight constraints in the labor market, housing and property market, transport issues, and local pockets of deprivation. The spatial development strategies are focused to economic growth on the high skill level and knowledge base in a sustainable way with minimized pressure on limited labor and land resources through co-operation with the interested.

Potential growth area: For concentrating growth in a sustainable and planned way in the long term, Milton Keynes and Ashford area are identified as potential growth area. Such areas will need to take a comprehensive plan-led approach to development, ensuring jobs and homes increase and providing the necessary physical and communication infrastructure for creation of sustainable communities served by public transport.

Source: Gov. office for the southeast, Gov. office for east of England & Gov. office for London 2001

Tab.3-3 Policies for three development areas of the ROSE

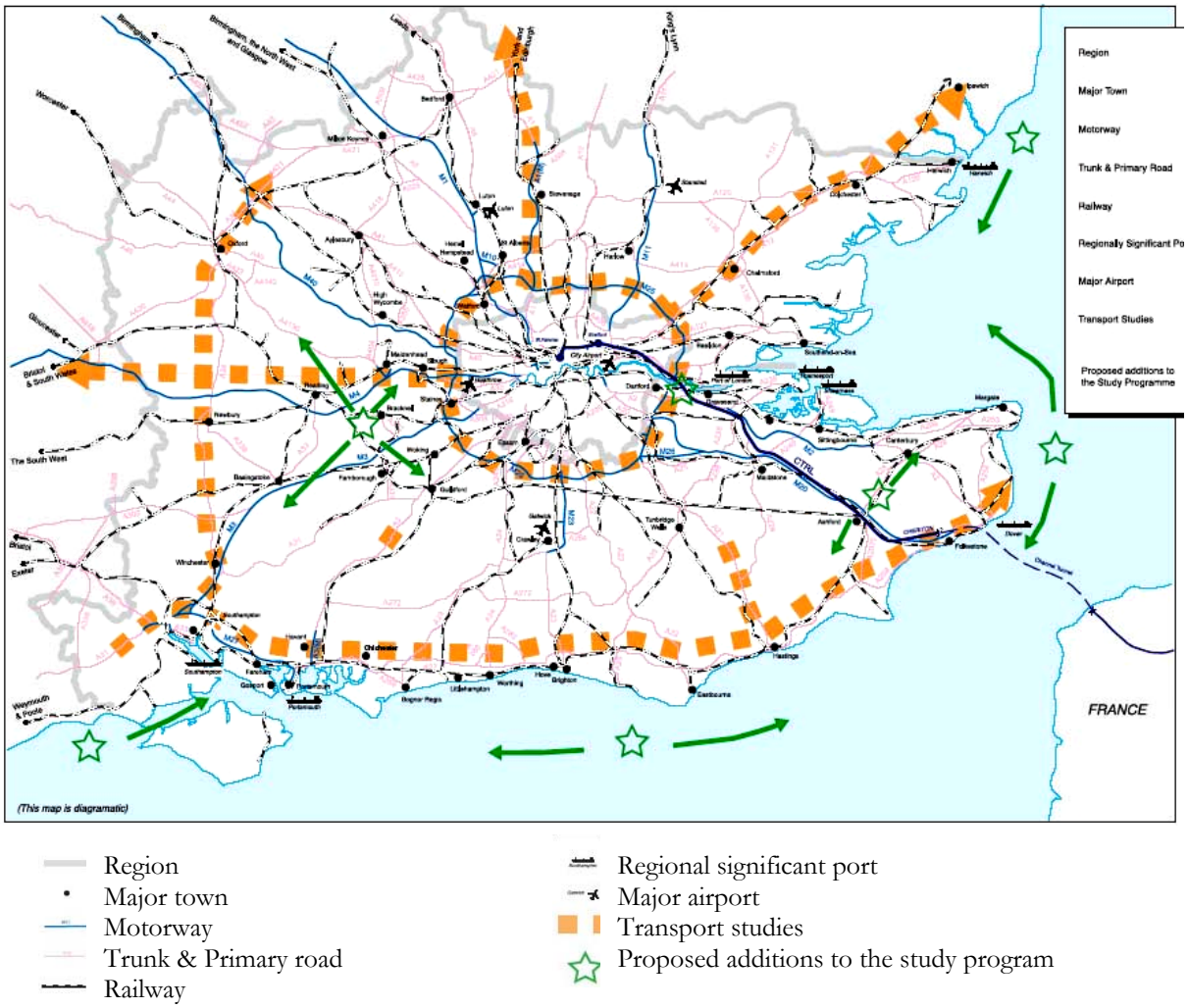
[12] Even though the Euro tunnel has opened, the project on the high speed railway line between the tunnel and London was rejected due to the environmental concern. RPG 9 however reviews this one. (Bae,Cheong 1996a: 266)

Meanwhile the development activities in rural areas should be managed to

- secure a multi-purpose countryside
- control the inappropriate development
- enhance its natural and cultural resources and
- sustain the economic and social vitality of rural communities.

From the transport routes in the south east region, on the other hand, the substantial influence of London can be read. In general the vertical connections to London are well developed, while orbit routes are comparatively less. In order to trigger the development in periphery, so here in RPG 9 is prioritized the transport investment for

- serving the region's role as the transport gate way to the continents;
- improving the regional transport links between the Thames gateway, Priority areas for economic regeneration, other major urban areas, ports, airports and the Channel tunnel rail link, and
- facilitating access to the potential growth areas. (Gov. office for the southeast, Gov. office for east of England & Gov. office for London, 2001)



Source: Gov. office for the southeast, Gov. office for east of England & Gov. office for London 2001

Fig.3-20 Communications in the region London

3.3.4 Region Paris

The tradition of centralization in French life intensified the disparity between Paris and other parts of country. In the postwar reconstruction period the further physical growth of Paris began to be considered seriously, but the infrastructure of capital city was in fact running down due to the underinvestment. – even though to many provincial French people Paris seems to have a disproportionate share of everything. After the great burst of investment by Haussmann in the 1850s and 1860s, there was relatively little new house building. The transport system suffered from the low investment, too. A massive dose of investment was required to make the city more efficient and more livable.

The 1965 plan suggested constructing on the either side of the Seine eight new cities. The size of eight new towns amounted to nearly double of the existing built-up area. To service all new cities, this plan demanded the 540 miles of new highways and the 156 miles of an entirely new regional express rail (RER) system. Also involved was the expensive renovation of existing centers within the urban fabric of Paris: La Défense and Nanterre, Saint Dénis, Bobigny, Créteil, Versailles, and Choissy-le-Roi/Rungis. It was an attempt to break the concentration of economic life at the center by developing a full range of economic opportunities as well as social and cultural facilities in a number of urban counter-magnets.

However the falling birth rate cut the number of new towns to five: Cergy-Pontoise and Marne-la Vallée on the northern axis, St. Quentin-en-Yvelines, Evry, and Melun-Senart on the southern axis. The progress of development - supplying housing, industry and above all offices - was at first slow but accelerated spectacularly from late 1970s. During the five years 1977-1982 they actually achieved more than 90 per cent of the total population growth in the Région Ill-de-France. The construction of RER rapid transit progressed continuously as planned, and the entire original system was completed in the early 1990's. But the construction of ambitious circumferential motorways was delayed by planning and environmental problems in some sections.

	Cergy-Pontoise	Marbe-la Vallée	St. Quentin-en-Yvelines	Evry	Melun-Senart
establishment of EPA	Apr.16.1969	Aug.17.1972	Oct.21.1970	Apr.12.1969	Oct.15.1973
area (ha)	8,000	15,000	6,300	4,100	11,800
planned population	300,000	400,000	320,000	500,000	300,000
relevant Commune	11	21	7	4	10

Source: Roullier, Jean-Eudes, 25 years of French new towns, 1993 (recited from Kim, Jae-Kuk 2000: 92)

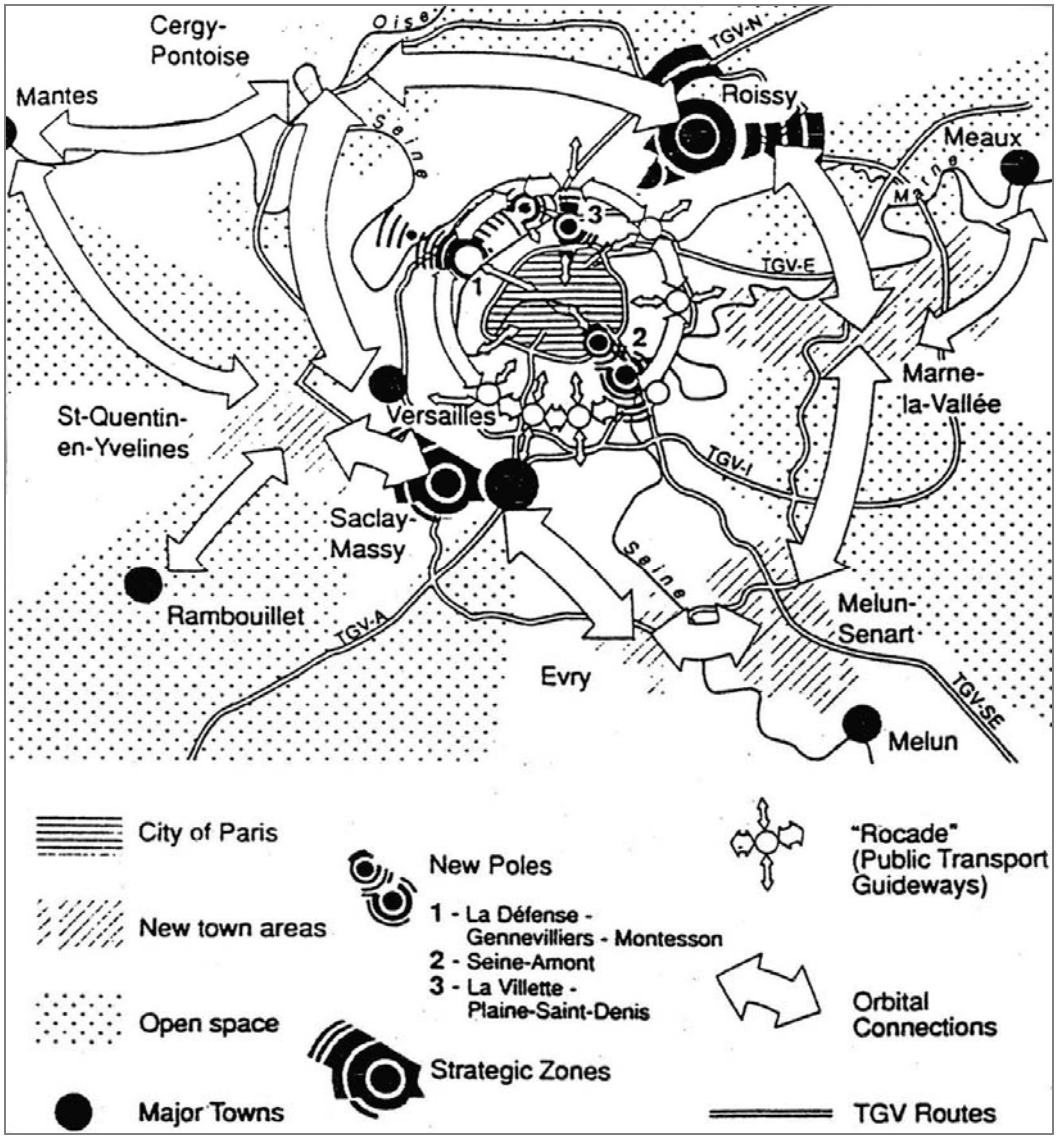
Tab.3-4 Five new town plan around Paris

Most of all, the fast growing office sector in the west region was remarkable: first in the giant La Défense scheme, and then to the adjacent inner suburbs along the Seine. The two new towns in the west, Cergy-Pontoise and St. Quentin-en-Yvelines, were benefited; but on the other side of Paris, Marne-la Vallée failed to attract its share. Far from becoming a polycentric city, at last Paris has remained polarized between the centralized business city and the suburban dormitories, and between the affluent west and lower-income east. Nevertheless Paris experienced a major physical restructuring. In this process, its traditional, social and economic structure has been intensified.

In 1990 a new regional plan for the next quarter century was established and here was projected the population growth from 10.3 million in 1990 just to 10.8 million by 2015. Its main feature was an unabashed concentration of economic development. The economic development in the region Paris was favored to be a top-level world city in the united

European market by investment in education as well as transport and communication infrastructure. Keeping the principle of the métropoles d'équilibre, it was also suggested to use the Ill-de-France as a means of aiding the development of provincial towns and cities by developing economic links between them.

Some of main principals of the 1965 plan were underlined and reinterpreted. The investment in the five growth poles was focused on the construction of top-level facilities like universities, hospitals and cultural centers: Three around existing urban centers in the middle ring (La Villette and the Plain of Saint Dénis in the north, La Défense-Genevilliers-Montesson in the west, and the Upper Seine valley in the south east), two at the edge of the agglomeration (Roissy-Charles de Gaulle airport in the north, Saclay-Massy in the south west) new towns would be linked by new motorways and public transport links, including a new public transport 'rocade' linking the three inner poles, while vast green area would be preserved, both within the agglomeration and outside it. (Hall 1992: 167-179)



Source: the Livre Blanc of 1990 (recited from Hall 1992: 175)

Fig.3-21 Regional planning of the region Paris (1990)

3.3.5 Region Tokyo

Since Meiji restoration in 1867, the population and industry had been centralized in Tokyo. During the 2nd world war the war cabinet established a national strategic plan to secure the capital region and key industry which was compelled to be located within the radius of 30km from down town Tokyo. This centralized policies in fact impacted the postwar-reconstruction plan in Tokyo.

The national capital region development law influenced by the post war Great London plan in 1944 was enacted in 1956. The 1958 capital region plan introduced the green belt areas of approximately 10km width around built-up region in Tokyo to order to control outgrowth of built-up areas. However the green belt zone of Tokyo could not work well, because it was just recommendation, not compulsory one and the economic booming in the 1960s pushed the fast development of sub-urbanization. In 1965 at last the radical amendment of the national capital region development law was inevitable and the metropolitan area extended to the 50km radius zone from the center of Tokyo. The green-belt concept was abolished in the 2nd capital region plan of 1968.

But the development of transportation and communication systems and the distinctive population decrease fades away conventional policies for the quantitative development through concentrating population and industries. The 5th capital region plan was established in March 1999[13]. It is aimed to rearrange the conventional mono-centric spatial structure in the capital region into a decentralized network sharing and supporting diverse urban functions with regional centers functionally independent from Tokyo's CBD. According to this plan, the capital region was divided with 5 parts: Tokyo metropolitan region, Northern Kanto region, Eastern Kanto region, West inland region, and Island region. Reflecting its own regional features each area will be developed.

The inner city development in Tokyo will encourage people to live in the urban center and give a chance to renovate and rebuild old wooden house districts vulnerable to disasters. Developing the not fully utilized areas can help to improve the efficiency of urban land stocks and keep the sustainability. The CBD of Tokyo will be restructured as an area with multiplied urban functions including its business function and the regional identities of six sub-centers (Sinjuku, Shibuya, Ikebukuro, Ueno/Asakusa, Kinshicho/Kameido and Osaki) strengthened, whereas Tokyo bay area will be developed as a new center for the 21st century.

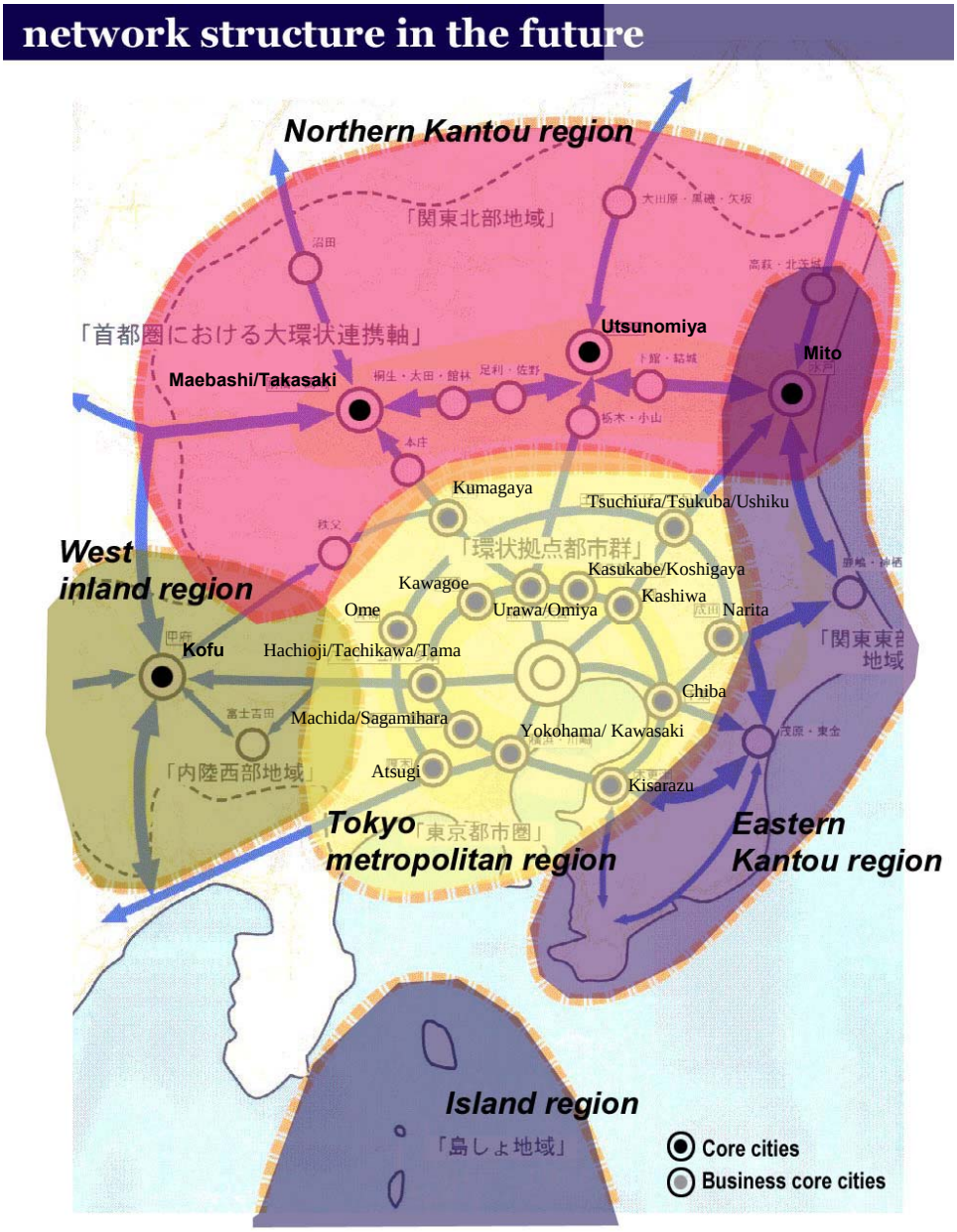
On the other hand 14 business core cities (Gyoumukaku-toshi) in suburbs were selected and will be developed as regional hubs with diverse urban functions. The construction of circular urban belt between business core cities can strengthen mutual interchange of metropolitan functions in the metropolitan region Tokyo.

Prefecture	Cities	
Metropolis Tokyo	Hachioji/ Tachikawa/ Tama, Ome	Machida/ Sagamihara
Kanagawa	Yokohama/ Kawasaki, Atsugi	
Saitama	Kawagoe, Kumagaya, Urawa/Omiya, Kasukabe/Koshigaya	
Chiba	Kashiwa, Narita, Chiba, Kisarazu	
Ibaraki	Tsuchiura/ Tsukuba/ Ushiku	

Tab.3-5 Business core cities in the metropolitan region Tokyo

[13] The 5th capital region plan defines that the capital region is composed with the metropolis Tokyo (Tokyo-to), Saitama prefectures, Chiba prefectures, Kanagawa prefectures, Ibaraki prefectures, Tochigi prefectures, Gunma prefectures and Yamanashi prefectures, while the metropolitan region Tokyo or the megalopolis Tokyo corresponds to the metropolis Tokyo, Saitama prefectures, Chiba prefectures, and Kanagawa prefectures.

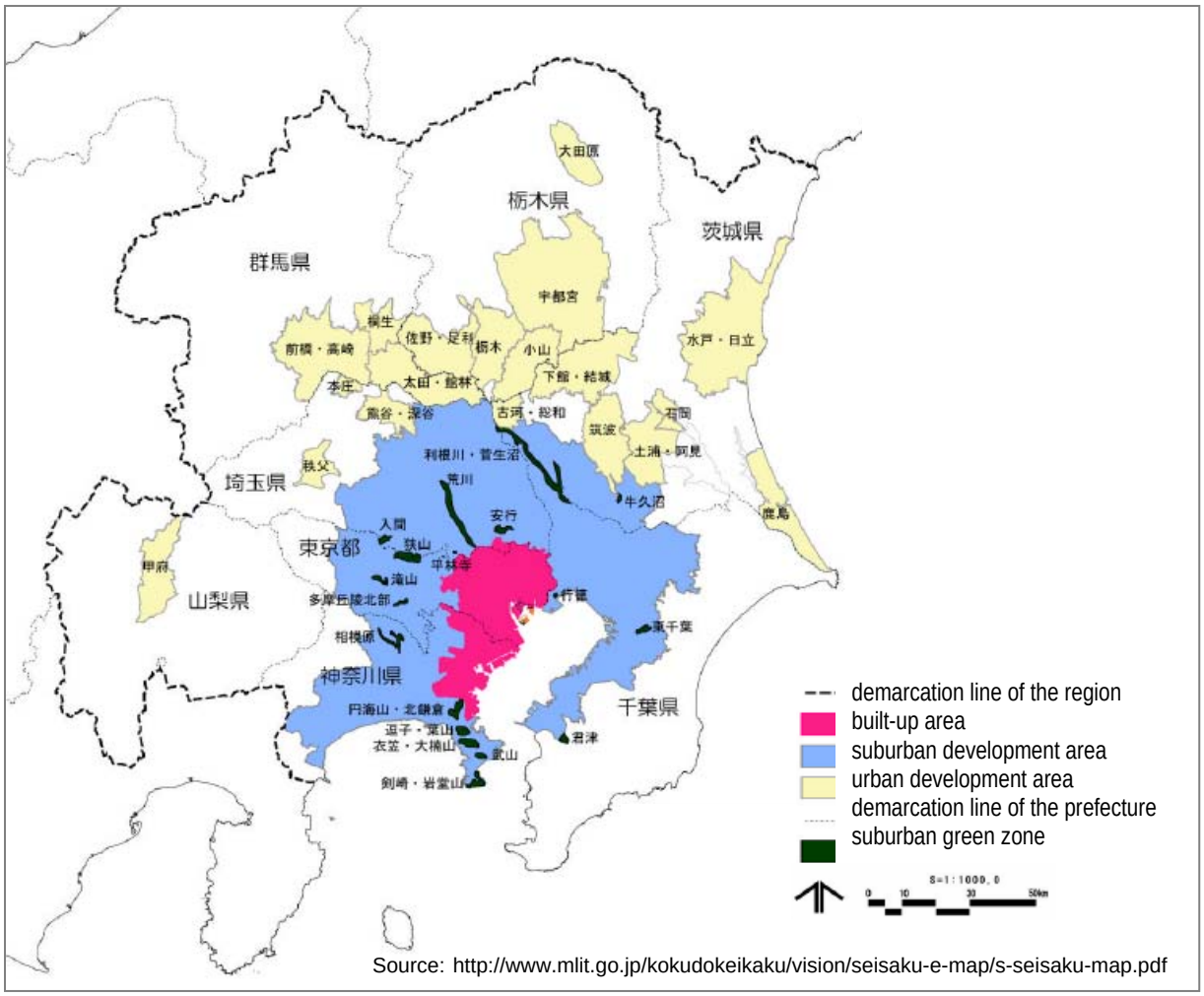
The periphery of the metropolitan region Tokyo is not yet urbanised and several industrial and commercial cities function as regional centres. In order to prevent urban sprawl and make this periphery functionally self-sufficient, the self-governing act revised in July 1999 suggested the development of core cities (Chuukaku-toshi). Candidates of these core cities can be communities with over 30,000 populations and over 100 km2 area: Mito, Utsunomiya, Maebashi/ Takasaki and Kofu. Meanwhile the construction of a great circular urban belt in the capital region can help to strengthen the interconnection between core cities and other regional centres. The land use development of the core cities will be managed, considering the harmony with urbanity and nature.



Source: http://www.nla.go.jp/daikei/vision/5th_s_k/k-image.html

Fig.3-22 Network system of the capital region (5th capital region plan)

Depending on the 5th basic development act for capital region in 1999, detailed standard are provided as the built-up area, suburb development area, and urban development area. (Ministry for Land, Infrastructure and Transport 1999)



Source: http://www.mlit.go.jp/kokudokeikaku/vision/seisaku-e-map/s-seisaku-map.pdf

The built-up area: It corresponds to Ku area of Tokyo and urbanized areas of Yokohama and Kawasaki in south and Kawaguchi in the north.

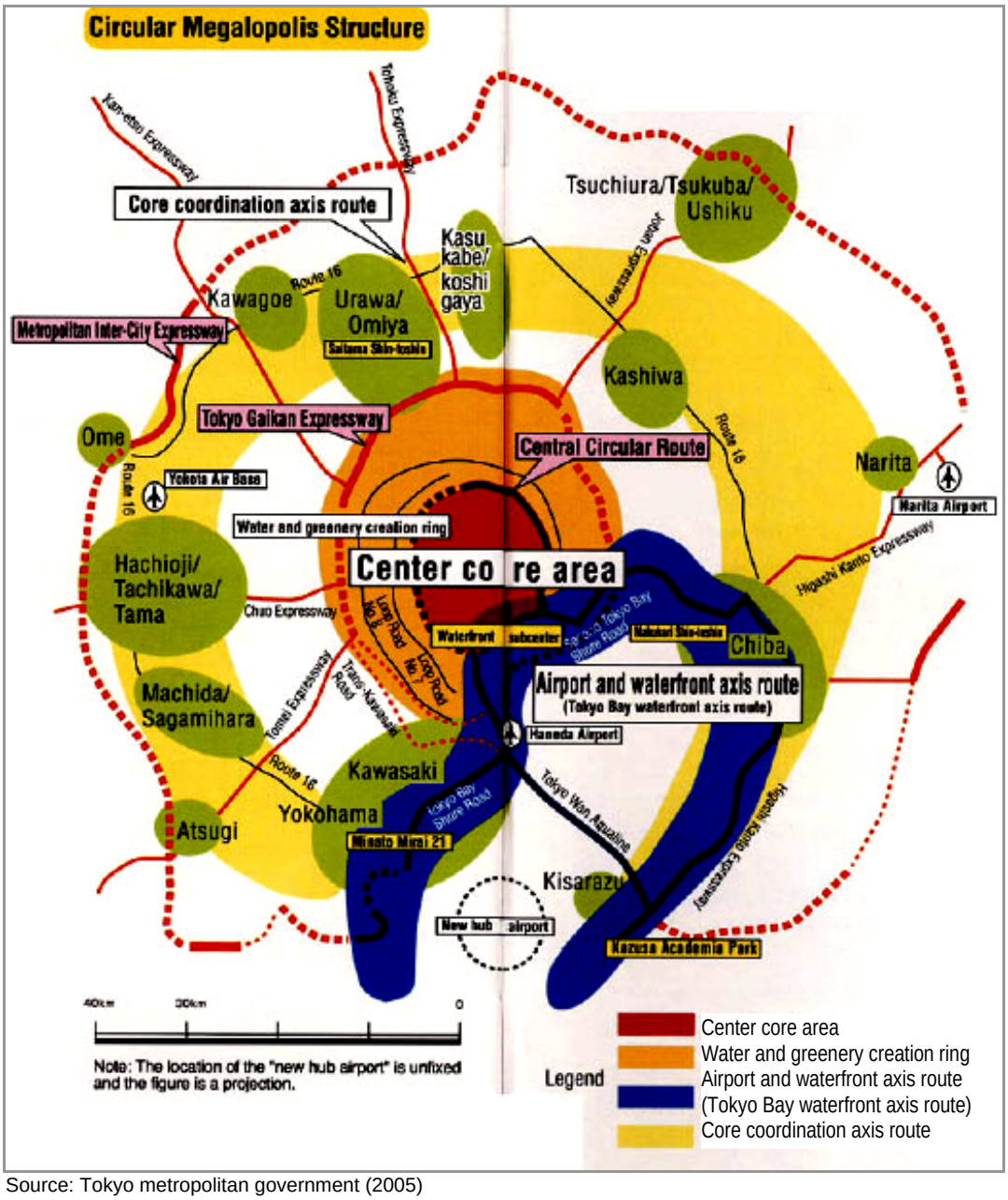
The suburban development area: Suburbs of the existing built-up area to be developed in harmony with the existing built-up areas. Preserving green spaces, satellite towns for industries and educational purposes should be established.

The urban development area: to prevent urban sprawl and manage development outside Tokyo it was proposed.

Source: Bae, Cheong (1996b: 111-126)

Tab.3-6 Land use plan in the capital region Tokyo

For Tokyo to play roles of not only the national capital but also a major world city, Tokyo plan 2000 suggests the circular megalopolis structure supporting diverse functions that the city must have: residence, industry, distribution, disaster-prevention and ecological functions, to say nothing of business function. Tokyo plan 2000 was proposed by the Tokyo metropolitan government and emphasizes to reduce the nuisances of concentrated spatial structure. At the present, the megalopolis Tokyo with the population of more than 33 million is engaged in dynamic urban activity, while performing the role of the national capital. So it is inappropriate to discuss Tokyo's urban structure within the scope limited to the Tokyo-to alone.



Source: Tokyo metropolitan government (2005)

Fig.3-23 Circular megalopolis structure

The basic concept of the circular megalopolis structure is to ensure a strategic and reasonable accumulation of city functions and complete the urban structure that contributes to the elevation of Tokyo's international status.

- The policy of dispersing business functions from the metropolitan center to sub-centers should be scrapped. Instead a new base should be added to the metropolitan center and sub-centers and they should play their own roles through cooperation. The entire center core area should nurture an environment that fosters the growth of international business.
- The urban axis accessible by air and water (to be called the Tokyo Bay waterfront urban axis) should be formed by utilizing Tokyo Bay as a common resource for the entire megalopolis Tokyo.
- A ring urban axis connecting a group of business core cities around the central core area should be developed and these business core cities be tied up with other regional centers in other regions. (Tokyo metropolitan government 2005)

3.4 Remarks

Growing household incomes demand much larger living areas per a capita. Development of high-speed transportation and communication technologies increases the intra- and inter-regional mobility and reduces the time budget between agglomerations and peripheral areas. This tendency accelerates the functional decentralization but on the other hand strengthens the urban expansion.

To manage increasing pressure of land use development in the sustainable way and accommodate growing intra-and inter-regional mobility, Germany, Switzerland, U.K., France and Japan set up their own spatial restructuring plans with different names, such as central place concept, networked urban system, integration and cohesion, networked poly-centrality, and national axial zone.

Individual spatial restructuring plans are differentiated in the objects of planning and the approaching ways. Germany attempts the decentralized but hierarchical urban networks by central place concept, even though its rigid hierarchical arrangement of urban facilities prevents the functional specialization and -sharing with other cities by the free market competition and leads to lose a regional affection as well as a regional identity, which make easy the exodus to the high-order centers. Swiss puts relative importance on the physical connections with autonomous communities for the functional interface with agglomerations and peripheral areas. U.K., France and Japan, the countries with strong tradition of concentration try to relieve congestion of their capital regions and develop counterweights in the peripheral regions identified with their own natural and cultural heritage by integrating diverse transportation connections and using communication technologies.

Despite of differences however they all pursue in form of network structure,

- decentralization and sharing of metropolitan functions,
- mutual complementation between urban- and rural areas
- integrated high-speed transportation networks
- economic dynamicity and
- conservation of natural and cultural heritages.

Different planning system of respective metropolitan regions on the other hand makes no difference in solving the common metropolitan problems. With a large perspective inclusive not only the metropolis but also whole areas engaged in the performance of metropolitan role, regional authorities aim to prevent current process of polarization to agglomerations in the scattered and sporadic forms and guide urbanization in the poly-centric and sustainable ways. For the implementation they suggest commonly to

- make economic poly-centers around the agglomeration (e.g. strategic areas for housing and industrial development, high-order centers, new towns, core cities and business core city), and
- link them for functional interchange by transportation and communication connections

Decentralization of metropolitan functions to several economic centers in the metropolitan region and functional complementation between urban centers and peripheral areas inside the metropolitan region, which are supported by transportation and communication connections, will reduce congestion of the central city and make residents enjoy diverse metropolitan functions in not only the metropolis but also the whole metropolitan region.

4 Tendency of spatial development in South Korea and region Seoul

The trend of urbanization is not an exception to South Korea. Now the urbanization of South Korea arrives at the terminal stage of urban development and Korean society is based on the urban life.

The urbanization of South Korea was affected by the top-down economic policies to concentrate population and industries into big cities. Social migration towards Seoul deepened up on the basis of the strong tradition of centralization in Korean life. Even though Korean government has issued since the 1970s lots of regulations to restrict the demographic and economic concentration to Seoul, these decentralization policies couldn't switch the settlement of people and industries in Seoul and its hinterland. The improvement of regional accessibility backs up the urban polarization and the steep increase of car-ownership accelerates the automobile-oriented suburbanization.

With the exogenous trends, the globalization and decentralization and the reconciliation between two Koreas, the aforementioned indigenous changes require a differentiated land use policies from conventional ones. The network cities may be a new instrument to make a poly-centric and sustainable urban structure and it can be approached not only at the national level but also at the regional level.

To suggest new land use strategies for network cities in South Korea however first the assessment of urban development patterns in South Korea should be made at a national- and regional level focusing on the region Seoul. So, in the first section the urbanization of South Korea was investigated since 1876 the start of modernization and a current long-term perspective to make a decentralized network structure was argued centering on the 4th comprehensive national territorial plan. With the land use policies in the region Seoul the spatial development patterns were studied in particular by the statistical analysis in the second section. And the statistically analyzed data were simulated by a GIS-program.

4.1 Urbanization and new spatial development visions of South Korea

The number of Korean cities has increased on from 1920 but it shows steep increasing patterns during the periods 1935-1940, 1955-1966 and 1970-1975. The development of urban population and urbanization rate indicate similar aspects. However the urbanization by the industrialization and rapid economic growth after the Korean War (1950-1953) implies an important turning point of urban development phase in South Korea.

This distinctive development of urbanity in each period was brought up by social ferments which affect social immigration fleeing from the rural areas into the cities: Manchurian incident by Japanese and industrialization based on North Korea in the 1930s, reconstruction after the dependence from Japan and the Korean War in the late 1950s and the rapid economic growth since 1960s by the downwards development policy of governments. Depending on the data from the UN, however the urbanization in South Korea will slow down after 2010.

Year	Number of cities	Urban population	Urbanization rate (%)
1789	3	238,791	3.3
1910	12	1,122,412	8.4
1915	7	456,430	2.8
1920	7	508,396	2.9
1925	19	1,058,706	5.7
1930	30	1,605,669	7.9
1935	38	2,163,453	10.1
1940	58	3,998,079	16.9
1944	74	5,067,123	19.6
1949	60	4,797,061	23.9
1955	65	6,320,823	29.4
1960	89	8,839,890	35.4
1966	111	12,303,103	42.2
1970	114	15,385,382	49.8
1975	141	20,875,782	58.3
1980	137	24,875,782	66.4
1985	156	29,982,807	74.1
1990	149	34,622,287	79.6
1995	114	39,634,503	88.8
2010	-	-	91.2
2020	-	-	92.7
2030	-	-	93.6

Note:
(1) Communities with over 20.000 inhabitants are considered urban areas.
(2) Urban population before 1945 is the numbers in South and North Korea and after 1945 figures only in South Korea. (Kwon, Yong-Woo 1999: 75)
(3) The numbers from 2010 are extracted from data of UN, 1997. (the Nippon foundation library 1998)

Tab.4-1 Development of urbanization rate in South Korea (1789-2030)

4.1.1 Urbanization

The compulsive opening of 3 main ports (Busan, Incheon, and Wonsan) by Japanese in 1876 triggered the urbanization in Korea. Before opening the door, just the capital city Seoul and several political regional centers - the cities with over 20,000 inhabitants in 1879 were Seoul, Gaeseong and Pyongyang. - were developed and structured in mono-centric and self sufficient units. The regional interchanges were very rare, even though products and people were moved in and out mainly on foot.

While expanding the trade with foreign countries after opening ports, the port cities grew up distinctively. Many foreigners, in particular Japanese came into these areas and settled their villages for commercial activities. In that time Busan, Incheon and Nampo had developed as cities with over 20,000-80,000 inhabitants. Upon the Japanese Annexation of Korea, Japanese authority downgraded the status of Seoul from the national capital to one of many local administrative units under the Gyeonggi province.

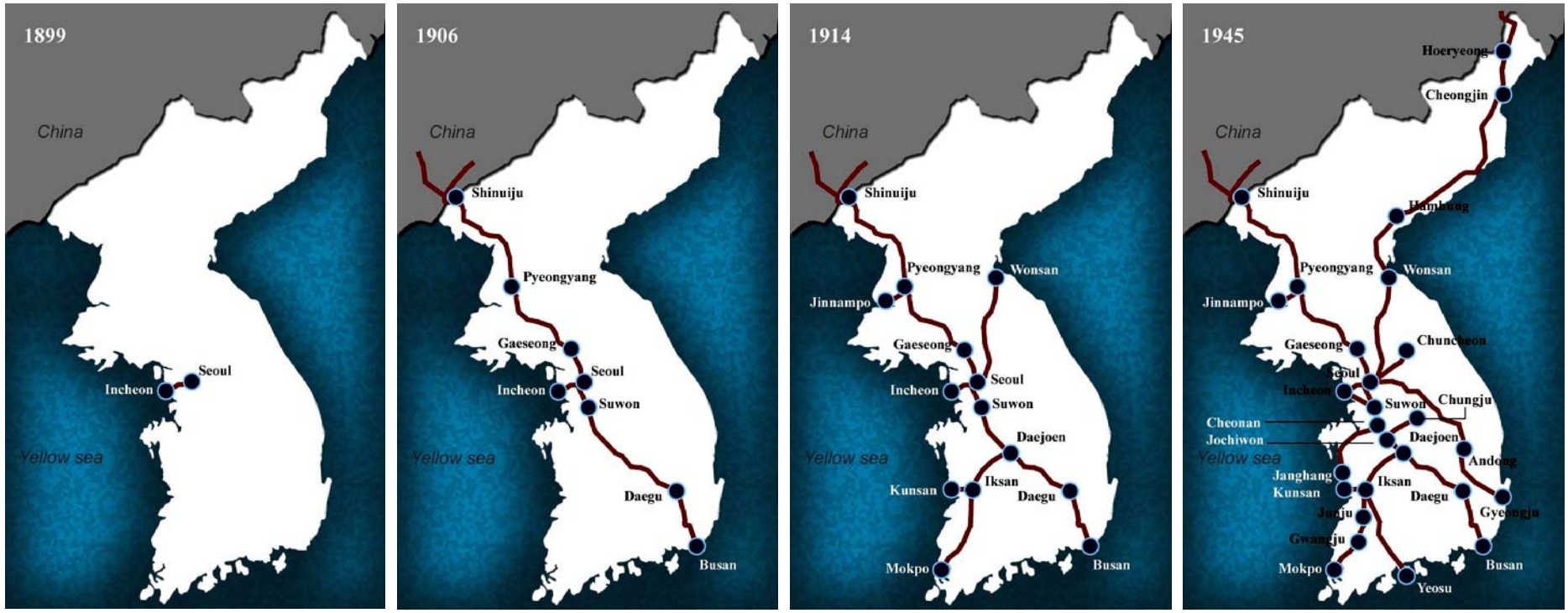
After the first rail road between Seoul and Incheon was built in 1899 by Japanese, the rail connections developed one by one, in 1905 between Seoul and Busan and in 1906 between Seoul and Shinuiju. People and products gathered on the major transportation nodes of rail lines connecting the port cities and inland areas and the urbanized areas had extended from the port cities into inland regions, including Seoul, Pyongyang and Daejeon.

The industrialization and radical population increase in Japan caused the food shortage and at last brought out the explosion of rice price (1918). So the import of rice from Korea became important from the 1920s. The agricultural centers collecting and distributing rice and rail connections linking them with the port cities like Mokpo developed remarkably. In the period of the 1930s and the 1940s, the North Korean industrial cities on coal fields grew rapidly to prepare the World War II. The development of North Korean cities was contrasted with the previous urban development pattern concentrated in southern regions of Korean peninsular with fertile farm lands.

As the rail connections developed, on the other hand, Seoul had become the superior traffic node and it had grown up to the big city with one million inhabitants. This development of transportation accelerated to flee from the rural areas and the immigrants formed slum in the big cities.

The independence from Japan (1945), the Korean War (1950-1953) and the division into two Koreas (1953-) changed the spatial structure and affected the population rearrangement. The immigration from the North and foreign countries caused the increase of social population in the big cities. While Busan, the provisional capital city during the Korean War had grown to the city with over 1 million inhabitants, the urban development in Seoul was, however, depressed and stagnated before the reconstruction of destroyed Seoul since the late 1950s. (Kwon, Young-Woo 1999: 74-82)

Overcoming the internal chaos following the National Liberation and the damages from the Korean War, Seoul started laying foundations anew since the late 1950s up to the 1970s and had developed to the modern city. With the construction of infrastructure and the development of motorized vehicles since the late 1960s, the cities developed along the high ways, in particular highway No.1 connecting Seoul and Busan and Seoul has grown to the primate city with many satellite cities around it now.



Empire of Korea (1897-1910)		Colonization by Japan (1910-1945)	
Sino-Japanese War (1894-1895)	Angle-Japanese Alliance (1905) Russo-Japanese War (1904-1905)	1st World War (1914-1918) Explosion of rice prices in Japan (1918) Great Depression (1929)	Manchurian incident (1931) 2nd World War (1939-1945)

Fig.4-1 Development of rail connections from 1899 to 1945 in Korea

Friedmann insisted that the economic development affect the urbanization pattern. On the industrialization phase an urban primacy pattern was outstanding, but it follows little by little the size-rank distribution pattern as national economy develops (Chun, Kyung-Ku 2002: 70) His theory was also proved in the Korean case. The migration from rural areas in the 1960s and the concentration to Seoul in the 1970s are reflected on q-value and primacy index. By the passage of time however these indicators become tangent to the size-rank distribution (Jeong, Bong-Hee 1990: 51)

		1789	1907	1930	1960	1970	1985
q-value		-1.044	-0.872	-0.939	-1.079	-1.135	-1.229
Primacy index	2-cities	6.812	5.491	2.698	2.511	3.424	3.867
	4-cities	2.235	1.719	1.152	1.369	1.859	2.016

Source: Jeong, Bong-Hee (1990: 51)

Tab.4-2 q-value and primacy index of South Korea

To prevent excessive condensation in Seoul especially northern Seoul caused by the immigration from rural regions to get the better jobs, the development programs in southern part of Seoul, “Gangnam” were done from the late 1960s through the 1970s. Under these programs high-rise apartment buildings began to line up along the Hang-river in Yeouido, Sinbanpo, Apgujeong-dong and Jamsil districts as Seoul's sub-cores for business or leisure activities. The districts in Gangnam have expanded rapidly to account for about half of Seoul in size. (Seoul metropolitan government)

Relocation projects of government offices and institutes and their effects

Effects from the decentralization of government offices: Case of Daedok in Daejon

A part of government offices moved out of Seoul to Daedok reaserch park, where is located at the intersection of Gyeongbu highway and Honam Highway. This research park consists of 48 research institutes, 3 higher educational institutes and 7 government offices. As of 1997, 17,044 employees work there. Through the relocation of public offices, not only the demographic decentralization from Seoul but also the regional economy could be grown.

Effects on the demographic migration and the regional economy:
(1) Immigration from Seoul: 43.9% of the employees in relocated government offices and institutes moved from Seoul
(2) Employment opportunities for the natives: 42.0% of workers come from Daejeon
(3) Regional income: 700 million US $.

(Park, Heon-Joo & Kim, Gwang-Ik 1997)

Fig.4-2 Relocation projects of government offices and institutes and their effects

With the development project in Gangnam a part of government offices was moved out to the periphery following decentralization policies at the national level since the 1960s. Even though, from 1964 up to now, varied relocation projects of government offices and institutes have planned, but only 3 projects in 1973, 1980, and 1985 were executed. Under these projects, 24 government offices and 20 public companies moved out of Seoul, but 5 of them came back to Seoul, because of the deficient infrastructure connecting Seoul and the need of

close cooperation with other related institutes. 51.9% of relocated government offices are in the region Seoul. Their decentralization effects are therefore not so significant. (Park, Heon-Joo & Kim, Gwang-Ik 1997)

In July 1971, the development-restricted zone was designated for the first time around Seoul after that of Great London and this green belt zone was extended to 30 km radius area from down town Seoul in the next year. Besides Seoul the development-restricted zones were established around other 13 cities to curb the disorderly expansion of the city and protect the surrounding natural environment. To support varied functions of capital city from 1970s, on the other hand, satellite cities have been built around Seoul and grow fast: Gwacheon was developed as a government city; Bucheon and Seoungnam as residential cities; Ansan, Anyang and Bucheon as industrial cities; Dongducheon and Uijeongbu as military cities.

However the hosing crisis of Seoul in the late 1980's coupled with the shortage of affordable housing in terms of quality and price threatened the economic and social stability of the nation. At last, the central government announced in April 1989 a construction plan of 2 million housing units and made five new towns (Bundang, Ilsan, Bucheon, Sanbon and Pyeongcheon) over the green belt in the sub-urban areas. Consequently the construction of new towns contributed to improving the living standard of Seoulites but the short planning time and the top-down methods resulted in the bed-townization of new towns that is different from the original plan to build up self-sufficient cities.

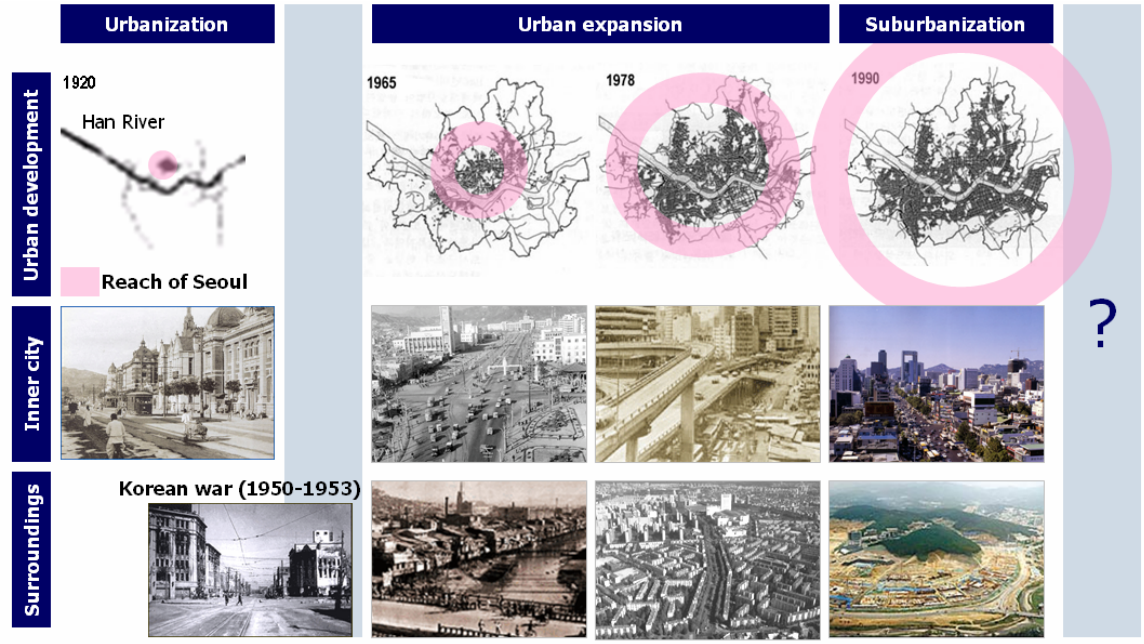


Photo: Seoul metropolitan government; Joongangilbo

Fig.4-3 Urban development of Seoul

According to the government's globalization policies, the 1st metropolitan plan for capital region (1982-1991) was amended in 1994 and it implied the conversion of land use policies from the development prevention in the region Seoul to the managed development to strengthen the competitiveness of metropolis Seoul against the giant world cities in North east Asia; Tokyo, Osaka, Beijing and Shanghai.

In 1997, the economy crisis striking the East Asia led South Korea to moratorium and brought up the economic, industrial and social rearrangements. This economical disaster had not small impacts on the spatial structure particularly of metropolitan regions including the region Seoul. The rigid development restriction in green belt zones since 1970s was more actively appeased and lots of development projects were suggested in these green belt

areas to invigorate the construction industry which was strongly stagnated by the monetary stringency after 1997. They have accelerated uncontrolled residential development around the built-up areas with well-equipped infrastructure, distinctively in the southern area of region Seoul. Such an urban sprawl impedes now the sound urban development supported by marginal urban services and aggravates the negative externality of agglomeration.

Housing problems: Depending on the statistics of KOSIS about the housing supplies in South Korea, much more serious housing problems in big cities were observed than those in provincial areas in 2000. The number of household in 6 big cities and Seoul is 6,847,046 and that of living quarters 4,779,321. Even though the housing supply rate of urban areas in 2000 (69.8%) was improved better than index of 1995 (62.0%), the housing problems are still serious. The rapid increase of nuclear families and single families and the shortage of housing lots in urban areas make the housing supplies worse and worse.

Air pollution: The amount of emission gas in Seoul has been reduced and its average is under the environmental standard. Due to the climate in Seoul, however the composition of emission gas changes seasonally. In summer the portion of O3 soars up and in winter that of SO2 rises which comes out due to the combustion of fossil fuel.

Water pollution: The water pollution level of Han-river becomes better, but the pollution level in the upper stream doesn't yet meet the environmental standard. The water pollution is also affected by the change of climate, so in the monsoon season of South Korea the level comes down. Nowadays due to the urban sprawl, the apartment complexes have been built and planned on the upper stream of Han river, cumulatively "Namyangju", "Hanam" and "Guri", and such projects escalate the water pollution.

Traffic jam: Everyday about 28 million trips generate in Seoul and it runs over the number of population in the metropolitan region Seoul. The number of registered cars in Seoul between 1980 and 2000 has soared up over 10 times and the number of cars per capita has increased from 0.02 to 0.25. As of 2000 the modal split of passenger cars in Seoul amounts to 35.3% and that of subway, one of environment friendly transports is 19.1%.

Uncontrolled residential development around Seoul in quasi-agricultural & forest area: Without the consideration on after-effects, local governments permitted the development activities in quasi-agricultural & forest area to gain more the tax revenues. Now it has caused the serious erosion of green spaces and the deficits of infrastructure around Seoul. Between 1995 and 2000 the forest areas of 5,989 ha have gone in the Gyeonggi province and it corresponds to 27.4% of total injured forest areas in South Korea.

Source: Seoul Metropolitan Government, (www.seoul.go.kr)

Tab.4-3 Urban problems in Seoul

4.1.2 Seoul and the desert of South Korea (Séoul et le désert sud-coréen)

Despite of government's decentralization efforts, as of 2000 the demographic concentration to Seoul (0.6% of entire land surfaces) is still high (21.4%) and it amounts in the region Seoul to 46.3%. Seoulites produce 24.0% of GDP and GRDP of the region Seoul constitutes 47.8% of GDP. Bank deposits concentration rate of Seoul is 51.9% and index of region Seoul accounts for 68.1% of whole nation. As of 2001, 21.6% of entire registered passenger cars run in Seoul and 48.6% in the region Seoul.

unit : %

	Seoul	Region Seoul	Non-Region Seoul
area	0.6	11.8	88.2
population	21.4	46.3	53.7
GRDP	24.0	47.8	52.2
manufacturing establishments	23.2	50.7	49.3
manufacturing workers	17.1	49.5	50.5
banking capacity	51.9	68.1	31.9
colleges, universities	24.2	41.0	59.0
medical facilities	27.7	49.3	50.7
passenger cars (2001)	21.6	48.6	51.4

Source: KOSIS (www.kosis.nso.go.kr)

Tab.4-4 Region Seoul in South Korea (2000)

The spatial polarization to Seoul was compared with five other world cities' (Tokyo, Berlin, Basel, Vienna, and Paris) focusing on the four factors: density, demographic concentration rate, GRDP or income per capita compared with the national average and unemployment rate.

Paris is the most densely populated area among six cities, but demographic concentration rate amounts to just 3.5%. Even though the population density of Seoul is less than that of Paris, population distribution rate of Seoul exceeds 20% and it is more than that of Tokyo-to (9.5%). All citizens in six cities produce and earn more than the national average and GRDP difference between Parisian and average French is the greatest among them. Yet, the chance of employment in six big cities is not sufficient in contrast with higher income.

		Seoul	Tokyo	Berlin	Basel	Vienna	Paris
density (Hab./km2)		16,342	15,140 *	3,811	5,069	3,765	20,164
demographic concentration (%)		21.4	9.5	4.1	2.6	19.4	3.5
GRDP or income per capita / national average (%)		102.08 (a)	136.28 (b)	93.80 (a)	169.3 (b)	145.11 (a)	155.14 ** (a)
unemployment rate (%)	city	4.5	5.0	17.6	2.1	5.8	11.9
	national average	3.7	4.8	10.7	1.9	3.9	11.5

Note: * : ward-area of Tokyo / ** : Ile de France / (a) : GRP per capita / (b) : income per capita

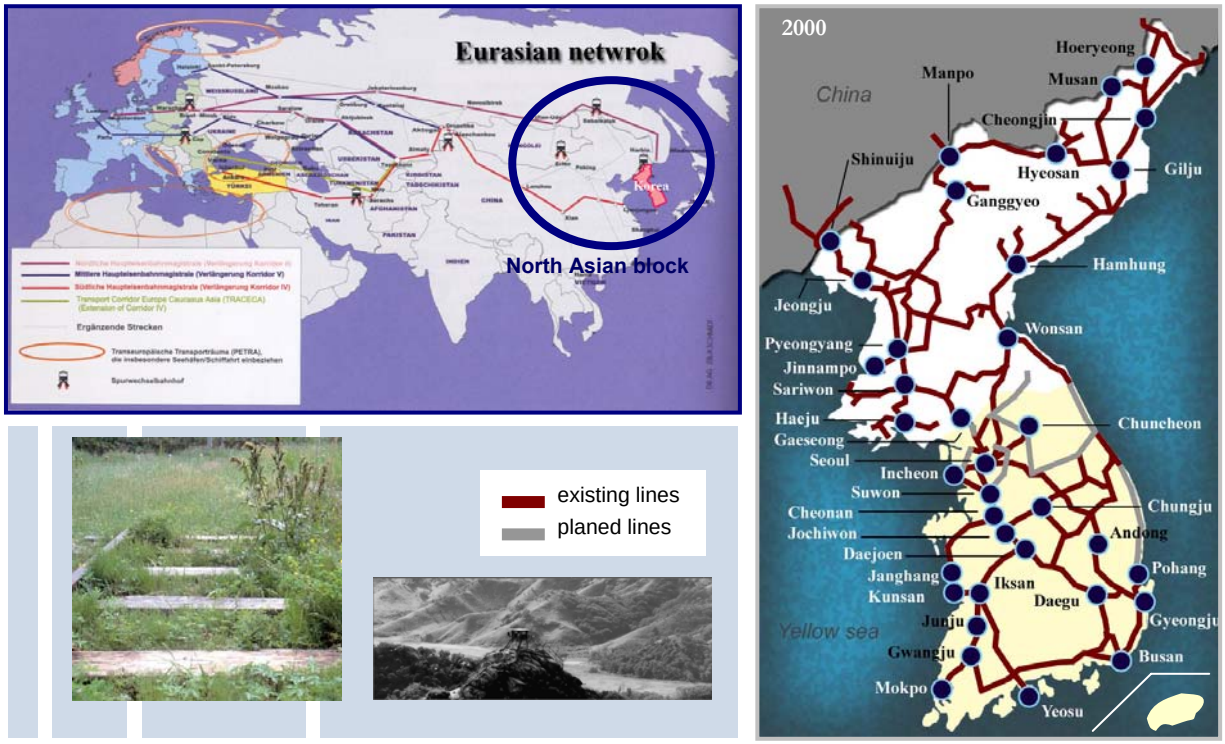
Source: KOSIS (www.kosis.nso.go.kr), Japanese statistics bureau (www.stat.go.jp), statistischer Jahresbuch Deutschland 2001, Statistik Schweiz: Eckdaten (www.statistik.admin.ch/stat_ch/ber00/deck_m.htm), Statistisches Jahresbuch Österreich 2001, Annuaire statistique de la France 2001

Tab.4-5 Analysis on six most densely developed cities

4.1.3 New spatial development visions

Confronting the advance of globalization in the world, the nuisances from the mono-centric spatial structure of South Korea have to be reduced and the potentials of the region Seoul (Refer to Appendix 1) should be maximized to compete with Tokyo and Beijing as one of strategic posts in the North-east Asian economic block that consists of Korea, Japan, northern China, Mongol and the Littoral Province of Siberia with 700 million people and the GDP of 5.7 trillion US Dollar. The impact on the region Seoul after the reunification should be considered at the same time.

The reconnection project of two Koreas' rail roads that had been severed due to the division into the South and the North since 1953 was completed on October 2004 in spite of raising tension on the Korean peninsular caused by North Korea's development of nuclear weapons. This project permits to connect not only between two Koreas but also between two continents, Asia and Europe though rail roads Gyeongui (Seoul – Pyeongyang – Sinuiju) and Gyeongwon (Seoul – Wonsan). It will strengthen the post of the region Seoul in North East Asia.



Source: Seo, Sun-Duk el al. (2001: 266), Förderkreis des Verbandes Deutscher Verkehrsunternehmen & Verband der Deutschen Bahnindustrie (Hrsg.) (1998: 26)

Fig.4-4 Inter-Korean rail connections and Eurasian rail network

The 4th comprehensive national territorial plan, a long tern guideline for the period of 2000-2020 is set forth for the development and management of balanced national territory. Here was suggested the new 3x3 axial structure on the national level to exploit out agglomeration advantage in the metropolises on these new 3x3 axes (Seoul, Incheon, Daejeon, Daegu, Ulsan, Busan, and Gwangju) and develop provincial areas along the axial corridors. The new axial zones will supplement two main development axes, Gyeongbu (Seoul-Busan) and Honam (Seoul-Gwangju/Mokpo).

Picture: www.moct.go.kr

New 3 x 3 axial structures

3 coastal axes

① Axis on Yellow Sea
: Mokpo/Gwangju-Gunsan-Incheon-Pyeongyang (N.K.)
-Shinuiju (N.K.)
② Axis on East Sea
: Busan-Pohang-Donghae-Wonsan (N.K.)-Cheongjin (N.K.)
-Najin/Seonbong (N.K.))
③ Axis on South Sea
: Mokpo-Gwangyang-Jinju-Busan

3 inland axes

① Axis of central inland
: Incheon-Wonju-Gangleumg/Donghae/Sokcho
② Axis of southern inland
: Gunsan-Jeonju-Muju-Daegu-Pohang
③ Axis of northern inland
: Pyeongyang/Nampo (N.K.)-Wonsan (N.K.)

Fig.4-5 New development axes (3x3 structure)

The urban networks along three coastal axes can help to balance land use development which has been biased on the axis Gyeongbu after Korean War, interface with Asia-Pacific region financially and culturally, and connect with North Korea for the preparation of reunification. Meanwhile three Inland axes will lead to drive the development impulse of coastal regions into inland areas and maximize the synergy effect through the reciprocal development between coastal- and inland areas. On the other hand, ten strategic regions on these axes were designated as growth poles to encourage the regional development.

10 strategic regions on the new 3x3 national axes

① Busan/Ulsan/Gyeongnam
: Hub port area for trading with Pacific region
② Gwangyang/Jinju:
: Joint development of port area to overcome regionalism
between two regions Yeongnam and Honam
③ Asan bay
: Industrial function supplementary to the region Seoul's
④ Jeonju/Gunjang
: Strategic region for trading with Sandjung, China
⑤ Gwangju/Mokpo
: Strategic region for trading with Sanghai, China
⑥ Daegu/Pohang
: International textile area and strategic region for trading
with Nikata and region Kyushu, Japan
⑦ Gangwon/East coast
: Strategic region for trading with west coast region of Japan and N. Korea
⑧ Daejeon/Cheongju
: Strategic region for development of inland region
⑨ Inland area
: Strategic region for development of inland region
⑩ Jejudo
: Strategic region for tourism

Fig.4-6 Ten strategic regions

4.2 Spatial development patterns of region Seoul

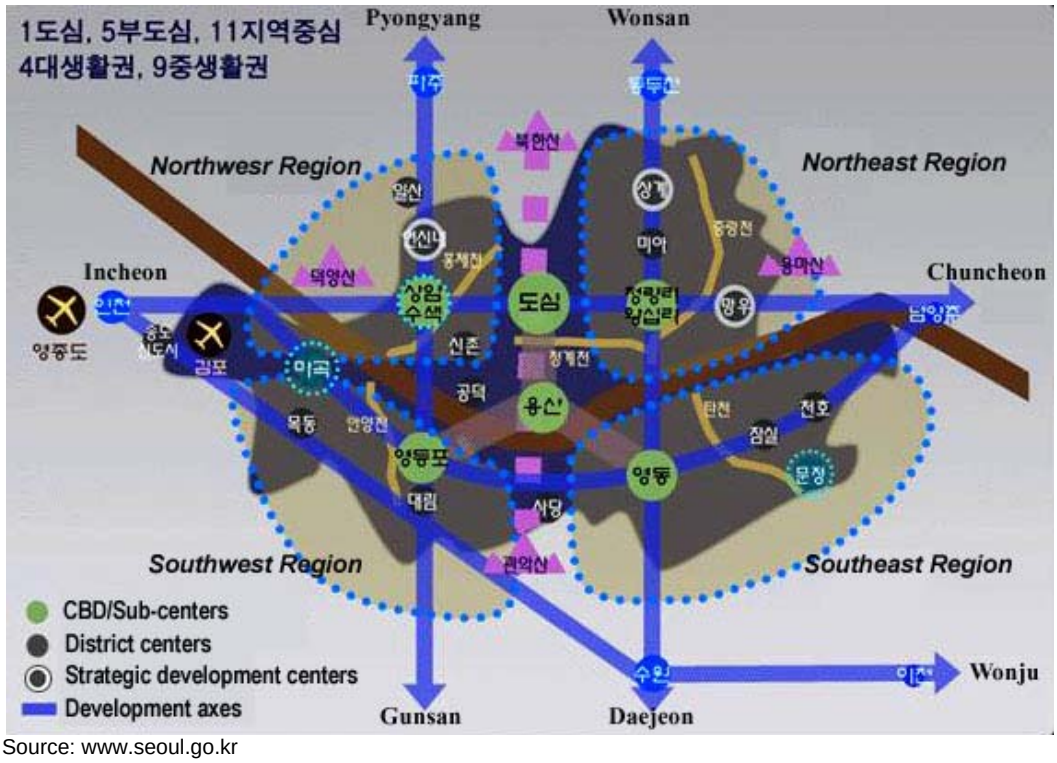
4.2.1 Regulative development plans

The 2nd metropolitan plan for the capital region was established on the region level. This plan is long-term guideline (1997-2011) on spatial development and management in the region Seoul. In order to exploit out regional potentials based on IT-industry, the region Seoul was divided into four functionally characterized zones and specific development strategies were suggested respectively: International interchange area, Interchange area with North Korea, residential area in the nature and industrial belt at the west coast.

In the international interchange area connecting Incheon and Seoul infrastructure supporting international functions is well equipped: two international airports, Incheon international port, Songdo international business area (now in construction), conventional centers, etc. However the development in this densely populated region can cause additional congestion and selective development policies are in need. The northern region Seoul bordered with DMZ will be developed in focus on the extension of economic cooperation with North Korea and post-unification. On the other hand the urban sprawl now impacts on environment in the east region Seoul, where the Han River, a source of dinking water in the region Seoul flows down. Considering the ecological consequences, therefore the development projects in this region should be controlled. A new harbor Pyeongteak will support the current industrial belt on the yellow sea (Incheon-Asan) and the development cumulatively along highway No.15 can help reduce the pressure on Gyeongbu axis (Seoul-Busan).

Therewith the region Seoul was sectioned again with three development management areas (overcrowding control area, growth management area and environment preservation management area) and different planning approaches were indicated. (Tab.4-6)

Meanwhile the local authorities in the region Seoul, municipality of Seoul, municipality of Incheon, and Gyeonggi provincial government established, on the local level, their own development plans consistent with higher-order regulations including the aforementioned 2nd metropolitan plan for the capital region.



Source: www.seoul.go.kr

Fig.4-7 Seoul master plan 2020

		overcrowding control area	growth management area	environmental preservation management area
area		2.035,5 km2 (17,3%)	5.868,3km2 (49,9%)	3.850,9km2 (32,8%)
population		18.386 thousand (84,2%)	2.715 thousand (12,4%)	726 thousand (3,4%)
cities and counties		Seoul, Incheon (partially), Guri-si, Uijeongbu-si, Namyangju-si (partially), Hanam-si, Goyang-si,Suwon-si, Seongnam-si, Anyang-si, Bucheon-si, Gwangmyeong-si, Gwacheon-si, Uiwang-si, Gunpo-si, Siheung-si	Dongducheon-si, Ansan-si, Osan-si, Pyeongtaeck-si, Paju-si, Namyangju-si (partially), Pochen-gun, Yongin-si (partially), Yeoncheon-gun, Yangju-gun, Gimpo-si, Hwaseong-si, Anseong-si (partially), Incheon (partially), Siheung-si (partially)	Icheon-si, Namyangju-gun (partially), Yongin-si (partially), Gapyeong-gun, Yangpyeong-gun, Yeoju-gun, Gwangju-si, Anseong-si (partially)
development strategies		- alleviate urban congestion - solve urban problems	- accommodate relocated central functions - make self-sufficient foundation	- control water supply system - improve infrastructure and public service
permission for the establishment of industrial plants		- prevent new plants and facility expansion of agglomerate companies - permit location of middle and small industrial companies adequate to urban milieu	- prevent new plants and facility expansion of agglomerate companies - permit location of high tech companies - location of middle and small industrial companies	- prevent new plants and facility expansion of agglomerate companies - permit location of environment friendly industries
school	university	- prevent establishment of new schools and relocation into Seoul	- prevent establishment of new schools but permit location of small schools accommodating 50 students	- prevent establishment of new schools but permit location of small schools accommodating 50 students
	collage	- permit establishment of new schools but prevent location in Seoul	- permit establishment of new schools	- permit establishment of collages except industrial parts
commercial facilities		levy of overcrowding charge	-	prevention
permission for residential development		development in over 100 ha area	development in over 100 ha area	development in over 3-6 ha area
permission for industrial development		development in over 30 ha area	development in over 30 ha area	development in over 3-6 ha area
permission for resort development		development in over 10 ha area	development in over 10 ha area	development in over 3-6 ha area

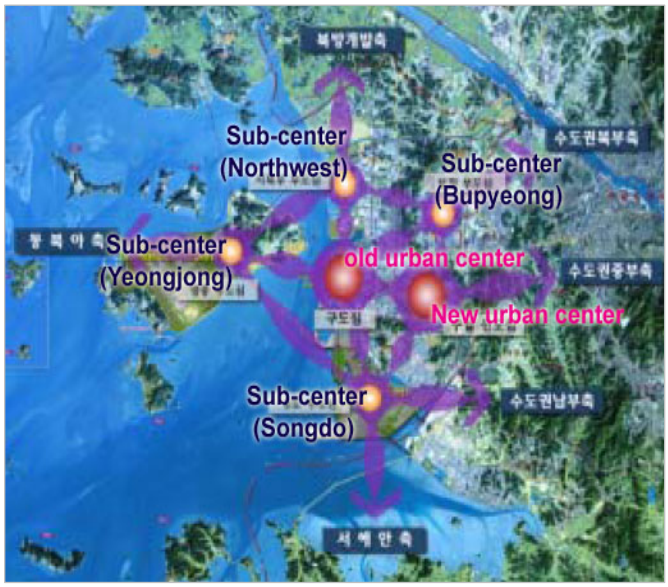
Source: Kang, Byeong-Joo (2001: 161-162)

Tab.4-6 Regional regulation for development activities (2nd metropolitan plan for the capital region)

Seoul municipality presented Seoul master plan 2020 aiming at construction of poly-centric metropolis with a city center, 5 sub-centers, 11 regional centers, and 53 district centers. Here were raised five strategic development issues:

(1) Intensification of role as a economic strategic post in the East Asia by networking international functions
(2) Construction of networks for mutual cooperation between South and North Korea
(3) Urban development in harmony with nature
(4) Balanced regional development by intensification of poly-centrality and urban renewal of deteriorated northern Seoul
(5) CBD restructuring by restoration and conservation of natural and cultural heritage

To reduce urban congestion and strengthen self-sufficiency and diversity in the capital city of South Korea, Seoul master plan 2020 divided Seoul into city center and four life regions: North-eastern region, South-eastern region, South-western region, and North-western region.



Source: Lee, Wang-Gi (2002: 191)

Fig.4-8 Incheon master plan 2020

Source: Lee, Chun-Hoo et al. (2000)

Fig.4-9 Gyeonggi grand design 2020

Incheon municipality drew a blue print for spatial development focusing on functional connections with three ports, Incheon new international airport, seaport Incheon and tele-port Songdo constructing now in the reclaimed land on Yellow sea. Incheon Master plan 2020 also suggested the functional depolarization by a poly-centric urban structure of two centers and four sub-centers.

On the other hand, Gyeonggi grand design 2010 was established by the Gyeonggi provincial government to control urban sprawl through “plan first and development later”, convert mono-centric spatial structure to poly-centric one, and maximize regional potentials as an incubator of intelligence industry. The Gyeonggi province is here spatially rearranged with metropolitan area and five development axial zones: Suwon-Hwaseong-Anjung, Seongnam-Icheon-Yeoju, Namyangju-Yangpyeong-Gapyeong, Dongducheon-Pocheon-Cheolwon, and Gimpo-Paju-Gaaaeseong. However the regional connection is considered just on the basis of road system in the region Seoul.

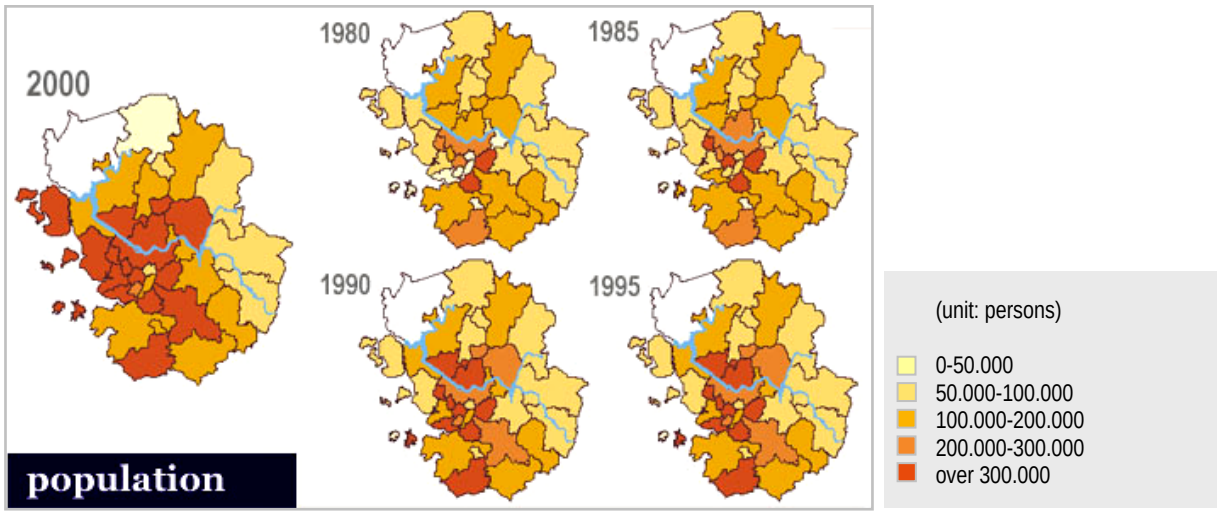
4.2.2 Demographic development

Population

The population of Seoul rapidly increased from 2.4 million in 1960 to 5.4 million in 1970 and 8.4 million in 1980. The annual rate of increase was about 10% between 1960 and 1970 and 5.4% between 1970 and 1980, while the annual growth rates of national population in the same periods were 2.2% and 1.9% respectively. Throughout the 1980's, Seoul experienced a marked slow-down in in-migration and an increase of out-migration into the outlaying suburban areas near Seoul. Although the population growth rate of Seoul tapered off, the absolute size was further on the increase from 8.4 million in 1980 to 10.6 million in 1990. (Jung, Hee-Yun 2002: 22)

However the construction of five new towns around Seoul in the late 1980s speeded up the suburbanization in the region Seoul. The population of Seoul has decreased since 1995 and the rush to suburbs is more and more aggressive. Seoul's share of population in the region Seoul also decreased from 62.9% in 1980 to 46.3% in 2000. On the contrary, population growth rates of Incheon and Gyeongi province between 1990 and 2000 exhibit 36.2% and 45.9% respectively, depite of the government efforts to develop the non-region Seoul. Especially the population share of Gyenggi province in the region Seoul was significantly increased from 29.0% in 1980 to 42.0% in 2000. (Jung, Hee-Yun 2002: 23)

In the 1980s the population growth was remarkable in the south-western part of Gyeonggi province within the radius of 30 km from the downtown Seoul along the axis Seoul-Incheon and Seoul-Suwon. Between 1995 and 2000 the rapid expansion was observed over the 30km-radius zone, cumulatively in the areas neighboring with five new towns: Goyang (47.4%), Yongin (59.1%), Namyangju (48.8%), Siheung (128.8%), Gimpo (39.5%), Gwangju (46.2%) and Osan (45.7%). This tendency develops towards the 50km-radius zone form Seoul. (Refer to Tab.7 in Appendix 2)



Source: Seoul development institute (2002: 138-139)

Fig.4-10 Development of population in the region Seoul (1980-2000)

Depending on the population projection of KOSIS (KOrean Statistical Information System), the number of inhabitants in Gyeonggi province will exceed that of Seoul from 2005. The population in the region Seoul was 28.3% of total population in South Korea in 1970, but 46.3% in 2000 and will be 50.8% in 2030. Gyeonggi province, the hinterland of Seoul is expected to absorb most of these impacts.

unit: 1,000 persons

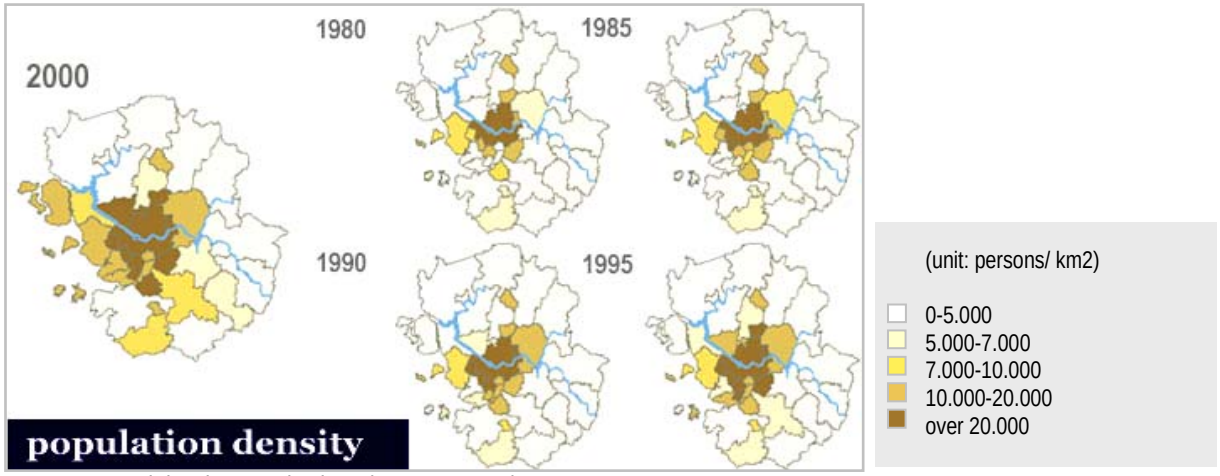
	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030
Seoul	5,686	7,005	8,516	9,725	10,473	10,342	10,078	9,983	9,869	9,723	9,508	9,274	9,026
Incheon	804	981	1,253	1,541	1,897	2,334	2,522	2,668	2,789	2,890	2,962	3,010	3,023
Gyeonggi	2,636	3,125	3,774	4,697	5,972	7,738	9,146	10,304	11,295	12,102	12,729	13,198	13,497
Others	23,115	24,170	24,580	24,843	24,527	24,679	25,261	25,506	25,641	25,637	25,451	25,166	24,750
South Korea	32,241	35,281	38,124	40,806	42,869	45,093	47,008	48,461	49,594	50,352	50,650	50,649	50,296

Source: KOSIS (http://kosis.nso.go.kr)

Tab.4-7 Population projection from 1970 to 2030

Population density

As population has concentrated into the region Seoul, the population density of region Seoul has consistently been increased. In 1999 the net population density measured by the built-up areas is 245 persons/ha in the region Seoul, 293 persons/ha in Seoul, 173 persons/ha in Incheon, and 225 persons/ha in the Gyeonggi province. While the net-population density of Seoul has a decreasing tendency since 1990, that of Incheon and Gyeonggi province show tendency to increase constantly. (Jung, Hee-Yun 2002:24) On the other hand, the increasing zones extend to Yongin, Namyangju, Gimpo and Gwangju. The construction of infrastructure and the development of high speed transits encourage the expansion towards Pocheon and Ganghwa in the 50km-radius zone further.



Source: Seoul development institute (2002: 140-141)

Fig.4-11 Development of population density in the region Seoul (1980-2000)

4.2.3 Industrial structure development

In the early industrialization phase of the 1960s, Seoul was the center of industrial growth in South Korea. Since the beginning of the 1970s, however the growth rate of Seoul has been continuously lower than the national average and it is related to the rapid decentralization of manufacturing industries to its surrounding suburban areas in the region Seoul. (Huh, Jae-Wan 2002: 46)

The employment in Seoul showed an increasing tendency between 1981 and 1996. (i.e. 2.4 million workers and 360,000 business establishments in 1981 but 4.1 million and 700,000 in 1996) Due to the foreign exchange crisis at the end of 1997, however, Seoul experienced a dramatic decrease in the employment that was 10-20% decrease of the 1996's. Now the number of employment in Seoul increases from 3.4 million employees and 660,000 business establishments in 1998 to 3.6 million and 720,000 in 2000. (Seoul development institute 2000: 142, Jung, Hee-Yun 2002: 25-26)

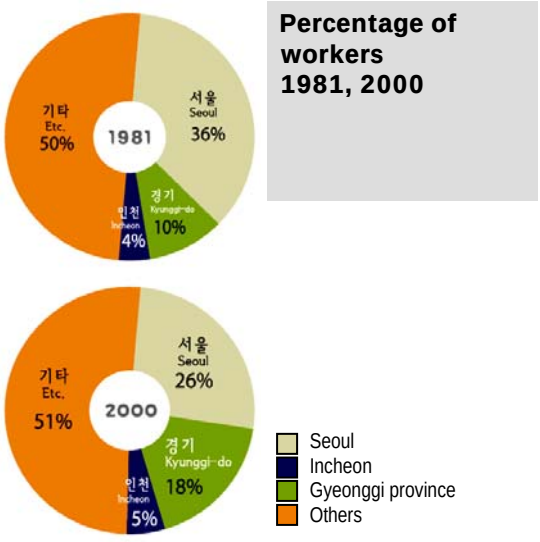
As the population of Incheon and Gyeonggi province has rapidly increased, the number of employment has also fast grown in those regions. Especially the industrial importance of Gyeonggi province has remarkably increased with annual growth rate of 14% between 1981 and 1991 and 6.1% beween 1991 and 2000. Its share of employment in the nation increased from 10% in 1981 to 18% in 2000. (Seoul development institute 2000: 142, Jung, Hee-Yun 2002: 25-26)

The distribution of employees explains the industrial weight of individual communities in the Gyeonggi province. By investing the percentage of communities' workers in total employees of Gyeonggi province, the big cities with over 50 thousand population in the neighborhood of Seoul were proved to have more responsibility in the regional economic activities: Suwon (9.9%), Seongnam (7.4%), Goyang (5.7%), Bucheon (8.6%), Anyang (6.5%), Ansan (8.3%).

Among the same sized communities the industrial importance of cities in the 30-50km radius areas from Seoul to the southwest was more remarkable than cities bordering with Seoul in the north. As of 2000 Yongin in the south and Uijeongbu in the north are both cities with 300 thousand inhabitants, but the number of employees in Yongin (131 thousand workers) is twice as much as Uijeongbu's (67 thousand workers). (Refer to Tab.7 in Appendix 2)

Source: Seoul development institute (2000: 142)

Fig.4-12 Trend of workers in the region Seoul (1981-2000)



Source: Seoul development institute (2000: 142)

Fig.4-13 Percentage of workers in S. Korea

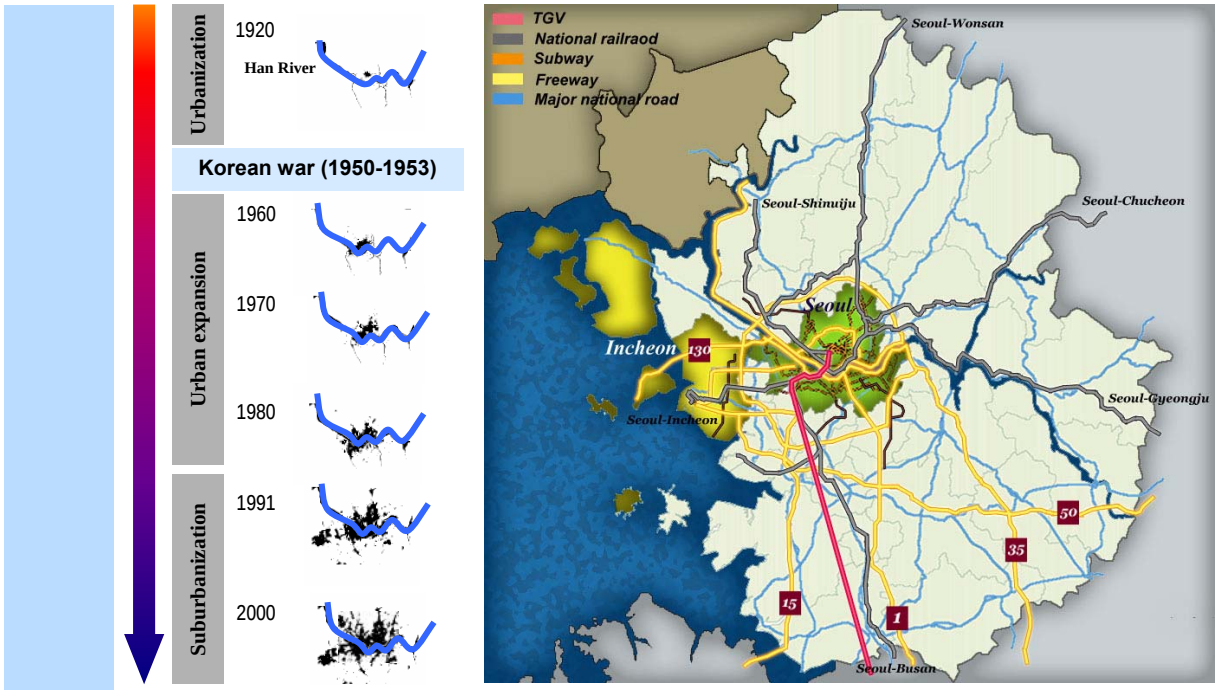
The high land price and labor cost in Seoul pushes manufacturing industries from Seoul into its hinterland, Incheon and Gyeonggi province, but the decentralization of industries has been strategically promoted since 1970's by the central government to reduce the over-concentration of population and industrial activities in Seoul. In the period 1980-2000 the marked growth of manufacturing industries in the Gyeonggi province explains this suburbanization of industries in the region Seoul. In 2000 the major industries of Gyeonggi province are manufacturing, electricity, gas and water supply, public administrative service and other social and personal service, while construction, wholesale and retail trade, transport, storage and communication, producer service and business service are concentrated in Seoul. (Jung, Hee-Yun 2002: 26, Huh, Jae-Wan 2002: 46)

The tertiary industries have the significance in Seoul. Seoul's share of business services to the national total has continuously increased and is now more than 50%. Among the business service, technical- and computer services are overwhelmingly concentrated in Seoul. Seoul's share of technical- and computer services to the nation was 61.4%in 1978, but the figure increased to almost 91% in 2000. The continuous concentration trend of technical and computer services, contrasts with the general trend of decentralization of manufacturing including the high-tech industrial sector and the general service industries. (Huh, Jae-Wan 2002: 48)

4.2.4 Land use development

The land use development of Seoul in 1985 developed mainly within 25km-radius zone from the center of Seoul along the major arterial roads, Seoul-Busan and the Seoul-Incheon. However the recent development is extended to over 35km-radius zone from Seoul and proceeds in more dispersed patterns along the new development corridors such as Seoul-Sungnam-Yongin, and Seoul-Goyang-Paju. The housing development has taken the form of leap-frog patterns over the the green-belt zone around Seoul.

In the process of the metropolitanization of Seoul, the agricultural lands have converted significantly into urban uses and the reach of Seoul extends now outwards. The built-up area of the region Seoul increased from 777.7 km2 in 1985 to 1,172.6 km2 in 1998 (about 1.5 times). The built-up area of Seoul, Incheon, and Gyeonggi province increased respectively by 22%, 66% and 65%. On the other hand the 444 km2 of open spaces have disappeared in the same period and it is as much as 75% of Seoul's total administrative area (605 km2). (Huh, Jae-Wan 2002: 21)



Source: Yoshida (2003: 40); Seoul development institute (2002: 149, 151) (modified)

Fig.4-14 Urban sprawl and transportation networks in the region Seoul

The hosing crisis in the late 1980's coupled with the shortage of affordable housing in terms of quality and price threatened the economic and social stability of the nation. At last the central government took a radical turn to make residential development over the green belt in the sub-urban areas and revised the national land use and management law that was not permissive enough to obtain the large developable residential estates. The revision in 1993 made possible to develop the quasi-agricultural and forest area mainly designated for agricultural and forestry uses. These dominant agricultural areas didn't require explicitly the planned urban development and necessary urban infrastructure provisions. Many small-scaled private housing developments occurred sporadically along the arterial roads, cumulatively in Yongin or Paju without the necessary provision of urban infrastructure and detailed zoning regulation. (Huh, Jae-Wan 2002: 21)

Consequently in 2003, "Act on the Planning and Utilization of National Territory" was revised and re-categorizes national territory with four zones: (1) urban area, (2) management area, (3) agricultural and forest area and (4) natural environment preservation area. The 2nd-type detailed planning system was also introduced to manage non-urban areas in the face of

various development demands and protects them from uncontrolled urban expansion. The 2nd-type detailed planning area (or district) is demarcated in case of 300,000m2 for housing sites and 30,000m2 or more for other land uses by taking into account the degree of development pressure and the purpose of development. These areas are developed in systemic and planned manners by establishing a phased management plan and collectivizing development activities. In addition, the standards of infrastructure provision in these areas are differentiated by the purpose of land use. (KRIHS 2002: 3-4)

Now the urban sprawl of Seoul doesn't reach the 50km-radius zone. Depending on growing population in the region Seoul and increasing demands of residential development in the suburban areas due to the affordable housing shortage in term of quantity and quality, it is expected that the reach of Seoul will extend up to 50km-radius zone along the transportation axes: to the west along the rail road Seoul-Incheon and highway Seoul-Incheon, to the northwest along the rail road Seoul-Shinuiju, to the north along the rail road Seoul-Wonsan and to the south along the rail road Seoul-Busan and highway Seoul-Busan.

However theses development activities should integrate with the construction of industrial- and economic base to reduce negative external effects from urban sprawl and make self-contained spatial structure. On the other hand, the development reserves should be secured to absorb the development pressure expected after the reunification, cumulatively in the northern area of Gyeonggi province bordered with North Korea.

4.2.5 Infrastructure development

Now Seoul is connected with neighboring cities in the region Seoul by six main railroads and six arterial roads, but these transportation networks are still remarkably radio-centric, even though two highway lines, No.100 and No.50 link are tangent to the cities in the south of region Seoul.

Six main rail-connections	Six arterial road-connections
• Gyeongin line (Seoul-Incheon), • Gyeongbu line (Seoul-Bunsan), • Gyeongui line (Seoul-Goyang/Paju) • Gyeongwon line (Seoul-Uijeongbu-Yeoncheon), • Gyeongchun line (Seoul-Chuncheon), and • Jungang (Seoul-Wonju-Gyeongju)	• Highway No.110, No.120 and No.130 (Seoul-Incheon), • Highway No.1 (Seoul-Busan), • Highway No.35 (Seoul-Cheongju), • Highway No.15 (Seoul-Mokpo), • Highway No.50 (Incheon-Suwon-Gangleung), and • Highway No.100 (Seoul outer-ring)

Tab.4-8 Transportation networks in the region Seoul

Rail roads

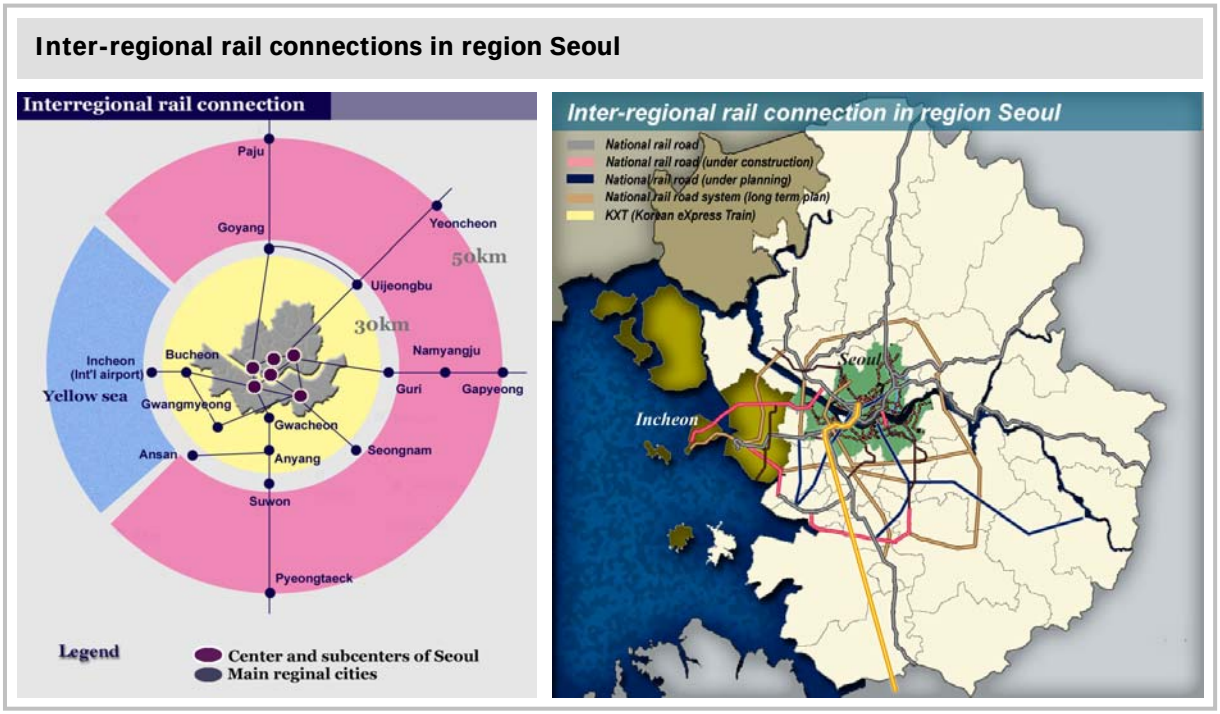
The cities in the region Seoul are bound together by metropolitan subway- and regional railway lines. Since 1974, when the subway line1 run through the downtown Seoul, the capacity of railway service has been constantly expanded. As of 2000 the total length of subway and regional rail roads is up to 454km and now seven regional lines and eight subway lines are in operation, including the most congested inner circular line (subway line2). Compared with the capacity of rail road system in other metropolitan regions - region Tokyo, region Paris, and region London -, however it is not still enough in quality and quantity.

	Length (km)		
	Urban rail roads	Interregional rail roads	Total
Region Seoul (2000)	276,2	177,8	454,0
Region Tokyo (1996)	270	1.873	2.143
Region Paris (1996)	211	1.401	1.612
Region London (1996)	438	3.119	3.557

Source: Ministry of Construction and Transportation (2002: 56)

Tab.4-9 Comparison with other metropolises in the total length of metropolitan rail roads

Now the rail road system in the region Seoul is the Seoul-oriented one, but additional railway connections with Seoul are still in demand: Hanam in the eastern suburban area and Gimpo in the north-western area. On the other hand, circular rail connections tangent to the cities around Seoul is planed with a long-term perspective.



Source: Seoul development institute (2002: 149, 151) (modified) (right)

Fig.4-15 Inter-regional rail connections in the region Seoul (left: present/ right: long-term plan)

From April 2004 the high speed railway system is in operation: KTX line Seoul-Busan and KTX line Seoul-Mokpo. The wagons of KTX (Korean eXpree Train) stem from the French TGV. The KTX line Seoul-Busan has been constructed since 1992 and connects now Seoul, Daejeon, Daegu, and Busan except the bock passing through Gyeongju. However from 2010 it will hook in Gyeongju. The KTX line Seoul-Gwangju/Mokpo links Seoul, Daejeon, Iksan, Gwangju and Mokpo by using conventional rail tracks, Honam line and the construction of new exclusive rail tracks for the KTX is now planed.

A high-speed transportation, KTX reduces the conventional time-distance between Seoul and Busan from six hours to two hours. It makes the whole nation a half-day trip zone. At present, there are four KTX stations in the region Seoul: Seoul station, Yongsan station, Gwangmyeong station, and a temporary station Haengshin. However the newly constructed Gwangmyeong station, Unlike other renovated old ones, is not directly connected with the metropolitan rail road system and this unqualified accessibility gets its patronage rate lower.

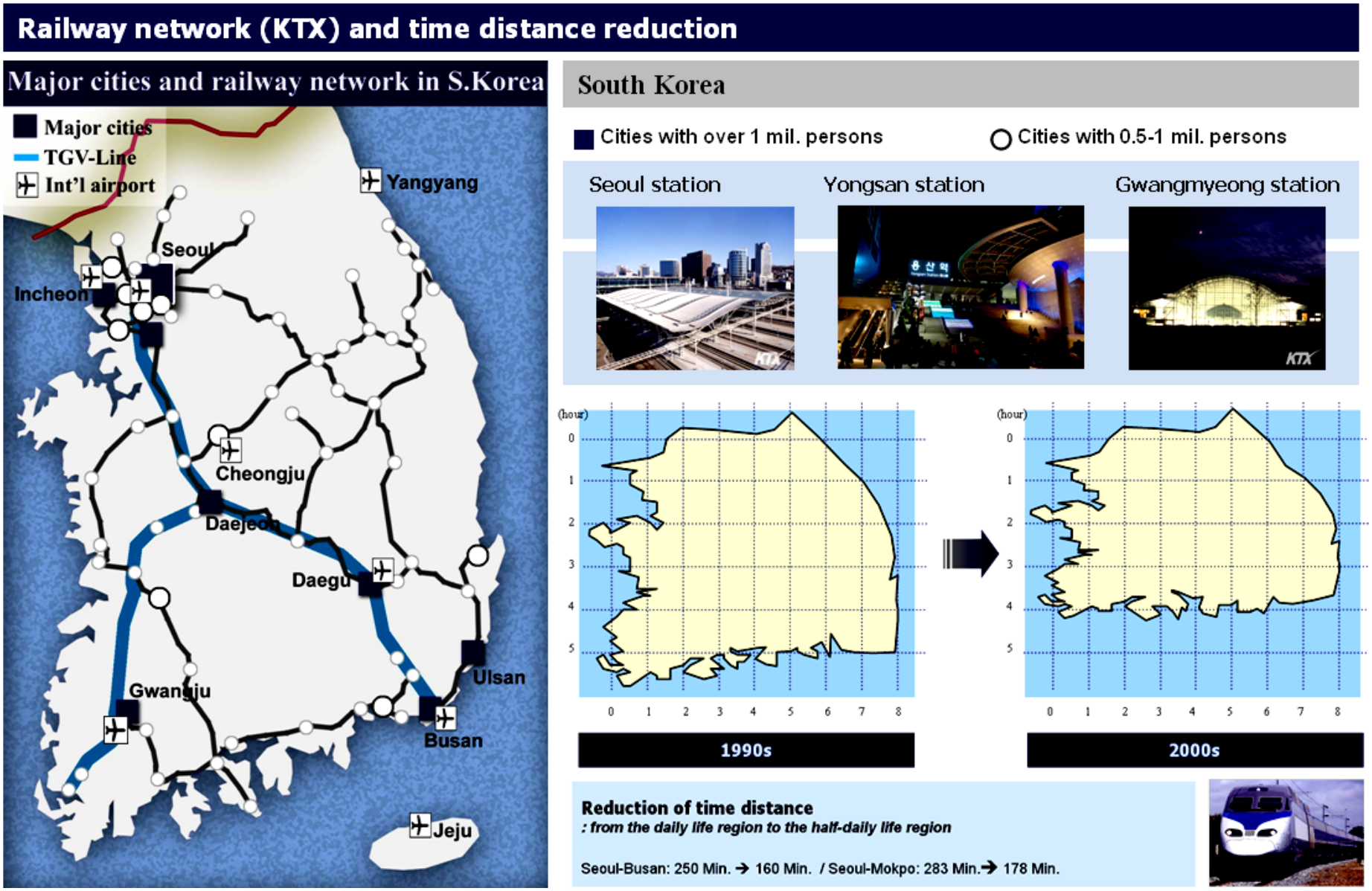
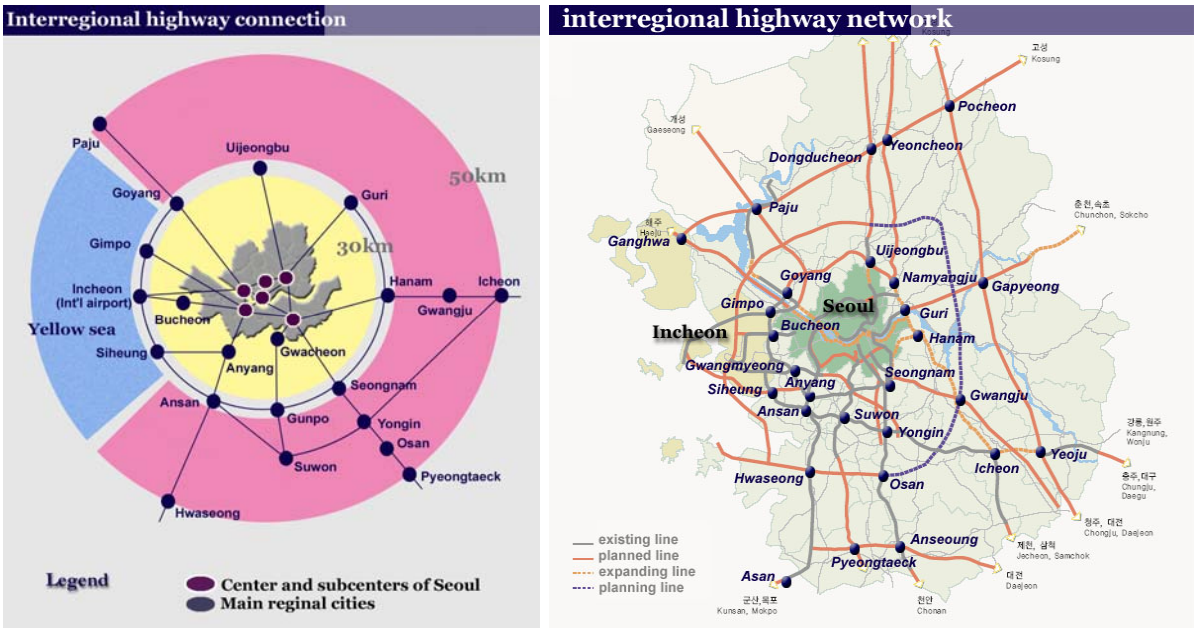


Fig.4-16 Railway network (KTX) and time distance reduction

Highways and national roads

As of 2000, 592km-long highways and 1,609km-long national roads are equipped in the region Seoul and their capacity corresponds to 10% of all road connections in the capital region. Even though the outer ring around Seoul is almost completed, the road system of the region Seoul is still Seoul-oriented like the rail road system and generates the through-traffic in the central city Seoul. Now with the road capacity improvement, the establishment of a 4X5 grid road system and the construction of bypasses in extremely congested sections are suggested in a report on the establishment of metropolitan transportation network. (KOTI & KRIHS 2000)

Inter-regional highway connections in region Seoul



Source: Seoul development institute (2002: 150) (right)

Note: 4X5 grid road-system

(1) 4 north-south axes:
- Ganghwa-Gimpo-Seoul-Ansan-Pyeongtaeck,
- Paju-Goyang-Gwangmyeong-Suwon-Pyeongtaeck,
- Yeoncheon-Uijeongbu-Seongnam-Osan, and
- Cheonlwon-Pocheon-Yangpyeong-Yeoju

(2) 5 east-west axes:
- Gimpo-Paju-Yeoncheon-Pocheon,
- Goyang-Yangju-Gapyeong,
- Bucheon-Seoul-Guri-Yangpyeong,
- Ansan-Yongin-Icheon, and
- Pyeongtaeck-Anseong

Fig.4-17 Inter-regional highway connections in the region Seoul (left: present/ right: long-term plan)

4.2.6 Mobility development

Orient–Destination analysis was made to understand inner- and inter-regional commuting pattern in the region Seoul. Here was analyzed the O-D data of matutinal commuters in the region Seoul respectively in 1995 and 2000 by KOSIS. Most of commuting trips generate in the internal boundary, but in terms of interregional trips, the commuting trips from Geyonggi province to Seoul are dominant.

unit: person

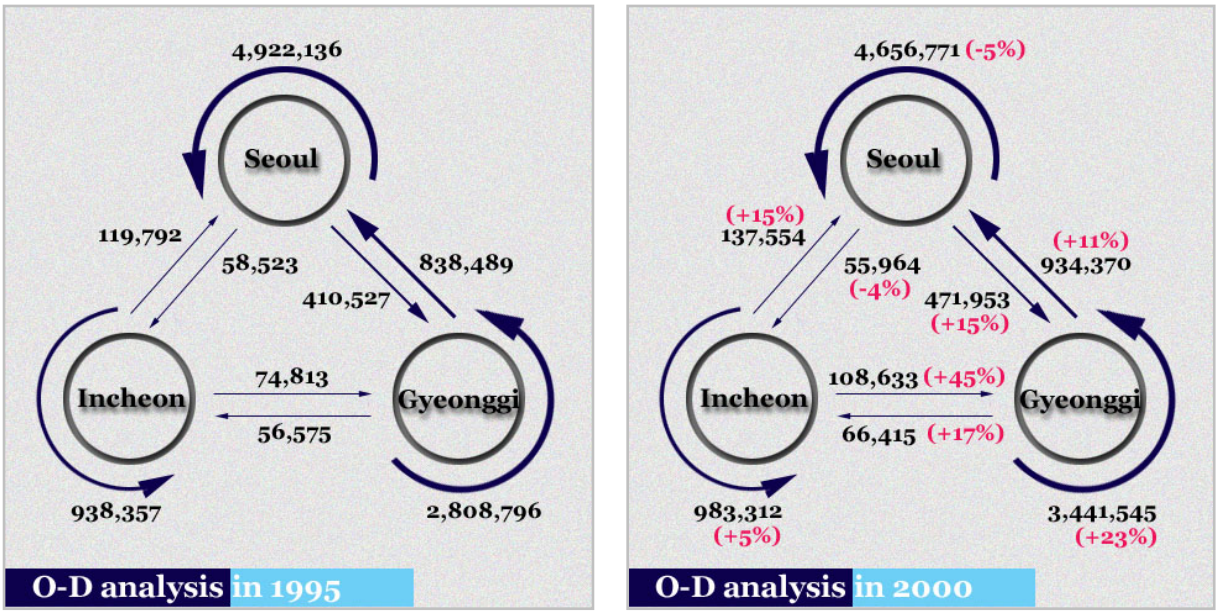
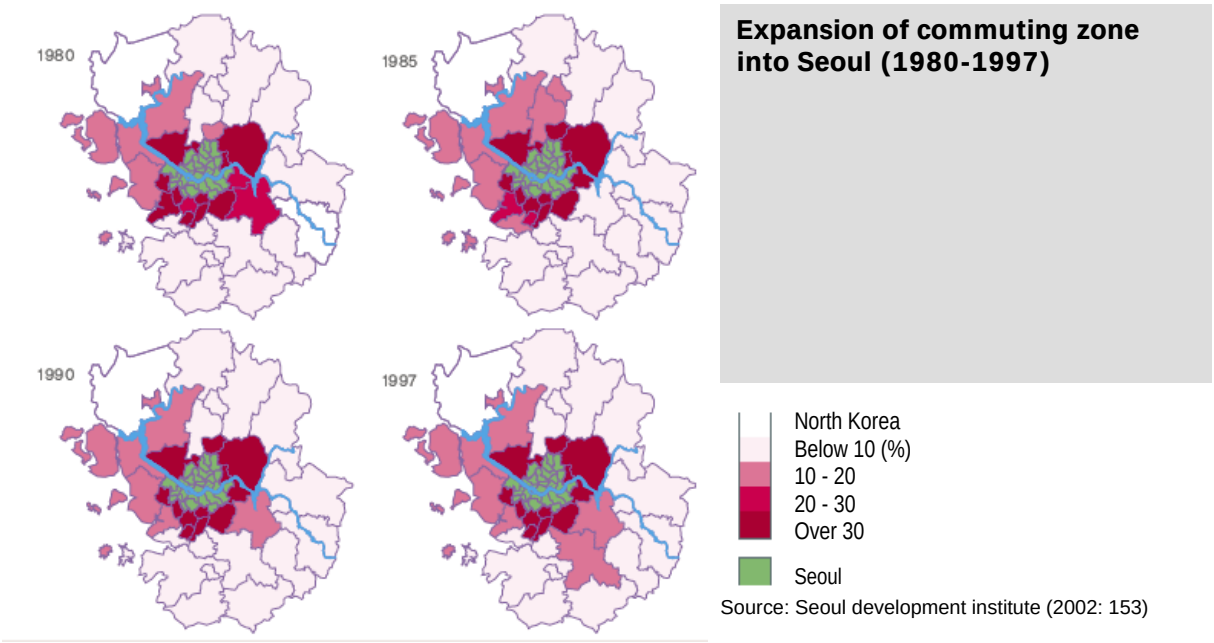


Fig.4-18 Inter-regional commuting patterns (1995-2000)

While the internal commuting trips in Seoul decrease 5% during 5 years, the commuting trips from Incheon and Gyeongi province to Seoul increase respectively 15% and 11% due to the suburbanization. In the same period, however it is noteworthy to increase the inner- and inter-regional commuting trips in Gyeonggi province: 23% increase in terms of the internal commuting trips, 15% increase in case of the trips from Seoul to Gyeonggi province, and 45% increase in the commuting volume from Incheon to Gyeonggi province. The increase of employees caused by the industrial suburbanization in Gyeonggi province affects to the growth of commuting volume in Gyeonggi province.

Commuting zone to Seoul

Commutation pattern reflects the actual movement of people in the region Seoul, regardless of the administrative boundaries. In the period 1980-1997 the number of commuters from the Gyeonggi province to the Seoul increased 14.2 million commuters to 80.9 million approximately at 5.7 times. Now the commuters' rate to Seoul gradually increases even in the cities to the radius 35-40km zone from the city center of Seoul. This development tendency reflects a rapid residential suburbanization in the region Seoul. (Seoul development institute 2000: 152)



Source: Seoul development institute (2002: 153)

Fig.4-19 Expansion of commuting zone

Generally the commuting zone is estimated with the commuters' rate, i.e. the portion of out-commuters toward the central city in the total employees and students. In South Korea the commuting zone corresponds to zone with more than 5% commuters' rate to the central city. (Korean geographic society 1999: 232) As of 2000 the commuting zone of Seoul extends to 30-40km radius-zone from the center of Seoul. – That was analyzed with O–D data of matutinal commuters in the region Seoul in 2000 by KOSIS. However the increasing population in the region Seoul and the suburban residential development to solve the housing shortage in Seoul, including additional five new-town projects (Pangyo, Paju, Hwaseong, Gimpo and Suwon), push the expansion of Seoul to the 50km-radius zone. (Refer to Tab.8 in Appendix 2)

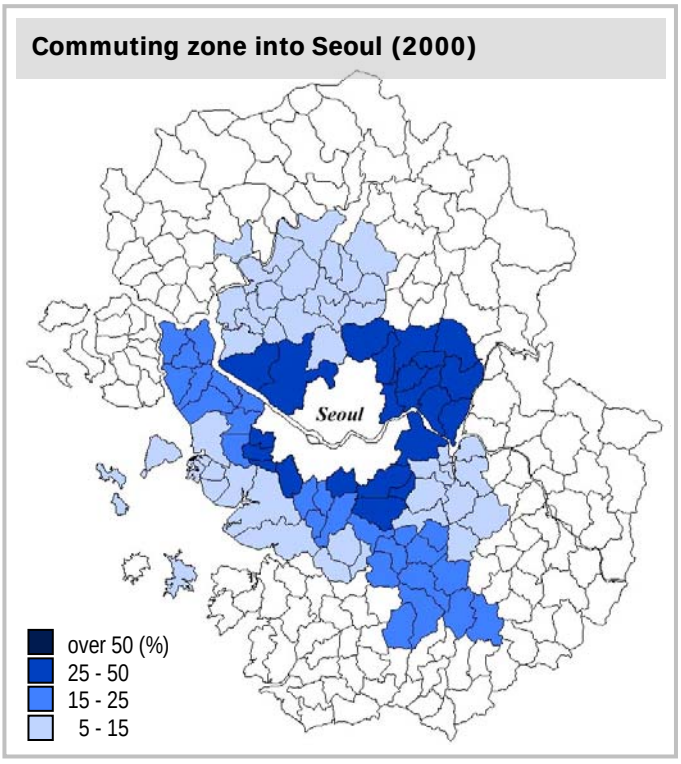


Fig.4-20 Commuting zone of Seoul (2000)

Out-commuting volume to Seoul

Most of commuting trips into Seoul generate in the cities bordering with Seoul, but the commuting zone to Seoul expands from the 30km-radius zone to the 50km-zone from the center of Seoul. It is reflected on the increasing rate of commuting volume in the counties located in the 30-50km-radius zone, cumulatively northwest and southeast parts of Gyeonggi province, where the population has increased since late 1990s.

Between 1995 and 2000 the commuting trips to Seoul soared up remarkably in the 30-50km-radius zone: Osan (120.4%), Yongin (237.9%), Icheon (100.8%), Yeoju (104.9%), Hwaseong (79.1%), Gwangju (122.6%), Pocheon (63.8%), and Yangpyeong (53.8%)

However it is interesting to observe the different commuting patterns in the period 1995-2000 between the north and the south of Gyeonggi province adjacent to Seoul. In the cities of northern region Seoul, where the industrial plants could not be established due to the military confrontation with North Korea, the commuting trips to Seoul increase and it indicates the distinctive bed-townization of Seoul: Uijeongbu (50.0%), Namyangju (66.5%), Gimpo (103.0%), and Yangju (84.9%)

In the southern region, on the other hand, the commuting trips to Seoul decreases a little bit cumulatively in the sections Seoul-Incheon and Seoul-Suwon which are important industrial belts of the region Seoul: Seongnam (-3.7%), Anyang (-11.2%), Bucheon (-10.0%), Gwangmyeong (-15.7%), Gwacheon (-6.2%), Gunpo (-3.0%), Uiwang (-5.7%), and Hanam (-5.4%). Depending on this tendency the progress of functional decentralization in the south region Seoul can be carefully analogized.

In case of Incheon, the commuting trips to Seoul increase in the outskirts of Incheon; Gyeyang-gu (37.1%), Ganghwa (35.7%), but the city centers show the decreasing pattern between 1995 and 2000: Jung-gu (-3.8%), Dong-gu (-21.9%), and Nam-gu (-6.3%). (Refer to Tab.8 in Appendix 2)

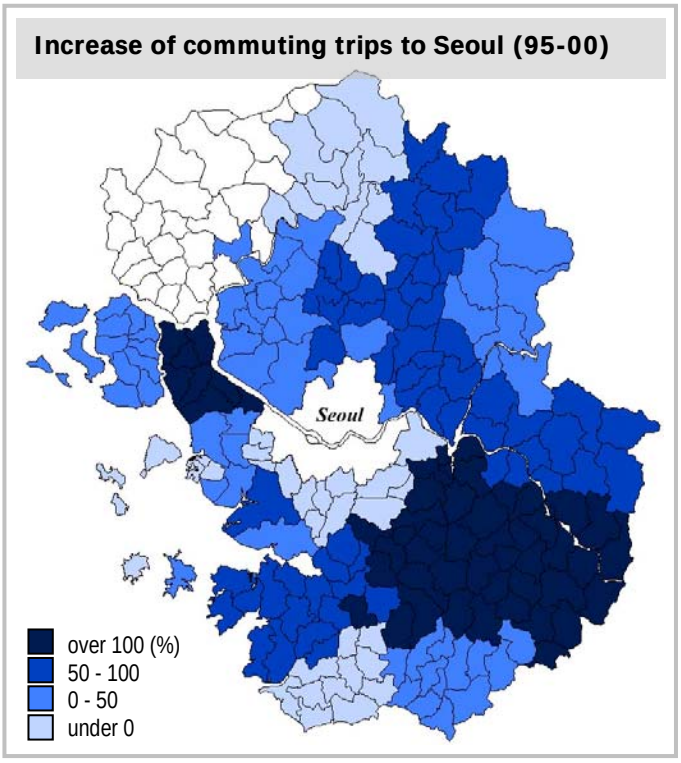


Fig.4-21 Increase of commuting trips to Seoul (1995-2000)

In-commuting volume to the cities of Gyeonggi province

The commuting volume from outside reflects indirectly the economic significance of a certain city in the metropolitan region Seoul. In 2000, most of in-commuting trips from the region Seoul toward the Gyeonggi province concentrated to the cities bordering with Seoul. That reflects the functional polarization to several cities in the Gyeonggi province. Approximately 138 thousand commuters moved to Suwon and it corresponds to 11.0% of total in-commuting trips to the Gyeonggi province: Seongnam (8.0%), Anyang (8.5%), Bucheon (7.4%), Ansan (7.2%), Goyang (5.3%) and Yongin (6.8%).

As of 2000, in contrast with the south of region Seoul in-commuting volume to the cities in the north is comparatively less. Just Goyang, Uijeongbu (3.7%) and Gimpo (3.5%) show the economic significance in the north by analyzing the ratios of in-commuting trips to them in total in-commuting trips to the Gyeonggi province.

Between 1995 and 2000, the commuting trips increased from Seoul to all cities in the Gyeonggi province except Bucheon (-9.4%), Gwangmyeong (-9.9%), Dongducheon (-14.9%), and Gwacheon (-14.9%). On the other hand, the increase of cross-bordering commuting trips from the cities in the Gyeonggi province to the cities in the Gyeonggi province was outstanding in 30km-radius zone from Seoul: Seongnam (148.3%), Guri (75.4%), Siheung (93.3%), and Hanam (141.5%). (Refer to Tab.9 in Appendix 2)

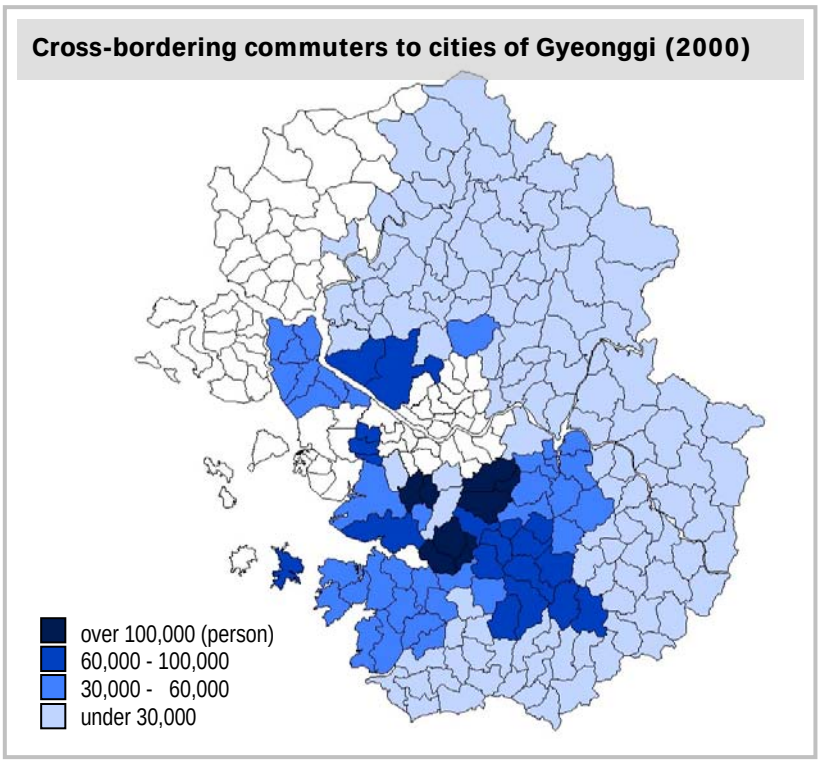


Fig.4-22 Cross-bordering commuters to the cities of Gyeonggi province (2000)

In-/ out-commuting ratio and internal commuting rate

Depending on the relation between in-commuting trips and out-commuting trips, Ji, Woo-Suk (1999) observed indirectly the self-sufficiency of a certain city. He interpreted the industrial- and economic structure of a community concerned is self-sufficient, if in-commuting trips are more than out-commuting trips.

With the analysis of in-/out-commuting trips, here the internal commuting rates in individual areas of region Seoul were additionally studied to estimate the degree of functional self-containment. If the percentage of internal commuters in total workers reaches nearly 100% in an area, then it can be indirectly determined that this community shows strongly the functional self-containment.

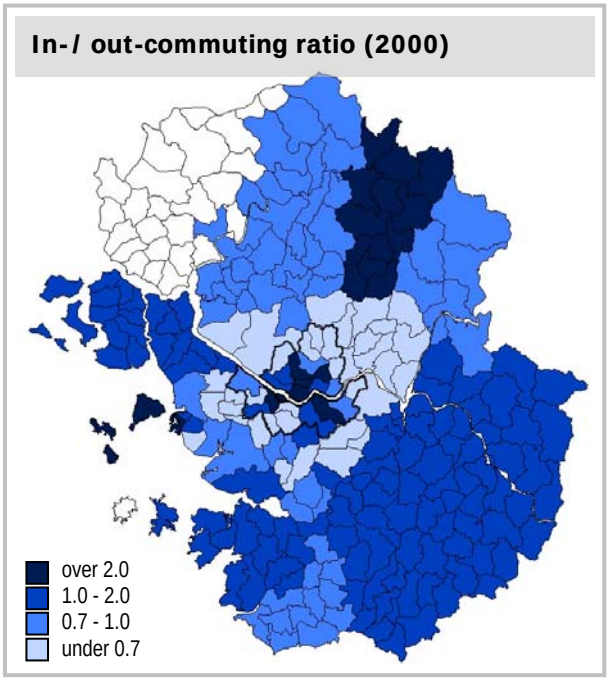


Fig.4-23 In-/ out-commuting ratio (2000)

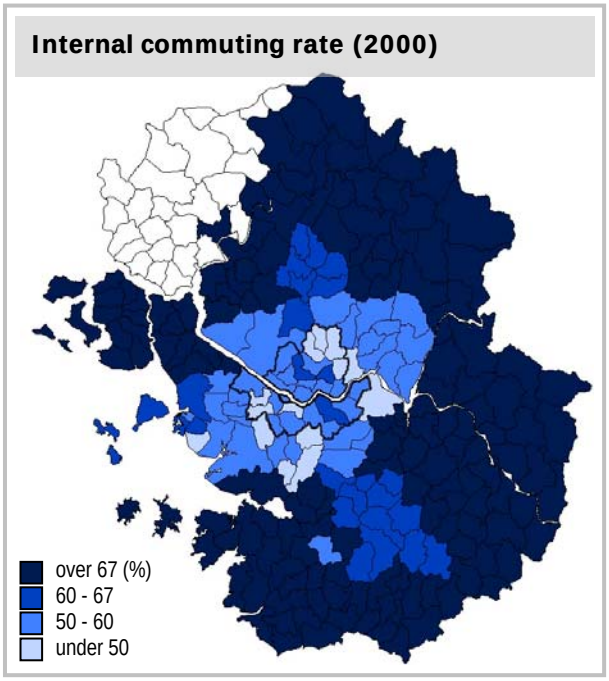


Fig.4-24 Internal commuting rate (2000)

In-commuting trips of Seoul's CBD and sub-centers were still much greater than their out-commuting trips in 2000, even though the in-/ out-commuting ratios of CBD and sub-centers slightly reduced in the period 1995-2000 except Yongsan, Dongdaemun and Gangnam: Jongno (6.42), Jung-gu (9.74), Yonsan (2.28), Dongdaemun (2.39), Yeongdeungpo (2.52), and Gangnam (3.90).

On the other hand, the internal commuting rates of CBD and sub-centers were more than a half in 2000 and their figures have got better between 1995 and 2000 except Jung-gu: Jongno (57.1% in 1995/ 60.3% in 2000), Jung-gu (60.0%/ 59.0%), Yonsan (48.4%/ 54.6%), Dongdaemun (50.0%/ 60.6%), Yeongdeungpo (50.3%/ 54.3%) and Gangnam (53.2%/ 60.6%).

The mobility pattern in Incheon was not different from Seoul's. The in-/out-commuting ratios of Jung-gu (3.65), Dong-gu (1.66), and Nam-gu (1.06) were over one and its outskirts' stayed at relatively low in 2000. However the indices of Incheon's CBD did not amount to those of Seoul's, Jung-gu and Jongno and it indicates industrial and economic attraction of Incheon was not as strong as that of Seoul. Meanwhile, the internal commuting rates of Jung-gu, Dong-gu, and Nam-gu improved between 1995 and 2000 and all were over 50%: Jung-gu (58.4% in 1995/ 66.0% in 2000), Dong-gu (30.6%/ 55.3%) and Nam-gu (50.8%/ 63.7%).

On the contrary of high in-/out-commuting ratios in the city centers of Seoul and Incheon, the low values in the cities of Gyeonggi province, cumulatively the communities neighboring with Seoul reconfirmed the strong functional dependency on these metropolises, most of all Seoul in 2000: Seongnam (0.50), Uijeongbu (0.55), Bucheon (0.57), Gwangmyeong (0.30), Goyang (0.37), Guri (0.69), Namyangju (0.32), Gunpo (0.44), Uiwang (0.42) and Hanam (0.55).

The workers in the communities showing their low in-/out-commuting ratios found out their jobs outside their home towns in 2000. It is mirrored on the low internal commuting rates of cities in the 30km radius zone: Seongnam (57.8%), Uijeongbu (51.4%), Bucheon (58.5%), Gwangmyeong (41.1%), Goyang (51.3%), Guri (49.0%), Namyangju (51.2%), Gunpo (40.6%), Uiwang (32.4%) and Hanam (48.7%).

Unlike other cities adjacent with Seoul, Anyang, Gwacheon, and Siheung in the 30-km radius zone showed the strong industrial and economic attraction in 2000. The in-/ out-commuting ratios of three cities were higher than 0.7, while their internal commuting rates were less than 60%. In-/out-commuting ratios of Anyang, Gwacheon, and Siheung was respectively 0.75, 1.13, and 0.74 and their internal commuting rates accounted for 53.5% (Anyang), 31.7% (Gwacheon), and 52.7% (Siheung).

Meanwhile, the functionally self-sufficient structures of communities outside 30km-radius zone were proven by the in-/out-commuting ratios with almost one and more than one and their higher internal commuting rates in 2000: Pyeongtaek (in-/out-commutating ratio: 0.93/ internal commuting rate: 82.6%), Paju (0.97/ 75.8%), Icheon (1.56/ 87.7%), Anseong (1.68/ 83.4%), Yeoju (1.48/ 89.3%), Hwaseong (1.77/ 75.0%), Yeoncheon (0.83/ 85.7%), Pocheon (3.78/ 88.9%), Gapyeong (0.94/ 86.8%) and Yangpyeong (1.25/ 90.8%).

By investigating in-/out-commuting ratios and internal commuting rates of communities in the Gyeonggi province, the hypothesis was verified: “The closer to Seoul an area is, the more it functionally depends on Seoul.” (Refer to Tab.10 in Appendix 2)

Cross-commuting rate

Cross-commuting rate reflects the development of inter-regional communication, even in the quantitative balance between work- and residential places. With this analysis method here was explained the development of mobility in the region Seoul.

This cross-commuting rate is calculated by the following formula:

$$Cj = (F\_in.j + F\_out.i) / K.j$$

F_in.j	: total in-commuting trips into the city, j
F_out.j	: total out-commuting trips from the city, j
K.j	: total internal commuting trips in the city, j
C.j	: cross-commuting rate in the city, j

If the internal commuting volume is equalized with the sum of in- and out commuting trips, the rate of cross-commuting trips reaches one and the internal commuting rate amounts to approximately 67%. (Ji, Woo-Suk 1999: 117)

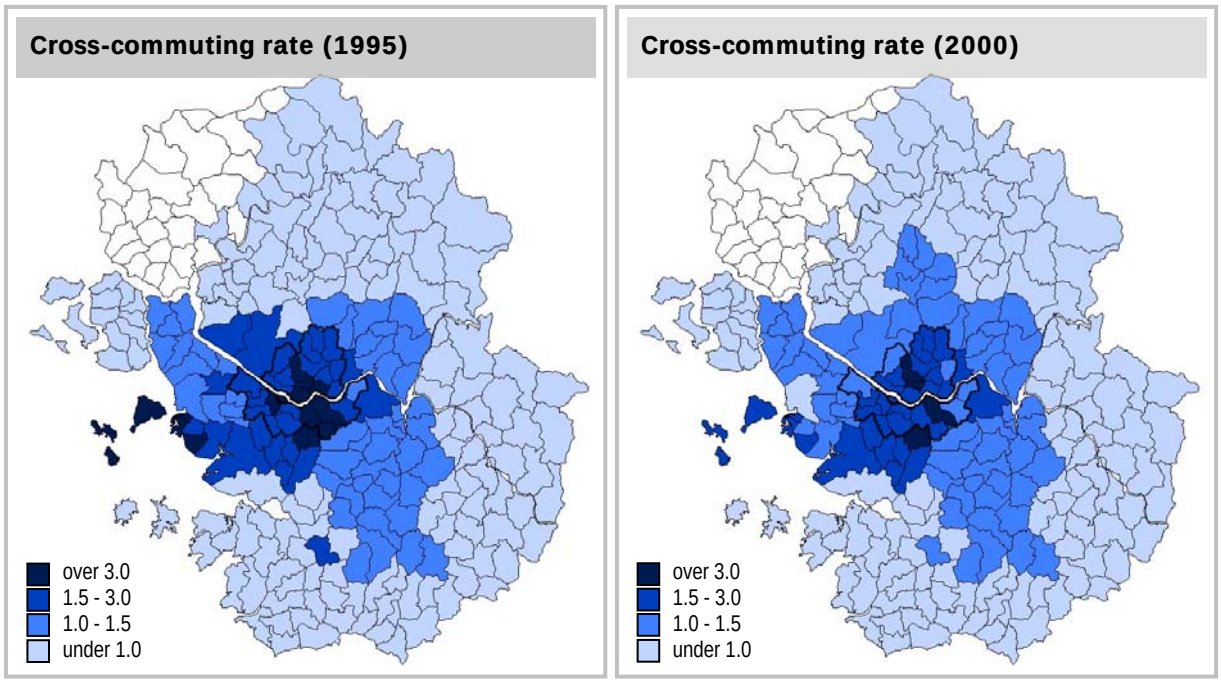


Fig.4-25 Development of cross-commuting rate in the region Seoul (1995-2000)

In 2000 the cross-commuting rates of the CBD of Seoul were the highest in the entire region Seoul, Jongno (4.88) and Jung-gu (7.45). It explains that as of 2000 the CBD of Seoul plays the supreme role in the functional hierarchy of region Seoul. The sub-centers of Seoul also showed relative high cross-commuting ratios in the same year: Yongsan (2.73), Dongdaemun (2.20), Yeongdeungpo (2.96) and Gangnam (3.19). Between 1995 and 2000 however the cross-commuting rates decreased in all districts of Seoul and this tendency can make it inferred that the decentralization of employment since the 1970's gradually reduces the functional polarization of Seoul.

The development of cross-commuting rate in Incheon was not other than that of Seoul's. In 2000 the central districts, Jung-gu (2.40) and Dong-gu (2.15) showed the highest values in Incheon and for 5 years the ratios of all districts in Incheon reduced except Gwangwa (0.15 in 1995/ 0.24 in 2000) and Ongjin (0.13/ 0.16) with dominant rural features.

The cross-commuting rates of the cities neighboring with Seoul were more than one in 2000. In particular the index of Gwacheon was higher than any other cities of the Gyeonggi province both in 1995 and 2000. These higher cross-commuting rates reflect the stronger functional communication between Seoul and cities in the 30km-radius zone from Seoul: Seongnam (1.09), Uijeongbu (1.47), Anyang (1.52), Bucheon (1.11), Gwangmyeong (1.87), Goyang (1.30), Gwacheon (4.58), Guri (1.76), Namyangju (1.26), Siheung (1.56), Gunpo (2.11), Uiwang (2.96), Hanam (1.63) and Gimpo (1.32).

In the contrast with the high cross-commuting rates in the cities bordering with Seoul the values were low in 1995 and 2000 in many cities and counties of the 30-50km-radius zone showing the relative higher internal commuting rates. They verify the isolated functional interchange of peripheral communities: Pyeongtaek (0.41), Paju (0.63), Icheon (0.36), Anseong (0.53), Yeoju (0.30), Yeoncheon (0.31), Pocheon (0.60), Gapyeong (0.29) and Yangpyeong (0.23). (Refer to Tab.11 in Appendix 2)

Day-/ night time population ratio

With the ratio between population in day- and night time, Magolis analyzed the degree of functional separation. He estimated, if the ratio of a certain community is under 0.75, its residential function is dominant, on the other hand, if the index of a certain city is more than 1.25, it features strong employment function. (Kim, Sun-Hee et al. 2003: 191) Depending on the Magolis' analysis the degree of functional separation in the region Seoul was analyzed in 1995 and 2000.

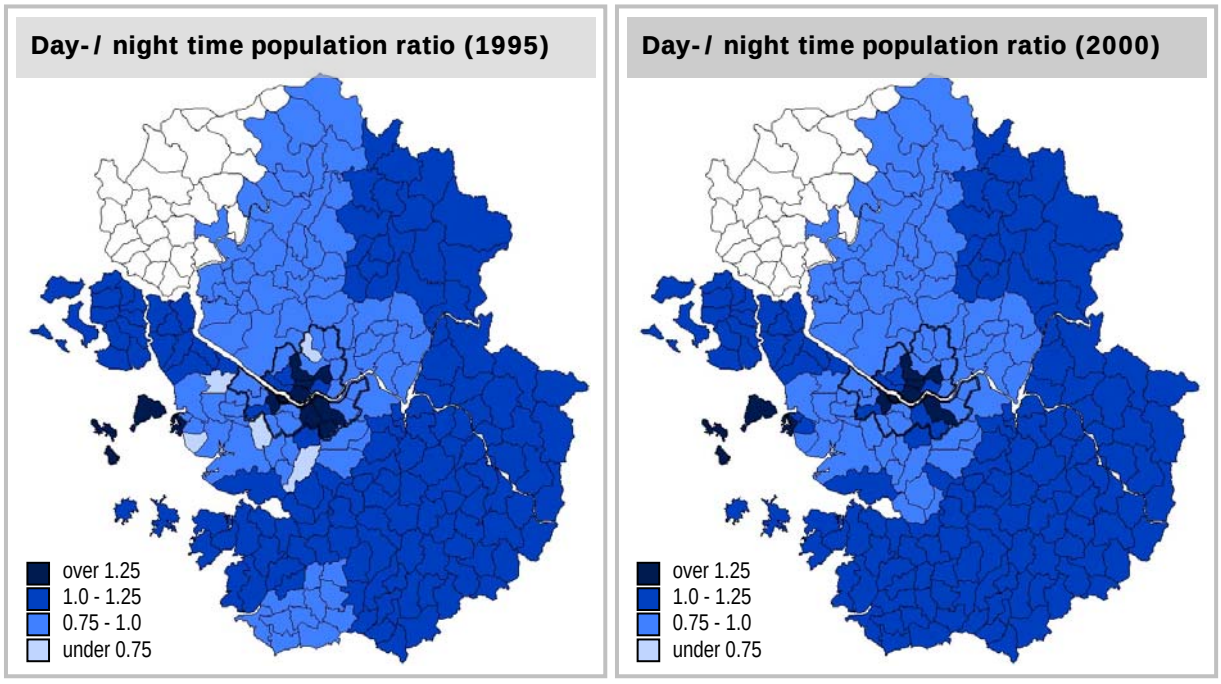


Fig.4-26 Development of day-/ night time population ratio in the region Seoul (1995-2000)

The ratio between the day- and the night time population in 2000 explains the donut effect in the CBD and sub-centers of Seoul: Jongno (2.16), Jung-gu (2.92), Yonsan (1.31), Dongdaemun (1.30), Yeongdeungpo (1.38), and Gangnam (1.66).

In the period 1995-2000, however the index shows decreasing tendency except Gangnam (3.8%) and Dongdaemun-gu (3.2%). This numerical data can draw an assumption on the increase of housing units in inner city areas and a functional rearrangement between urban centers in Seoul. The former supposition is proved by Tab.4-10 that indicates the increase of housing units in inner city areas during this time slot.

	housing units (1995)	housing units (2000)	increase (1995-2000) (%)
Jongno	34,522	34,371	-0.4
Jung-gu	22,164	28,041	26.5
Yongsan	40,355	43,627	8.1
Dongdaemun	58,940	62,982	6.9
Yeongdeupo	60,485	69,406	14.7
Gangnam	118,402	123,682	4.5

Note: data from KOSIS

Tab.4-10 Increase of housing supply in the city centers of Seoul (1995-2000)

The latter argument can be clarified with the data on the destination of commuting trips between 1995 and 2000 in the region Seoul. In this period the commuting trips decreased into the old centers, Jongno (-15.4%), Jung-gu (-22.8%), Yonsan (-11.9%), Dongdaemun (-3.3%) and Yeongdeungpo (-12.0%), whereas the commuting volume increased into the new sub-center, Gangnam (9.8%) which was developed since the late 1960s, on the contrary.

The day- and night time population indices in the inner city areas of Incheon showed the situation not different from Seoul's. In 1995 and 2000 the number of day time population in city centers of Incheon exceeded that of night time population; Jung-gu (1.91 in 1995/ 1.45 in 2000), Dong-gu (1.00/ 1.15), and Nam-gu (1.00/ 1.01) and particularly the ratio of Jung-gu decreased remarkably for five years (-24.1%).

Even though the day- and night time population ratios of cities adjacent to Seoul were more than 0.75 in 2000, the indices of the cities in the 30km-radius zone from Seoul were less than one. It still indicates their functional dependency on their primate city: Seongnam (0.89), Uijeongbu (0.89), Anyang (0.94), Bucheon (0.91), Gwangmyeong (0.80), Goyang (0.85), Guri (0.92), Namyangju (0.84), Siheung (0.94), Gunpo (0.83), Uiwang (0.80), and Hanam (0.88). On the contrary the values of cities and counties in 30-50km-radius zone were over one, but less than 1.25. (Refer to Tab.12 in Appendix 2)

4.3 Remarks

The conventional top-down economic policies to concentrate population and industries into big cities play no more important role for the dynamic and diverse society in this century, but contributed to the current mono-centric territorial structure. At the end of 1999, Seoul grew up to the ten-million-metropolis, representing about 20% of the entire population and it makes Seoul one of the most densely populated cities in the world. Up to 2000 the average of car ownership developed ten-times as many as that of the 1980s and now over 28 million trips go through Seoul a day.

However current numerical- and rigid- restrictions against demographic and industrial polarization to Seoul don't still restructure polarized territorial structure and hampers now the exploitation of economic potentials based on high-quality but relatively inexpensive labor forces in the region Seoul. To develop and manage the balanced national territory, the current 4th comprehensive national territorial plan was established centering on the construction of new 3x3 axial structure and 10 strategic regions. It was revised in 2005 to reflect progress of globalization, construction of high-speed railway (KTX), development of information technology, reducing work times, détente between two Koreas and new decentralization policies based on three special laws: national balanced development, decentralization of authority and construction of new administrative town.

Meanwhile the increasing household incomes and the development of inter-regional transportation step up the urban development pressure in the periphery, cumulatively along the transportation corridors Seoul-Busan and Seoul-Shinuiju. The built-up area of region Seoul rose to 1.5 times in the period 1985-1998 and commuting zone to Seoul extends now over 30km-radius zone from the center of Seoul. To stabilize quantitative and qualitative housing demands which are reflected on explosively skyrocketing land price in the region Seoul, five new town projects of the 2nd stage (Pangyo, Paju, Hwaseong, Gimpo and Suwon) are carried out in the suburban areas.

Today, urban structure of region Seoul still features spatial dichotomy of Seoul and its suburbia, but the interchange between suburban communities is more and more active in the 30km-radius zone. Between 1995 and 2000, the internal commuting trips in the Gyeonggi province increase to 23% and inter-regional commuting trips grew up, 15% in case of the trips from Seoul to Gyeonggi province, and 45% in the commuting volume from Incheon to Gyeonggi province.

Centering on the cities in the south of Gyeonggi province, the dis-urbanization phase[14] progresses partially too. In Seongnam, Anyang, Gunpo, Uiwang, and Hanam, out-commuting trips to Seoul decreased, while in-commuting trips rose at the same period. However commuting volume to Seoul is still remarkable in the north- and east region Seoul.

Despite of the pressure of suburbanization, most cities and counties over 30km radius zone is still outside the reach of Seoul and functionally self-sufficient. As of 2000 the portion of out-commuters to Seoul in total workers and students is under 5% and the internal commuting ratio is more than 67%.

[14] Four phased urban development by Heinze and Kill (Mayinger 2001): urbanization, suburbanization, dis-urbanization and re-urbanization. It revolves in the focus on the reaction between a city and its hinterland.
The development of motorization extends the reach of cities to the suburban areas (urban sprawl) and some cities grow up to touch the outskirts of neighboring cities. This process called suburbanization blurs the former distinction between the rural- and the urban areas. At last, a vast urban area has been made up, where the central city functions as the commercial and employment center and its fringe as the industrial and residential area. The terms 'con-urbanization' and 'agglomeration' were invented to describe the spatial structure which is newly resulted from urban sprawl. However the vast urban areas, the agglomeration areas suffer from congestion problems, such as pollution, absorption of open space, traffic congestion and expensive rents. The urban problems push inhabitants to move further in the periphery supported by the development of high speed transportation.
The suburban development encouraged by cheaper rents outside of the agglomeration and the predominant use of automobiles makes the development of agglomeration stagnated or even declined. (dis-urbanization) The declination of agglomeration causes new dichotomization between the poor city and wealthy suburbs, unlike that in the phase of suburbanization, i.e. dichotomization between the busy city and cozy suburbs.
Finally the deteriorated agglomeration revives again through urban renewal activities. The integrated transport system fully interconnects between agglomeration and its hinterland and the polycentric connections are stronger than radial ones. This urban development phase is named with re-urbanization.
The agglomeration areas develop again on the large scale, repeating this orbit of urban development.

5 Strategies for network cities in South Korea and region Seoul

The concept of network cities is an approach to share metropolitan functions with existing or new urban centers by fast and reliable mutual connections rather than to concentrate international economic functions into a few metropolises. By the cooperative mechanism between cities with different industrial, cultural and natural heritage, network cities can achieve dynamic synergy effects. At that time constituent communities of network cities work together like an urban organism. The cooperative mechanism of network cities is not competitive but complementary. This networked urban system can be also developed from national and (macro-) regional requirements.

In order to convert the current mono-centric structure of region Seoul and strengthen the functions of other metropolises as global gateways, here were suggested strategies for network cities in South Korea cumulatively in support of railway connections, which can relieve ecological impact and contribute to sustainability through intensive urban development on transportation nodes. The railway connections are complemented by road networks.

Urban networks were first approached in the context of the whole nation. Agglomerations, cities and towns are hooked up each other by railways and motorways. The inter-metropolitan networks supported by high-speed transportation connections can play a role to decentralize metropolitan functions from Seoul to five metropolises, Deajeon, Daegu, Ulsan, Busan and Gwangju, compete functionally with region Seoul as counterbalancing urban networks and supplement metropolitan functions of Seoul. On the other hand motorways between Seoul and major cities on the South coast and five national rail trunks connect national- and regional gateways with major cities and towns to facilitate logistic flows as well as passenger trips. They can relive capacity overloads of urban links by KTX, too.

Following the 1st regional innovation development plan, the potentials of nodes in city networks are functionally identified. This functional identification, i.e. industrial specialization can be made in the forms of industrial clustering. It can be activated by the relocation of public organization related with regional strategic industry, the equipment of infrastructure in the strategic areas by so-called decentralization fond, and the administrative service and financial supports for locating potential SMEs (small and medium enterprise) as well as conglomerates.

Next, to assist in creating more balanced development and relieving development pressure in Seoul and its surroundings, city networks were approached respectively at regional- and over-regional level by selecting nodes and linking them in the complementation with urban networks at the national level. Alternative economic centers are selected inside two metropolises of the region Seoul, Seoul and Incheon, in the region Seoul and outside of the region Seoul. However these counterweights of metropolis Seoul should be chosen in consideration of physical and social factors, spatial theories, and statistical tools can be made use of: such as central place theory, Benison's centrality index and life region analysis based on the transportation corridors. In particular a current project on the construction of a new administrative town was dealt with in the over-regional context. A new growth pole outside the region Seoul will be constructed to implant a part of metropolitan functions of Seoul and give an impulse to regional development outside of the region Seoul. On the other hand it was suggested to strengthen the functions of economic centers by the attraction of industrial investment or the revitalization of indigenous industrial potentials.

Actually individual cities and regions in- and outside the region Seoul are already vigorously improving themselves as alternative centers for investment, but an urban constellation in mutual networks will widen accessibility to high-level urban functions and promote the more efficient use of built-up infrastructure as well as sharing metropolitan economic functions.

The alternative centers in the networks will act as counterweights against the economic pull of global center, Seoul.

The inter-nodal links include connections between regional centers, connections between regional centers and suburban areas, and inter-city connections at the over-regional level as well as connections with the metropolis Seoul. The physical urban links should be made by environmentally sustainable transports. They should be integrated systematically with each other to improve the accessibility to Seoul and regional centers by inter-modality and integrated transportation diagrams.

5.1 National approaches for network cities

5.1.1 Construction of urban connections

The high-speed rail connections between Seoul and other metropolises reduce the time distance. They will encourage people and industries to move from Seoul, but on the other hand inter-metropolitan KTX-networks can extend the reach of the region Seoul to the south and bring out the megalopolis Seoul connecting Seoul and Daejeon. Therefore a new growth pole region that can be equivalent to this megalopolis Seoul is now in need at the national level. This counterweight region can be formed by city networking of rods and nodes. Through connecting two metropolises (Busan and Gwangju) and two national strategic ports (Busan and Gwangyang) on the south coast, the circumstances for the construction of an urban networking can be implemented.

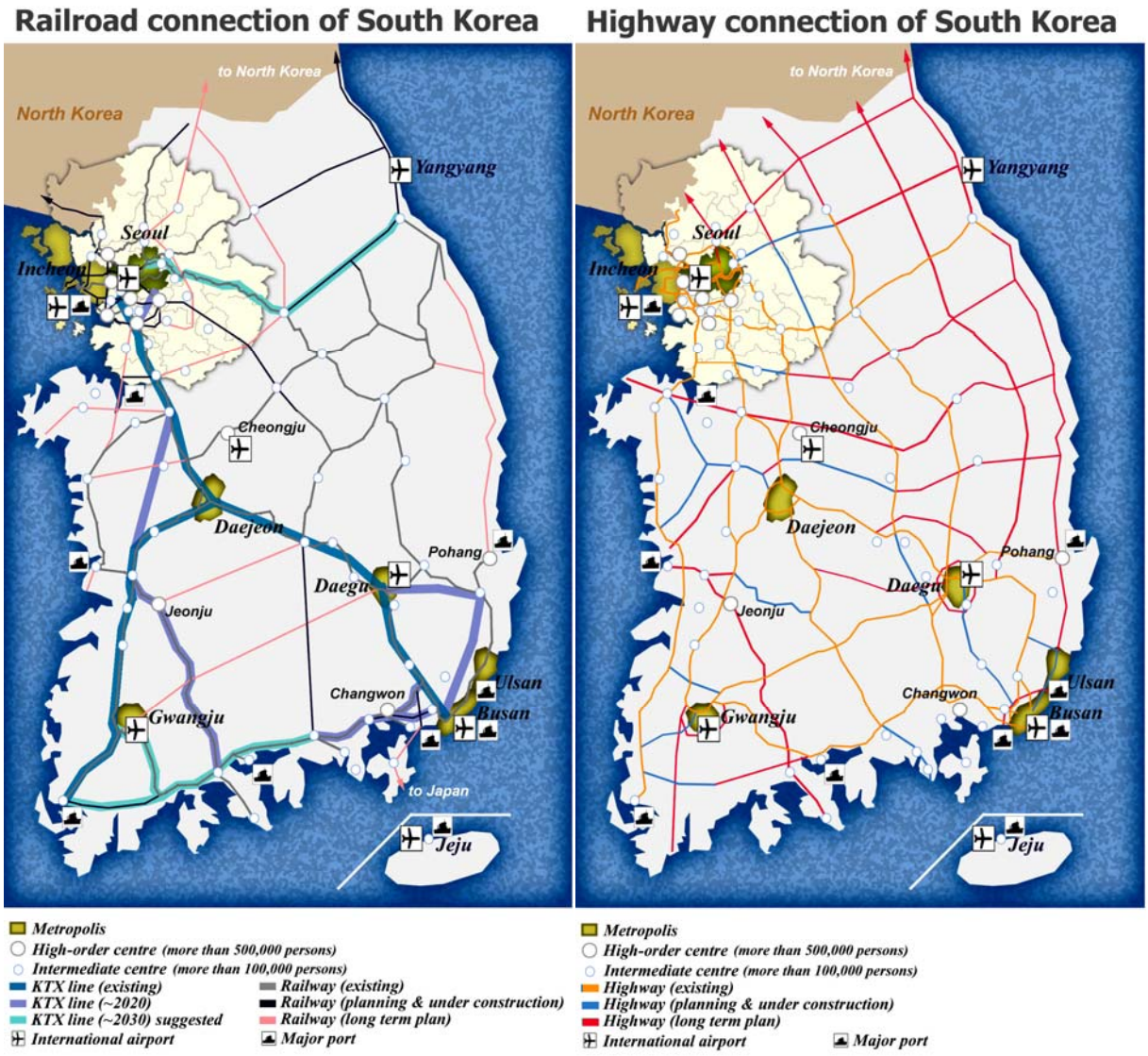
The construction of an urban Konzern on the south coast can discourage the demographic immigration to the region Seoul, share diverse urban functions and at last make the characterized regional attractions, to say nothing of a notorious regionalism between two neighboring regions (Gyeongsang province and Jeonla province).

In a short term, in order to make a ground for constructing a counterweight region in the south of Peninsula, it can be a more realistic proposal to speed up the current Gyeonjeon line (Busan-Gwangju) by KTX trains than to make a new additional KTX line. Now there is carried out a project for the linearization and electrification of Gyeonjeon line.

Based on the demands, however a new additional KTX line on the south coast may be constructed in a long term and it should be prior to a project for constructing an east-west KTX line (Seoul-Gangleung) in the Gangwon province. - Due to the economical inefficiency, the construction of east-west KTX line has been now shelved. For the revitalization of Gangwon province affluent in tourist attractions, a national railway line that is now under construction to link Seoul with Wonju and Gangleung can be speeded up by KTX trains, instead of an east-west KTX line project.

This KTX line on the south coast will trigger to build a new growth pole region and complete a colossal national triangle (Busan-Daejeon-Gwangju) supported by KTX lines. This national triangle can play a role to compete functionally with the megalopolis Seoul and complement it. Herewith a long-term project on the railway connection between Daegu and Gwangju will functionally intensify this national triangle and broaden the mutual understanding to overcome antagonistic regionalism.

Like the Euro star between London, Paris and Brussels, on the other hand, an international high-speed railway connection between the Korean Peninsula and the Japanese Islands (Geojae-Simonoseki) is now in the conception. It will be extended to the Siberian railway by the reconnection projects that proceed step by step between two Koreas. The international rail connections will map again the current logistic flows in the World as well as in East Asia and strengthen Korea as a logistic switching point.



Note: Inter-city connections are based on the highway construction plan of Korea Highway Corporation and the national basic transportation plan 2000-2019. 7X9 national highway systems with 2 KTX lines and 5 main railways are suggested in the national basic transportation plan 2000-2019.

Fig.5-1 Inter-city connections in South Korea

The rail connections between major cities should complement intra- and international high-speed rail networks through integration of operations and reduce their capacity overloads by supplying by-pass routes. In particular the north-south railway lines can share the freight transportation concentrated on the Gyeongbu line. Now the efficiency of five main national railways - Gyeongbu line (Seoul-Daejeon-Busan), Homan line (Daejeon-Mokpo), Jeonlla line (Iksan-Yeosu), Chungang line (Seoul-Gyeongju), and Janghang (Cheonan-Janghang) - gets better step by step by the improvement of track facilities, such as direct connection with a logistic harbor, linearization and electrification, double tracking, performance improvement of railway vehicles, etc. Therewith the construction of east-west lines will improve the accessibility and impulse regional development in the periphery cumulatively the Gangwon province. It can also accommodate increasing recreation trips on the weekend as well as in the vacation seasons. Projects planed in the national basic transportation plan 2000-2019 by the ministry of construction and transportation (1999b: 47) include section Chuncheon-Sokcho and section Wonju-Gangleung that connect between the region Seoul and the Gangwon province.

With the development of rail networks, the Korean government has suggested the 7x9 national highway networks in the national basic transportation plan 2000-2019. This system is composed with seven north-south axes and nine east-west axes to relieve the functional overloads of highway 1 (Seoul-Busan) and reduce the traffic congestion in the region Seoul caused by current mono-centric road system.

< 7x9 national highway system >

7 north-south axes:

- Ganghwa-Incheon-Gusan-Mokpo
- Munsan-Seoul-Cheonan-Gwangju-Wando
- Dongducheon-Seoul-Daejeon-Jinju-Chungmu
- Pocheon-Yeoju-Gumi-Masan
- Cheolwon-Chuncheon-Wonju-Daegu-Gimhae
- Yanggu-Bonghwa-Yeoncheon-Busan
- Ganseong-Gangleung-Uljin-Busan

9 east-west axes:

- Incheon-Seoul-Chuncheon-Ganseong
- Incheon-Seoul-Hongcheon-Sokcho
- Siheung-Yaju-Wonju-Gangleung
- Anjung-Uemseong-Jecheon-Samcheok
- Dangjin-Cheonan-Yeongju-Uljion
- Seocheon-Gongju-Sangju-Andong-Yeongdeok
- Gunsan-Hamyang-Daegu-Yeongcheon-Pohang
- Gochang-Namwon-Golyeong-Daegu
- Mokpo-Suncheon-Masan-Busan

Source: the national basic transportation plan 2000-2019 by the ministry of construction and transportation (1999b: 37)

Tab.5-1 7X9 national highway system

5.1.2 Functional identification of urban nodes

To construct urban networks sharing various urban services, however the cities cumulatively on the aforementioned national triangle should be not only physically connected with each other but also functionally characterized. Now the current participatory government propels actively diverse projects in the non-region Seoul to make a balance of national development. Along with a project on the construction of a new administrative town, there are projects on the construction of innovative towns centering on the relocated government offices, projects on the construction of company towns planed and developed by a conglomerate or a combine of several companies, and projects on the construction of industrial clusters. To make the functionally identified cities on this triangle here the last projects were focused on.

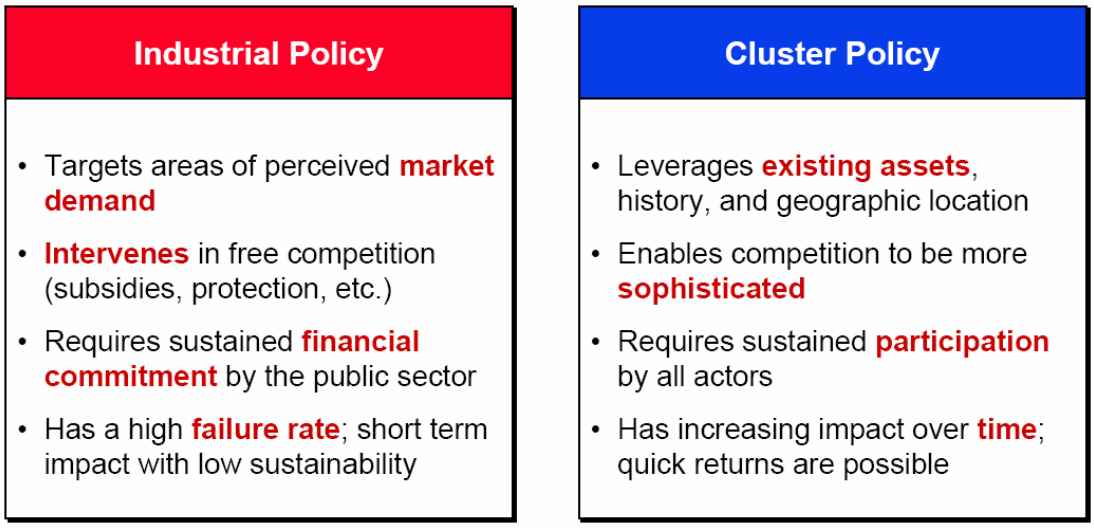
To intensify the competitiveness of regional economy on the basis of regional potentials and discourage a brain drain to the region Seoul, a presidential committee on balanced national development established a committee on regional cluster policies in 2004. It is composed with vice ministers from six deputies (ministry of science and technology, ministry of commerce, industry and energy, ministry of health and welfare, ministry of culture and tourism, ministry of information and communication, and ministry of agriculture and forest) four supporting departments (ministry of education and human resources development, ministry of labor, ministry of planning and budget and the Korean intellectual property office) and twenty specialists. Considering regional potentials the presidential committee on balanced national development suggested the strategic industries of individual regions in South Korea by the five-year regional innovation development plan and the specialized functions of each region are intensified now.

Region	Strategic industries	Region	Strategic industries
Metropolis Seoul	-Digital contents -Bio-Industry -IT-Industry (Multimedia) -Finance	Prov. Gwangwon	-Bio-Industry -Medical appliance -New material -Tourism/ Culture
Metropolis Busan	-Distribution -Machinery -Tourism/ Convention -Film/ IT-industry	Prov. Chungbuk	-Bio-Industry -Semiconductor -Mobile communication -Chemistry
Metropolis Daegu	-Mechatronics -Electronics/ Information -Textile -Bio-Industry	Prov. Chungnam	-Electronics/ Information -Automobile and its components -Culture -Agricultural and livestock industry
Metropolis Incheon	-Distribution -Automobile -Machinery/ Metal -IT-Industry	Prov. Jeonbuk	-Automobile components/ Machinery -Bio-Industry -Nucleonics -Culture/ Film/ Tourism
Metropolis Gwangju	-Optical industry -Electrical appliances -Automobile/ Hi-tech components -Design/ Culture	Prov. Jeonnam	-Bio-Industry -New material/ Shipbuilding -Distribution -Culture/ Tourism
Metropolis Daejeon	-IT-Industry -Bio-Industry -Hi-tech components/ Material -Mechatronics	Prov. Gyeongbuk	-Electronics/ Information -New material/ Components -Bio and Chinese medicine -Culture/ Tourism
Metropolis Ulsan	-Automobile -Shipbuilding -Chemistry -Environment	Prov. Gyeongnam	-Machinery -Robert -IT-Industry -Bio-Industry
Prov. Gyeonggi	-IT-Industry -Bio-Indusrty -Culture/ Contents -Distribution	Prov. Jeju	-Tourism -Health and beauty -Agriculture -Digital contents

Source: Presidential committee on balanced national development (www.balance.go.kr/policy/sub_04.htm)

Tab.5-2 Regional strategic industries (1st regional innovation development plan)

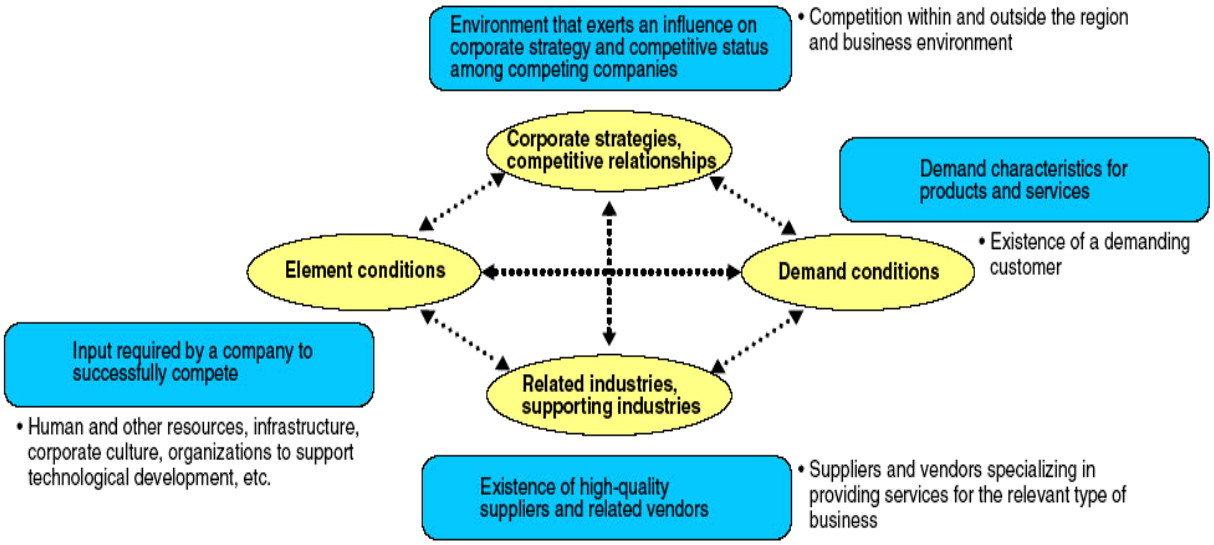
To confront with rapid changes in the economic environment, such as increasing competition from other developing countries, primarily China, strong Korean Won, shift of production base overseas, more flexible combine with companies and demand of structural changes, now current Korean government struggles like other developed countries (esp. Japan) to construct industrial clusters based on mutual networks with specialized competitive companies, universities and public institutions. It is a different approach from conventional policies on the construction of industrial plants.



Source: Ketels (2004)

Fig.5-2 Different approaches to economic development

The necessity of industrial agglomeration is now supported theoretically by the industrial cluster model of Michael E. Porter. He suggested an industrial cluster model, as a model to keep or strengthen high productivity, innovation and new business creation accompanied with spillover effect. Even in the globalization period tearing down the physical and time barriers between countries, his cluster concept is defined as “geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular filed that are present in a nation or region” (Mitsui 2003: 3). He picked up four determinants: elementary conditions, demand conditions, related and supporting industrial structure, and management strategy and competitive milieu.



Source: Compiled based on various materials such as Michael E. Porter, *Theory of Competitive Strategies II*, translated by Hirotaka Takeuchi, DIAMOND Inc., 1999.

Fig.5-3 Conditions to fully form an industrial cluster (Diamond framework)

Reflecting the success of industrial clusterization in foreign countries, the central- and local governments or the government-owned agencies should reform the inconsistency and redundancy of various public policies and decentralize the political power to regional and local governments. The subsidies from the national government can motivate regional governments to promote diverse projects for clustering regional enterprises and institutions.

Until the private specialists like business-consultants, venture capitalists or business angles emerge autonomously from private sectors a governmental body must initiate this role within the market-driven system. In this point, particularly regional governments with the sustainable knowledge of the regional situations should perform the projects not with conventional bureaucratic approaches but with market-oriented ones to attract the regional investment. The industrial relocation support centers that are run separately by national and local government is to offer competitively one-stop services including tax premiums and loans as well as administrative supports. They should be able to intermediate SME (Small and Medium Enterprise) managers, universities and institutions, entrepreneurs, business consultants, local and central governments. Therewith the well-equipped virtual industrial location information center need be made the best use of.

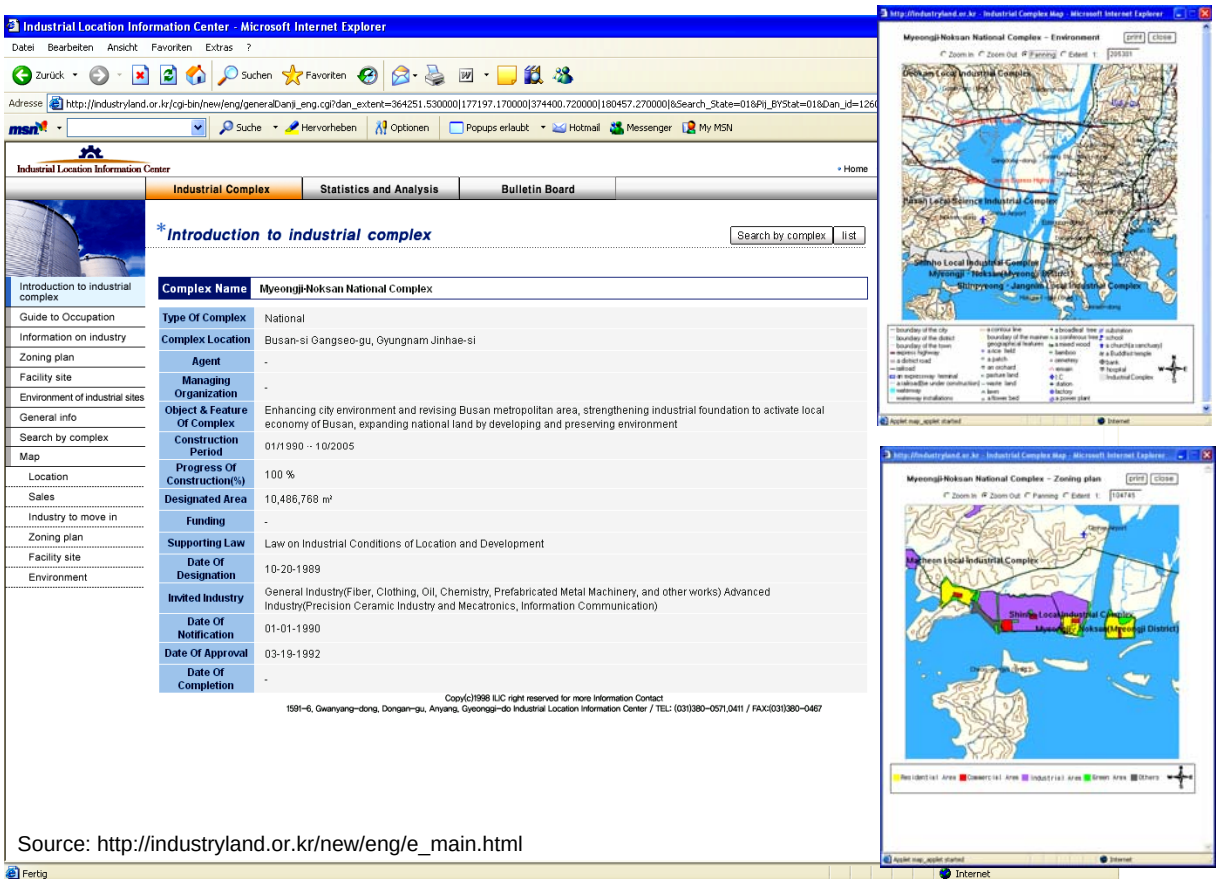


Fig.5-4 Virtual industrial location information center

The success of industrial cluster however doesn't depend on the physical agglomeration but can be made through the competition and cooperation with individual actors. It is clarified with the failed conventional top-down policies by the central government and the successful cases in foreign countries show that an autonomous milieu can maximize the agglomeration effects. Therefore industrial cluster should no longer start from nothing but focus on identifying the firm-level potentials of existing agglomerations. Various co-works and seminars with a university and SMEs can bolster the clusterization and a university may rent its own research facilities to SMEs for low price. Well-equipped current internet networks will supplement face to face contacts, too.

At the national level, finally the synergy effects can be maximized through the cross-sectional exchanges of information and experiences, and flexible collaboration with other industrial clusters. The cross-sectional cooperation between industrial clusters can be bolstered by city networks. The network cities ensure not only physical and virtual inter-city connections but also functional interchanges between the cities. The cities, main elements of urban networks supply industrial clusters with workers, consuming markets, and diverse administrative and financial services for economic actions.

In addition to inter-city transportation connections, the functional identification of nodes completes urban network system. Fostering specific industrial clusters based on geographical-, physical-, industrial- and social factors, especially in the individual metropolitan areas can contribute to functional characterization and mutual cooperation between metropolitan areas in the frame of network cities:

- Seoul as the international and financial center; Globalization and World Cities inventories Seoul at one of beta world cities (Adam & Göddecke-Stellmann 2002: 516) and here is concentrated a half of national capital

- Incheon as the center of international- and distribution functions; Around the international airport- and see port areas, a free trade zone is now designated
- Busan with national strategic harbors and a Korea maritime university as the logistic- and maritime center
- Daegu as the center of electronic- and textile industry on the basis of established electronic- and textile industrial plants
- Daejeon as the center of administrative and research functions, depending on the Dajeon national government complex, KAIST (Korea Advanced Institute of Science and Technology), and a new administrative town that will be constructed in its proximity
- Gwangju as the center of culture and optical industry supported by its cultural heritage and existing optical industrial complexes in the hinterland
- Ulsan of the heavy industrial city as the center of automobile and ship-making industry

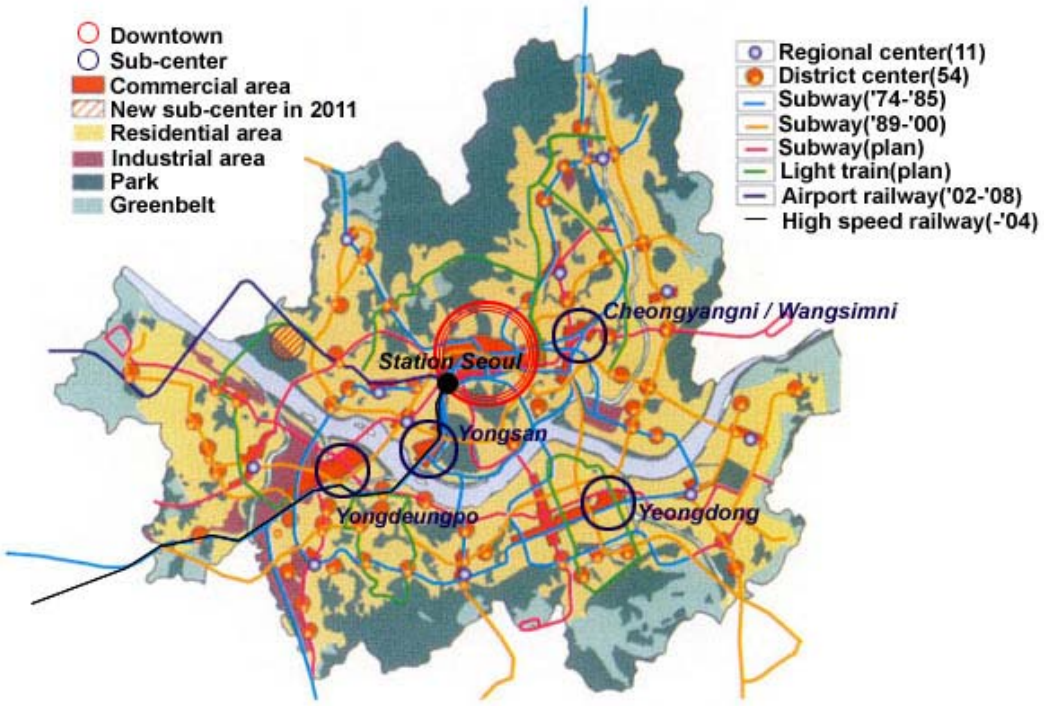
5.2 Regional approaches for network cities

5.2.1 Designation of regional centers

Alternative economic centers which connect each other in and outside the metropolis in the form of urban networks can reduce urban polarization and impulse development in the periphery. However these counterweights of metropolis should be chosen in consideration of physical and social factors and spatial theories and statistical tools can be made use of.

City center and its sub-centers in the metropolis

The poly-centric structure of Seoul makes it useless to designate additional sub-centers, so in this research the key points will be indicated in the next section to improve the accessibility cumulatively by public transits to say nothing of qualifying the pedestrian and cycling milieu in CBD (Jongno) and 5 sub-centers (Yonsan, Cheongyangri/Wangsimni, Yeongdeungpo, Yeongdong and Sangam functioning as a new sub-center of north-west Seoul in 2011) and to restructure inner-city areas corresponding a new role of Seoul as an international business center in harmony with natural and cultural heritage.



Source: Seoul Metropolitan Government (1997) (modified)

Fig.5-5 Poly-centric structure of the metropolis Seoul

Based on Incheon master plan 2020, now the metropolis Incheon is also being rearranged to poly-centric structure composed with 2 CBDs (old- and new city center) and 4 sub-centers (Bupyeong, Yeongjong, Songdo, and Northwest) cumulatively by projects on the construction of the new international airport Incheon and its hinterland supporting international business and logistics. (Fig.4-8) Accordingly an additional sub-center in Incheon need not be suggested. Approaches for urban networks in the metropolis Incheon is not other than that of Seoul and the statements on Incheon were here substituted with those of Seoul.

Regional centers in the metropolitan region

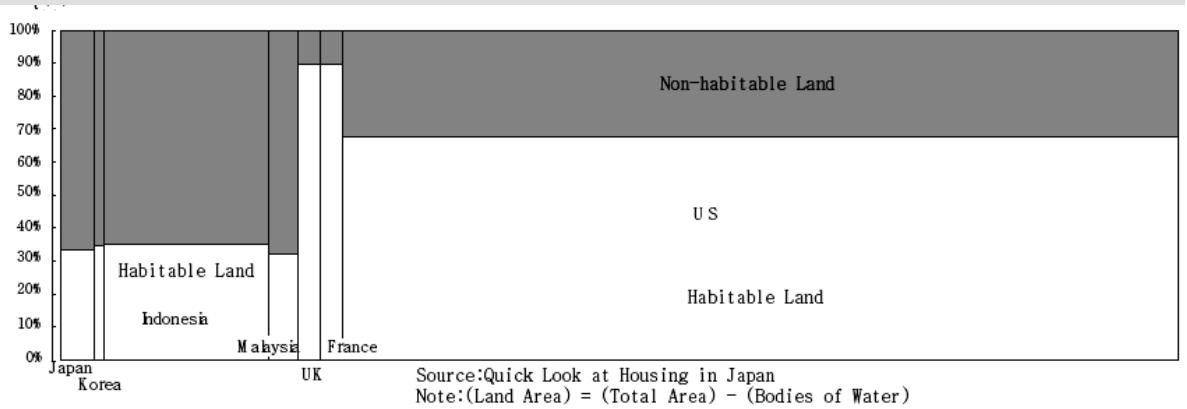
Considering urban development tendency in the region Seoul described through statistical analyses in the chapter 4, regional centers around Seoul were suggested by central place theory, Benison's centrality index, and life region analysis based on the transportation corridors in the region Seoul.

① Suggestion of regional centers by the central place theory

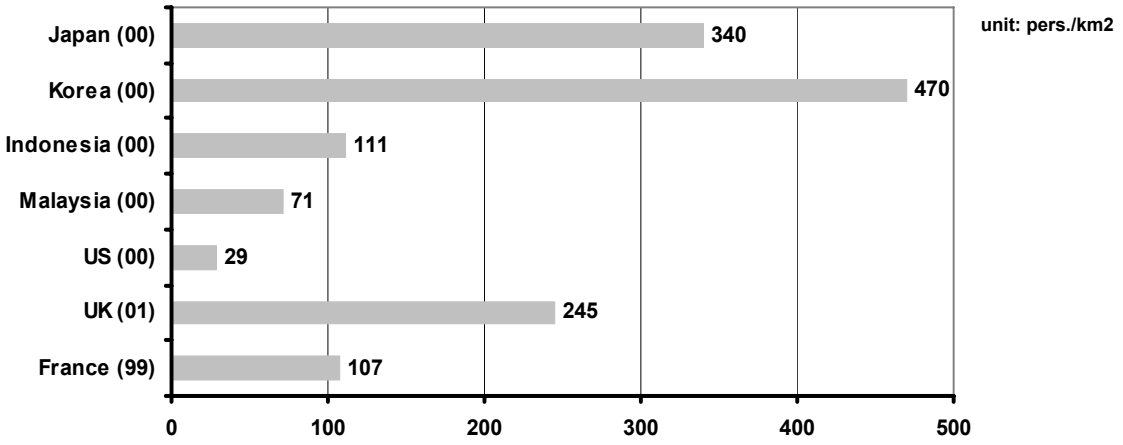
The central place theory is the backbone of German spatial planning. Despite of the critiques on its rigid functional regulation, it can contribute to compact and sustainable development. For the application of German principle to Korean regional planning, the differentiation between two countries must be considered in the demographical and geographical situations.

First the population density of Germany is now 230 persons per km2, while the index of South Korea shows 480 persons per km2. It is about twice higher than German. Considering the geographical situation of South Korea, however the actual population density is four or five times as high as that of Germany composed mostly with plain land areas. The geographical situation of South Korea and Japan was described by Yoshida (2003): "Both Japan and South Korea have less habitable land as mountainous areas that account for approximately 70% of their total land areas."

Developable land stocks for residential areas (1994)



Population density (2000)



Source: Yoshida (2003: 36)

Fig.5-6 Demographical- and geographical situation of South Korea

Based on this demographic and geographical differentiation a Korean standard of the central place theory was modified five times more densely than German's in this research.

	Germany (Stiens & Pick, n.d)	South Korea (modified on the basis of German)
Population density	230 pers./km2	480 pers./km2
Metropolis		more than 1,000,000
High-order center (I)		at least 800,000
High-order center (II)	more than 100,000	at least 500,000
Intermediate-order center	at least 20,000* - 40,000**	at least 100,000
Under-order center	at least 6,000* - 15,000**	at least 20,000

Note:
(1) * : peripheral area (Ger. Ländlicher Raum)
(2) ** : urban area (Ger. Städtischer Raum)

Tab.5-3 Application of German central place concept

In South Korea the city with over 1 million inhabitants is designated as the metropolis. Now two cities with over 0.8 million persons are found only in the region Seoul which can be grown to the metropolis in the future through expanding its administrative boundary and constructing a new town to solve the housing shortage in Seoul. Therefore these cities are here classified as the specialized high-order centers with the intermediate features between the metropolis and a high-order center.

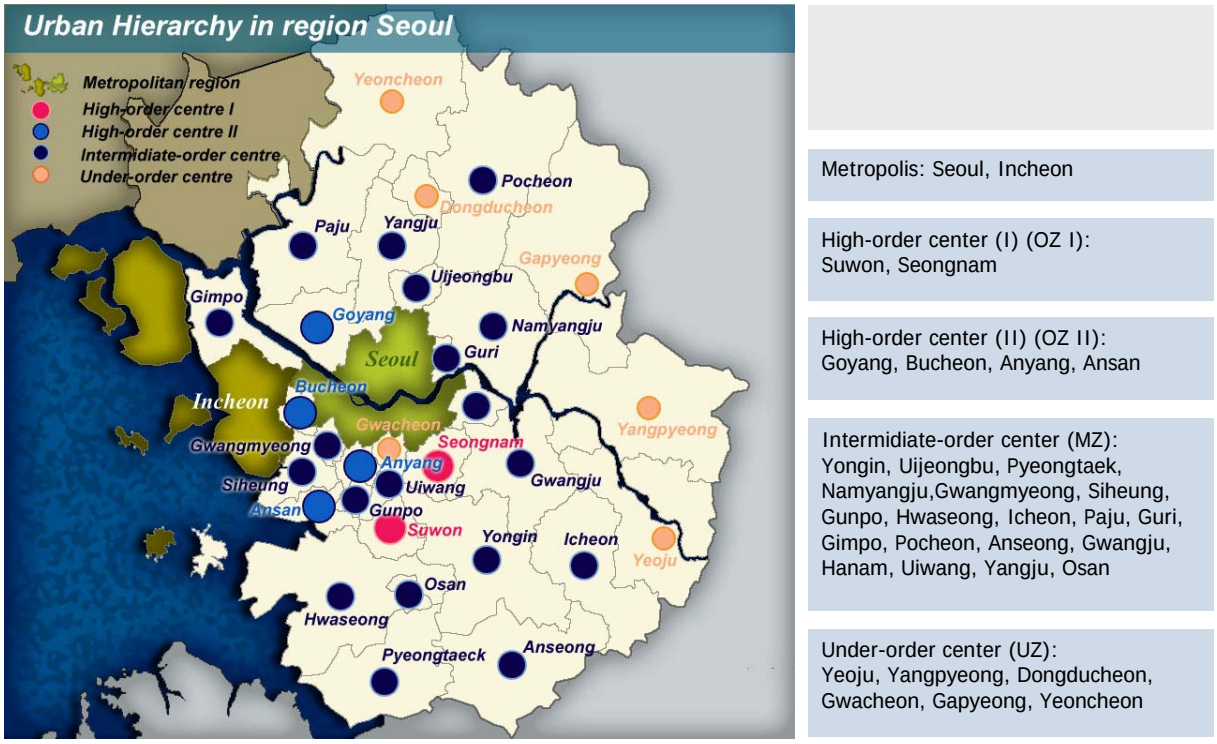


Fig.5-7 Urban functional hierarchy in the region Seoul based on the central place theory

Depending on the central place theory modified in this research, there are found two metropolises including Seoul, two specialized high-order centers, four high-order centers, nineteen intermediate centers, and six under-order centers in the region Seoul. Among them, two specialized high-order centers (Suwon, Seongnam) and four high-order centers (Goyang, Bucheon, Anyang, Ansan) can be designated as regional centers in the region Seoul.

② Suggestion of regional centers by the centrality index

While establishing the metropolitan plan for the capital region, its spatial structure was analyzed by Seoul development institute in 2000. Here was used the Benison's centrality method weighted with the data on the number of service businesses in this region.

Based on the result from this analysis, Seoul is classified as the main central city with centrality index over 500. Incheon and Suwon is assorted as sub-central cities in the region Seoul. As regional centers, five cities are selected in the 30km-radius zone from the center of Seoul (Seongnam-si, Bucheon-si, Anyang-si, Ansan-si, Goyang-si) and a city and a county in the 30-50km-radius area. (Pyeongtaek-si and Yangpaeong-gun).

centrality index	cities and counties
over 500 (1 city)	Seoul (central region: 1,514.26/ north-eastern region: 420.96/ south-eastern region: 856.16/ south-western region: 527.74/ north-western region: 169.69)
100-500 (2 cities)	Incheon-si (351.02) Suwon-si (132.58)
70-100 (6 cities and 1 county)	Seongnam-si (90.79), Bucheon-si (89.11), Anyang-si (79.01), Yangpyeong-gun (76.83), Ansan-si (76.35) Pyeongtaek-si (73.48), Goyang-si (68.88)
40-70 (4 cities and 5 counties)	Gapyeong-gun (51.78), Yangju-gun (50.00), Yeoncheon-gun (47.26), Pocheon-gun (46.72), Hwaseong-gun (46.32), Uijeongbu-si (45.15),Yongin-si (43.33), Paju-si (42.30), Anseong-si (42.22)
Under 40 (12 cities an 2 counties)	Yeoju-gun (35.96), Icheon-si (34.50), Namyangju-si (32.93), Siheung-si (30.55), Gimpo-si (30.06), Dongducheon-si (29.16), Guri-si (28.16), Gwangmyeong-si (27.23), Gwangju-gun (23.87), Osan-si (22.75), Gunpo-si (20.18), Gwacheon-si (18.47) Hanam-si (13.96) Uiwang-si (10.29)

Source: Lee, Sang-Dae Lee (2001: 42)

Tab.5-4 Centrality index (Benison's method)

Sub-centers and regional centers classified with centrality index numbers can be suggested here as regional centers to accommodate a part of metropolitan functions from Seoul and complement Seoul's.

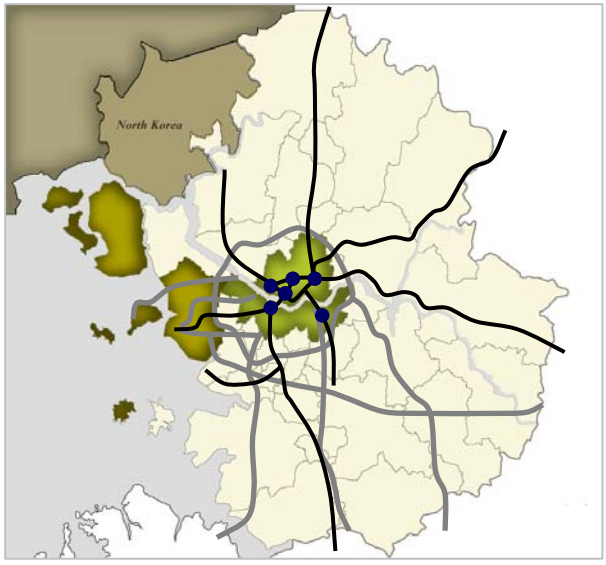
However Lee, Sang-Dae (2001: 42) insisted that Yangpyeong should be difficult to interpret as a regional center, because Yangpyeong still features a peripheral resort area with restaurants and hotels for tourists on the lake Paldang. He indicated this problem is caused by a week point of the aggregate centrality method based on the central place theory and analyzed data just considered of service businesses without industrial ones.

③ Suggestion of regional centers by life region analysis

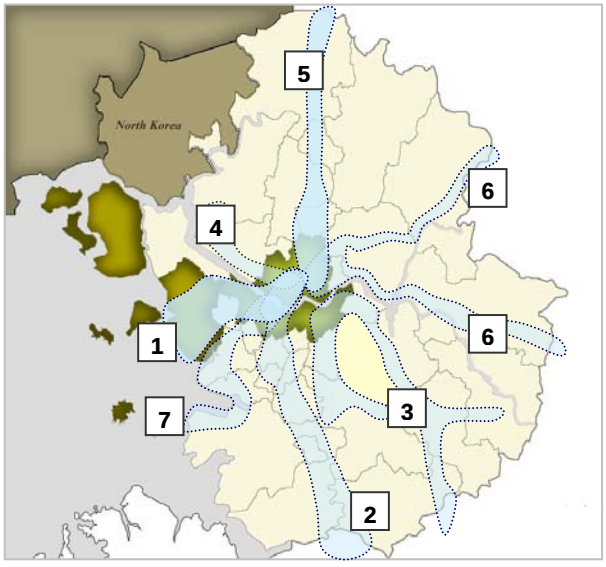
Creating unique urban zones with diversity and complexity, urban development spreads out along with transportation corridors. The accessibility to markets and diverse urban services pulls the location of companies and feasible contacts with other industrial partners produce the knowledge-spillover by mutual communication and cooperation. Well-quipped transportation connections induce residential development activities cumulatively around the city centers on transportation corridors, too

To find out several urban zones formed along with transportation corridors, the transportation connections in the region Seoul were investigated. Now in region Seoul there are developed the six main railway- and six arterial roads connections centering on the connections Seoul-Busan and Seoul-Incheon. Urban development in the region Seoul proceeds outstandingly along these transportation networks. (Fig.4-14) Depending on the transportation connections, here can be suggested seven transportation corridors in the region Seoul.

Major transport connections in region Seoul



Transportation corridors in region Seoul



Development axes CBD/ Sub-centers Major railroads Highways

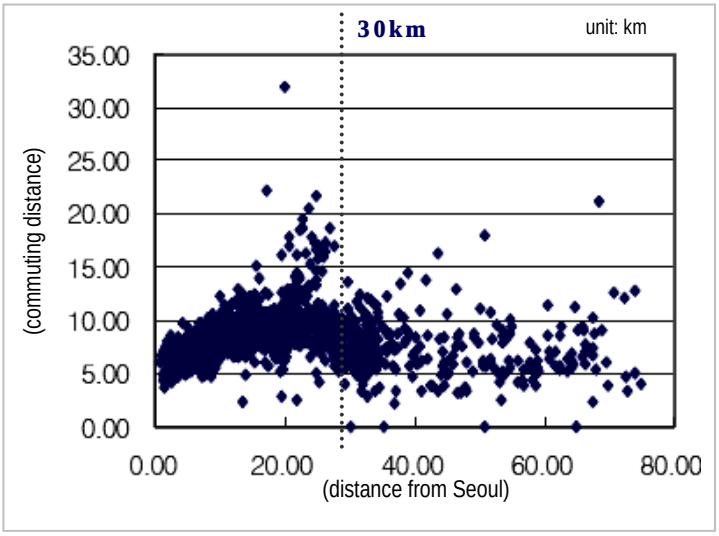
Life regions		Transportation corridors	Main transportation lines
1	Gyeongin	Seoul-Bucheon-Incheon	Railway : Gyeongin, Incheon Int'l Airport (p) Highway: No.110, No.120, No.130
2	Gyeongbu	Seoul-Ansan-Suwon-Osan-Pyeongtaeck	Railway: KTX (Seoul-Busan), Gyeongbu, Gwacheon Highway: No.1/ National road: No.1
3	2nd Gyeongbu	Seoul-Seongnam-Yongin/ Icheon	Railway : Bundang, New Bundang (p) Highway: No.1, No.35 National road: No.43, No.3
4	Gyeongui	Seoul-Goyang-Paju	Railway : Gyeongui, Ilsan National road: No.1 Regional road: No.23
5	Gyeongwon	Seoul-Uijeongbu-Yangju-Dongducheon-Yeoncheon	Railway : Gyeongwon National road: No.3
6	Gyeongchun	Seoul-Guri/ Namyangju-Gapyeong/ Yangpyeong	Railway : Gyeongchun, Jungang National road: No.46
7	Seoul-Ansan	Seoul-Anyang-Ansan	Railway : Ansan, new Ansan (p) Highway: No.15

Note: (c) in construction/ (p) in planning

Tab.5-5 Seven life regions on the transportation corridors in the region Seoul

While setting Seoul and Incheon as two metropolises like the analysis by the central place theory, next the regional centers should be found out that play ruling roles as central nodes in these seven life regions formed by transportation corridors. For the selection of regional centers here were considered the size of population (Fig.5-7) and the effect scope of Seoul analyzed by mobility patterns in the region Seoul.

Depending on the commuting patterns, here the effect scope of Seoul was estimated to reach the 30km-radius zone from the center of Seoul, which is highly populated and fully urbanized. First, the average commuting distance turned down over the 30km-adius zone in 1997 and it indicates that most of out-commuters to Seoul search for their homes insides of 30km-rdius zone.



Source: Kim, Sun-Hee et al. (2003: 109)

Fig.5-8 Average commuting distance (1997)

Additionally the German standard of city region (Stadtregion) was applied to determine the reach of Seoul. In Germany the reach of the metropolis is regulated up to the areas, where more than 25% of out-commuters and at least over 25% of employees commute to the highly densified central city with over 80,000 inhabitants: äußerer Pendlereinzugsbereich. (www.bbr.bund.de 2004d) In the 30km-zones including Seongnam, Uijeongbu, Bucheon, Gwangmyeong, Goyang, Gwacheon, Guri, Namyangju and Hanam, as of 2000 more than 25% of out-commuters moved towards Seoul in the every morning and over 25% of employees inclusive of students commuted out to Seoul. - In South Korea the students are considered commuters together with workers. (Refer to Tab.13 in Appendix 2)

The highly urbanized high-order centers in the 30km-radius zone from Seoul were suggested here as regional centers. In the point of functional decentralization it could be adequate to select the regional centers outside the reach of Seoul. However the regional centers should have a size of population and marginal infrastructure to supplement metropolitan functions in Seoul. Additional development to construct feasible regional centers in the region Seoul can attract potential immigration from non-region Seoul and extend the reach of Seoul. Therefore it is a more realistic and cost-effective solution to select the regional centers in the 30km-radius zone, where

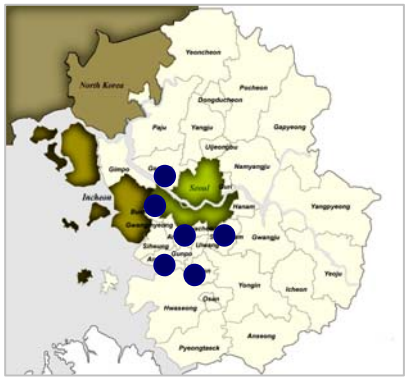
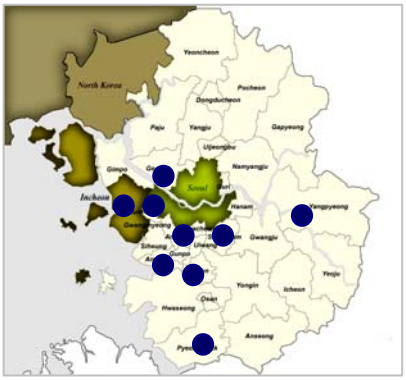
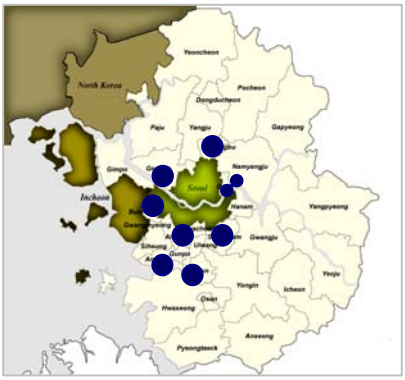
- demographic structure is stabilized,
- industrial- and economic functions have been decentralized since the 1970s from Seoul, and
- urban facilities are well-equipped including transportation connections with the primate city, Seoul.

Together with six regional centers in the densely populated south- and west region Seoul, it is necessary to make two additional centers in the north region Seoul confronting militarily with North Korea and the east region Seoul supplying water to Seoul. Military and environmental reasons have controlled strictly development activities, so the north and east zones of region Seoul are now highly dependant on Seoul in comparison with the south and west region Seoul evolving from mono-centric spatial structure to poly-centric one. It was proven by the investigation of commuting patterns in the chapter 4, too.

In this point the suggestion of additional regional centers will contribute to the development of poly-centric structure in the north and the east region Seoul and the management of current sporadic and scattered suburbanization in these areas. In the northern region Seoul, it may be adequate to designate as a regional center, Uijeongbu where the 2nd administrative office of Gyeonggi province is located to offer administrative services for people in the northern Gyeonggi province. Meanwhile a regional center in the eastern region Seoul can be considered in the form of twin cities composed with two neighboring cities, Guri and Namyangju, which connect each other by the Seoul outer-ring.

Even though Guri and Namyangju are two intermediate cities, the geographical closeness to Seoul and their beautiful landscape propel now the residential suburbanization followed by the population growth. This demographic development will encourage the location of high-rank urban services that strengthen the regional centrality. Hashimoto (2001) verified the correlation with two factors, demographic development and location of high-rank urban services, in his report on the regional system in the metropolitan region Tokyo, where the urbanity develops at the interval of several years in the same orbit with region Seoul due to the social and cultural similarity.

④ Choice of regional centers

Central place theory	Centrality index	Life region analysis
		

	Metropolis	Regional center
Central place theory	Seoul, Incheon	Suwon, Seongnam , Anyang, Ansan, Bucheon, Goyang
Centrality index	Seoul	Incheon, Suwon, Seongnam , Anyang, Ansan, Bucheon, Goyang, Pyeongtaek, Yangpyeong
Life region analysis	Seoul, Incheon	Suwon, Seongnam , Anyang, Ansan, Bucheon, Goyang, Uijeongbu, Guri/Namyangju

Tab.5-6 Regional centers designated by central place theory, centrality index and analysis on life region

By the central place theory and the Benison's centrality index, the regional centers can be set up only in the highly densified south- and west region Seoul, but not in the north- and east region, where the residential suburbanization is remarkable and the urban functions are highly polarized to Seoul. Reflecting the spatial- and social structure in the region Seoul, on

the other hand, the life region analysis suggests the regional centers even in the highly dichotomized north and east region Seoul. The division of life region is based on the transportation system and the regional centers have been selected in the consideration of population size and commuting patterns.

Depending on the result of analysis on the life regions, in this research seven cities and a development pole in the form of twin cities were designated as regional centers in the region Seoul: Suwon, Seongnam, Anyang, Ansan, Bucheon, Goyang, Uijeongbu, and Guri/ Namyangju.

New growth pole over the reach of metropolis

In order to remedy a development arteriosclerosis from the polarization to Seoul, current participatory government enacted so called three special laws, national balanced development, decentralization of authority, and construction of a new administrative capital which Korean supreme court judged as a plan against the existing constitution in October 2004. Depending on three special laws, now the central government issues more actively than any other times lots of regional development plans for the non-region Seoul in forms of constructing innovative towns, company towns and a new administrative town. In particular a plan on the construction of a new administrative town is a modified project of the failed construction plan of a new administrative capital and was passed by the parliament in March 2005, despite of the strong resistance of Seoulites. In this research the candidate area of a new administrative town (Gongju/ Yeongi) was treated as a new growth pole over the reach of Seoul.

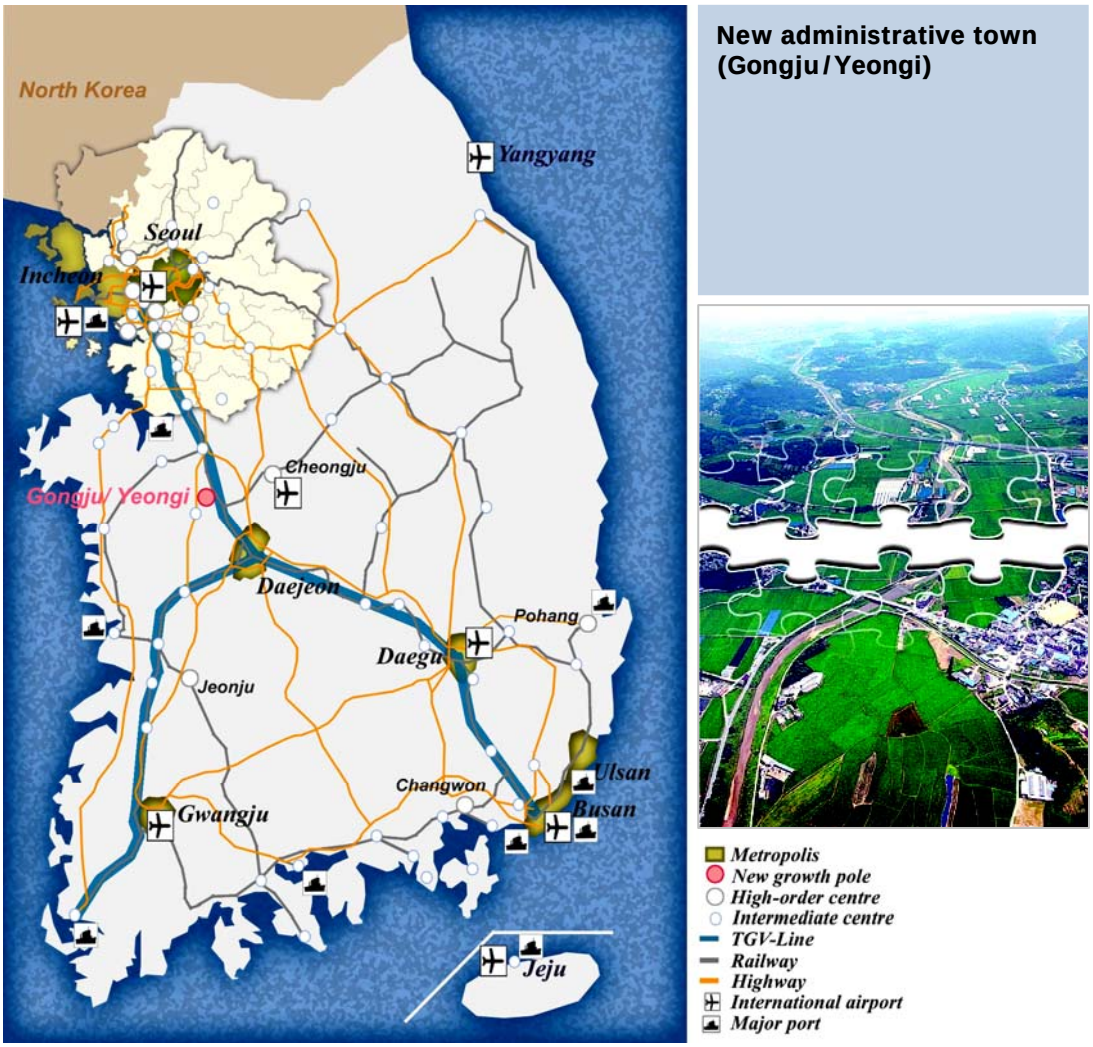


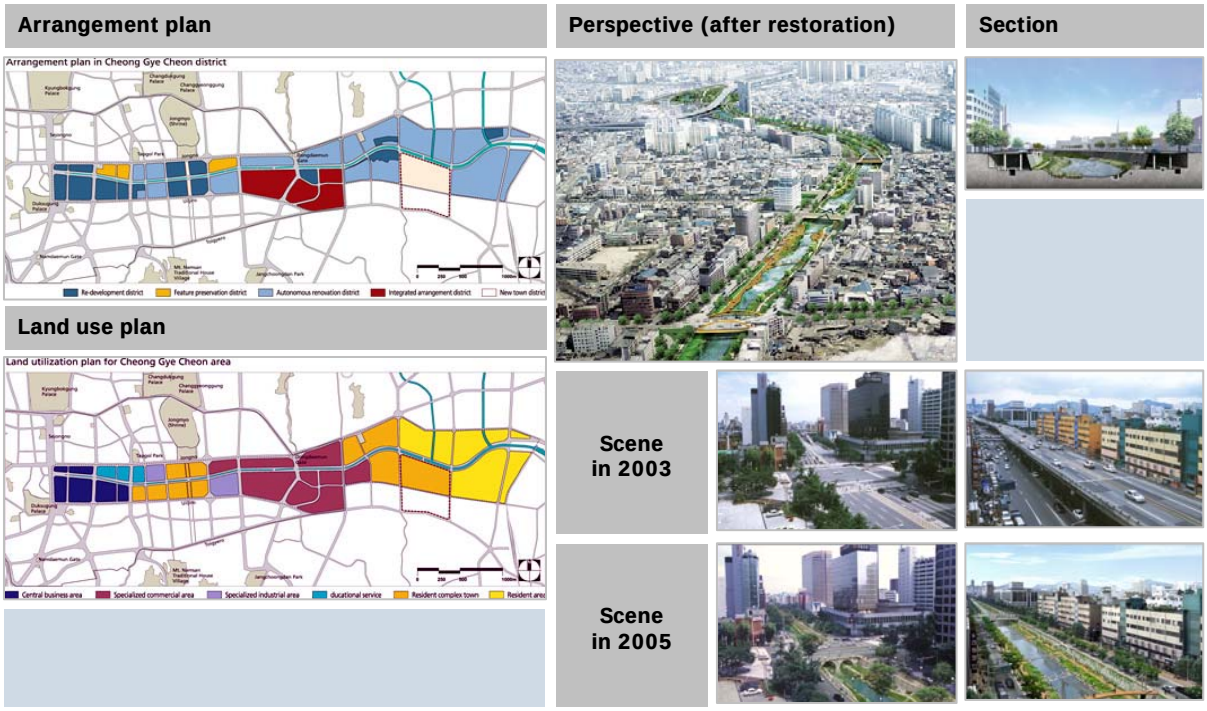
Fig.5-9 New administrative town as a new growth pole in the periphery

5.2.2 Restructure of regional centers

The instrument adequate to a functional feature of each regional center, city center and its sub-centers in the metropolis, regional centers in the metropolitan region and a new growth pole over the reach of metropolis, should be introduced to prevent the functional smoothing process by urban sprawl and make nodes functionally self-contained.

City center and its sub-centers in the metropolis

Depending on lots of regulations to relieve the urban congestion in Seoul and decentralize the urban functions of Seoul, the development activities in the old city center have been controlled since 1970s rigidly. Due to that the inner city area didn't keep abreast of changing demands and lost its own attractiveness. However three major projects, i.e. the restoration project of Cheonggaecheon (stream)[15], the operation of KTX (high speed rail), and the new airport railway connecting between Incheon International airport and the center of Seoul (Seoul station (KTX)) will open a new perspective for the urban regeneration. Through these projects the conventional CBD can be converted with ICBD (International, cultural and business district) in harmony with nature and cultural resources, but at that time the large-scaled planning approach is necessary to make the urban silhouette composed with not only the old and the new but also the artificial and the natural. It will help to keep the historically characterized old city center from the development of gigantic skyscrapers that are the creatures of economic principles.



Picture: www.seoul.go.kr, http://www.joins.com

Fig.5-10 Restoration project of Cheonggaecheon (stream)

The restructuring projects in the inner city areas should also proceed in the conjunction with mixed land use plans and integrated transportation plans, in particular oriented to public transport connections. When developing the 500m-radius zone around a railway- and subway station, the concepts of TOD and MXD should be introduced through strict development regulations and diverse incentives, such as readjustment of land parcel, up-zoning, density and volume control, etc. They can facilitate the integration of long-and short-

[15] The Cheonggyecheon (Stream) restoration began on July 1. 2003. The stream had been covered since 1937. Uncovering the 5.39-kilometer-long stream from Gwanghwamun Post Office building to Majangcheolgyo (Railway Bridge) was finished in 2004. Now Cheonggyecheon was completely restored.

distance transit modes, improve a pedestrian milieu, and avoid additional capacity increase of roads. Before permitting a development activity, a development agreement can be contracted between a developer and a local authority in order to obviate the conversion of a permitted development plan that may disqualify an urban milieu.

To reduce the traffic volume by private vehicles, the city center can be designated as a public transport priority zone and the varied traffic modes are to be integrated on the basis of railway- and subway connections. This concept was reflected partially on the Seoul bus system reform now. At the same time diverse TDM measures should be carried out in the cooperation with neighboring authorities. They include maximized parking standards for traffic generating development like ABC-location policy in Holland, parking zone control, parking toll, priority to short term parking, TSM (traffic system management), carpooling, road pricing, gasoline tax, ITS (intelligent traffic system), etc.

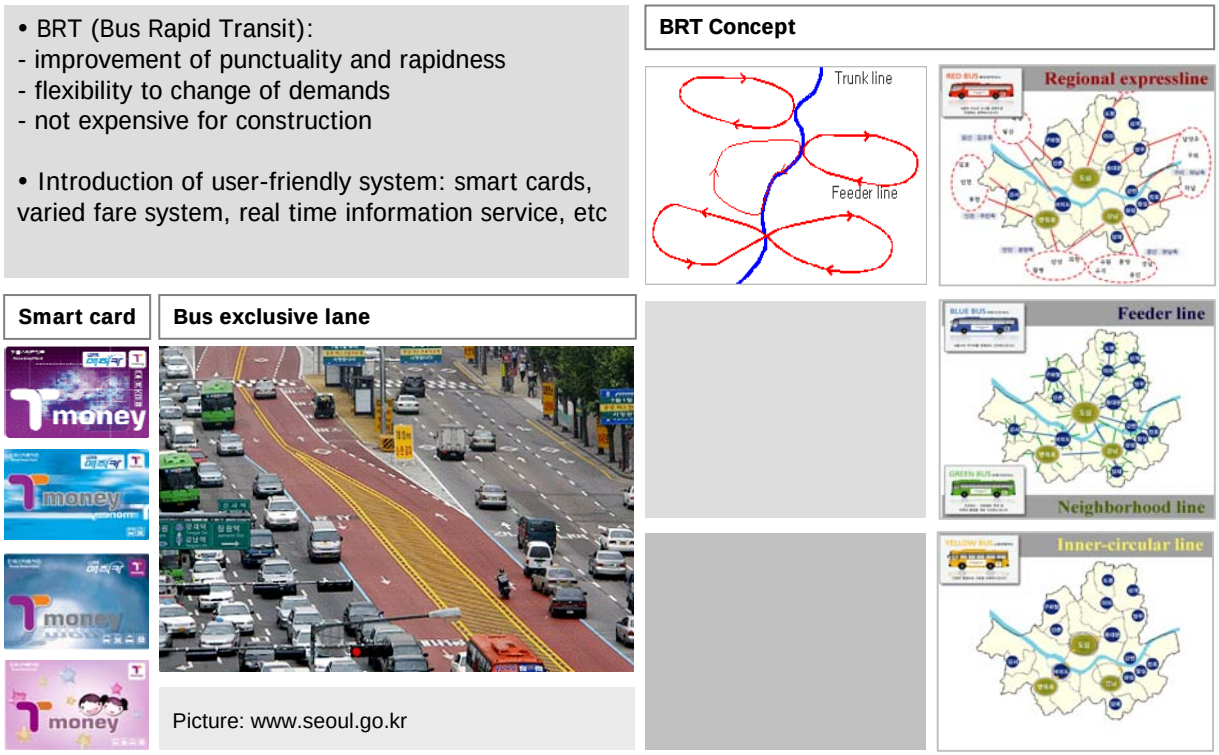
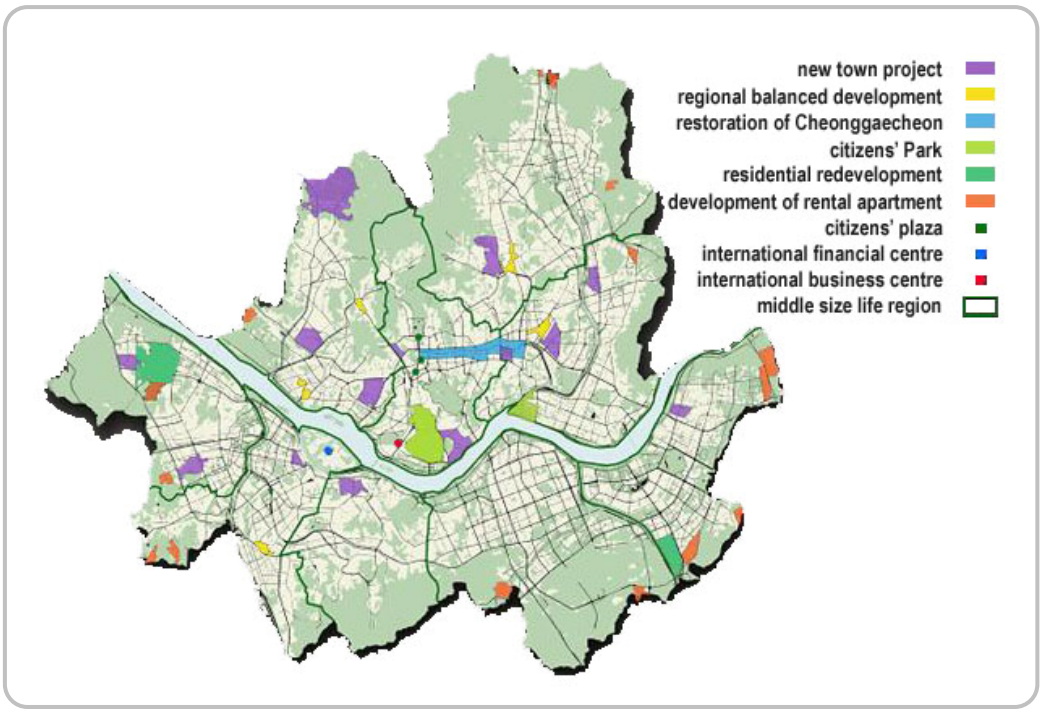


Fig.5-11 BRT of Seoul

In the old city center of Seoul, where varied land uses are in the close proximity, walking is the most significant traffic mode. Providing a better quality environment for pedestrians can encourage more people to make trips on foot and it needs to be coupled with the easy access for both public transits and businesses. With improvement of pedestrian environment cycle networks should be also linked gradually with those along the Han-river.

An integrated approach with land use-, transportation-, and environment planning is applied to 5 sub-centers as well as an old city center. However these sub-centers have their own specialized functions and relate strongly with their hinterland, so the own feature of each sub-center should be reflected on strategies for network cities. The cooperation is needed with communities communicating intensively with the sub-centers.

Projects for urban networks in the metropolis should proceed in the relation with new town projects in northern Seoul, removal of the US military base in Yongsan and Multimedia city project in Sangam.



Picture: www.seoul.go.kr

Fig.5-12 Major land use development projects of Seoul (Seoul basic urban planning 2020)

In the Seoul master plan 2020, Seoul municipality suggested green networks linking small- and scattered parks in Seoul. They are composed roughly with north-south green axis and green belt around Seoul and eco-belts support them which connect the Han-river and its streams that flow though built-up areas.

Picture: www.seoul.go.kr

Fig.5-13 Green networks of Seoul (Seoul basic urban planning 2020)

Regional centers in the metropolitan region

The function of regional centers around Seoul should be converted from bed towns of Seoul to its sub-centers in the suburban area. A restructuring approach for regional centers but must be made in the relation with Seoul. To reduce the commuting distance to Seoul and bring down traffic volume from the 50km-radius zone to Seoul, employment and commercial functions as well as residential development should be replanted from Seoul in the regional centers of region Seoul, as several employment core cities (Jap. Gyoumukakutoshi) were established around the metropolis Tokyo. However projects and programs for functional decentralization have to be supported by urban facilities substitutable for Seoul's and integrated with transportation connections to Seoul, because the removed urban functions are still in the relation with Seoul. The Korean and Japanese experiences in the past show definitely the necessity of this package approach. And the transportation links have to be the public transport-oriented ones, such as express railway lines like RER in Paris, BRT system in Seoul, etc.

To make a city network in the region Seoul, the diverse high-rank urban services in Seoul and regional centers around it should be shared through not only vertical- (links with Seoul) but also horizontal connections (links with regional centers). In a short term, the current concentric metropolitan railway system can be supplemented by the BRT service horizontally linking the central railway stations in regional centers. Better qualified P+R (park and ride) and R+R (ride and ride) services at railway stations will intensify the existing railway connections. This BRT service will be able to accommodate the increasing inter-regional trips between regional centers and back up the sharing of metropolitan functions, to say nothing of reducing the traffic volume by private vehicles.

On the other hand the improvement of connections between regional centers and local centers in the suburban area can reduce the functional dependence on Seoul and curb the expanding regional dichotomization to the 50km-radius zone from Seoul. Even though the urbanity in the 50km-radius zone isn't yet dominant and the spatial structure is relatively self-contained, this region is within one-hour distance from the sub-centers in Seoul as well as the regional centers in the region Seoul. Now the pressure of residential development is strikingly growing along the major transportation connections to Seoul.

Regional centers can be characterized through the urban functions replanted from Seoul and the revitalization of indigenous industrial potentials. The development of industrial potentials in individual regions is managed by long- and short-term phased guidelines. They include regional industry development plans, land use plans for industrial areas and preventive measures against environmental pollution. The guidelines should be tuned up with neighboring authorities through communication, coordination and cooperation and backed up by active initiatives of citizens.

To make use of industrial potentials in each region, meantime, the following measures can be introduced and examined by pilot projects in the frame of the aforementioned guidelines.

- Competitive subvention by central- and local government,
- One-stop administrative service including tax reduction and exemption,
- Construction and extension of infrastructure and vocational training centers
- Clusterization with entrepreneurs, investors, researchers and manufacturers, etc.

Considering geographical factors, indigenous industrial structure, and institutional reports and plans - e.g. industrial policies for the 21st century in Kyonggi-do (Lee, Sang-Hoon 1999), strategies for restructuring urban system and developing regional city in capital Region (Lee, Sang-Dae 2001), and the Gyeonggi grand design 2010 (Lee, Chun-Hoo et al. 2000) - the establishment of IT industrial cluster is apt for the 30km-radius zone from Seoul, inclusive of Seoul and Incheon. Physical and virtual infrastructure is here well equipped and not

expensive but highly qualified labor forces can be easily found. The current industrial belt on Yellow sea, (Siheung, Ansan, Hwaseong, and Pyeongtaeck) should be functionally connected with the R&D belt linking with Ansan, Suwon, Yongin, Icheon, and Yeoju in the southern region Seoul.

Even though the military confrontation with N.K. has strongly restricted the development in the northern Gyeonggi province, the geographical advantage of counties in the north of region Seoul, cumulatively Gimpo, Goyang, Paju, Uijeongbu, Dongcucheon and Yeoncheon, should be utilized as an outpost for economic cooperation with N.K.

Now mutual cooperation speeds up in the atmosphere of reconciliation with two Koreas. In June 2003, the reconnection project of broken rail road between South and North was finished and in October 2004, the industrial plant was constructed in the 1st stage with South Korean capital in Gaeseong, North Korean city.

Industry plant in Gaeseong (N. Korea)

- Construction of manufacturing plant in cooperation with S. Korean investors
  - Phase1 : 2002-2004 (ca. 90 ha)
  - Phase2 : 2004-2006 (ca.250 ha)

- Transportation connections with S. Korea
  : Sea port
  - Nampo-Incheon
  : Rail connection
  - Linie Gyeongui: Seoul-Pyeongyang-Shinuiju
  : Highway
  - Seoul-Shinuiju
  - Seoul-Musan (2007-2011)

http://enews.moct.go.kr/news/newsview.jsp?News_id=enews&News_sec_id=15502&News_art_id=20040630143421001

Fig.5-14 Industry plant in Gaeseong (North Korea)

International- and non-polluting industries, such as floricultural- and publishing industry, and convention centers, are recommendable for the north-western region Seoul, cumulatively in Gimpo, Goyang and Paju. This region is located in the near at Incheon international airport, Incheon international sea port and DMZ, where the natural resources are preserved ecologically well. By the completion of land reclamation project in 1991 on the west coast, some developable land stocks can be gained in Gimpo.

Development activities have been controlled in the eastern region Seoul to conserve reservoirs which are sources of water supply for the whole region Seoul, but the beautiful landscape attracts tourists cumulatively in Gapyeong, Yangpyeong and Yeoju. To reduce the impact to natural system and maintain the better water quality in the upper stream of the Han-river, the development of resort facilities must be guided based on the ecological impact assessment. Meanwhile the revitalization of indigenous regional industry can keep regional unique feature from regional smoothing by urban expansion: e.g. a ceramic industry in Icheon and Yeoju.

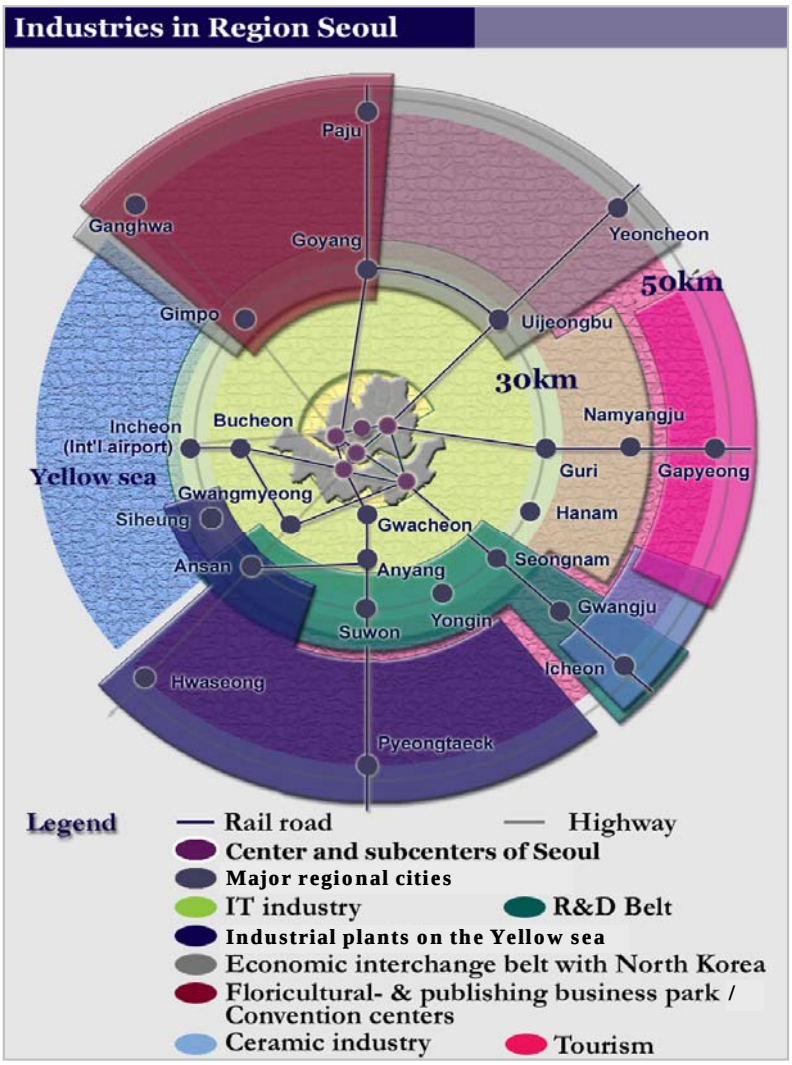


Fig.5-15 Industries in the region Seoul

The compact and mixed land use of developable areas in brown fields can allow homes, working places, green spaces, cultural facilities and community services to be in closer proximities. The development in green fields should be executed carefully, only if there is no alternative except that. GPP (growth phasing program) and UGB (urban grow boundary) introduced based on the inter-communal agreements and space-specific mortgage insurance service will encourage development activities in brown fields prior to those in green fields as well. And the developable land stocks must be controlled through the “plan, monitor and manage approach” recommended in the RPG9 of U.K.

Now small-scaled and sporadic residential development impedes sound and sustainable land use in the 30km-radius zone form Seoul, cumulatively around built-up areas with easy access to Seoul and well-equipped urban facilities. Diverse planning analysis instruments and regulations are introduced to control urban sprawl in suburban areas and they supplement current zoning laws: e.g. development effect assessment, development impact fee, 2nd type detailed plan, etc. To monitor development activities in inner- and outer urban areas continuously, on the other hand, the function like the “Informationsplattform” suggested through a project NBS in Stuttgart, Germany can be added to existing web-based land information service. The scope of service should be also extended to the metropolis Incheon and the Gyeonggi province in the cooperation with local authorities.

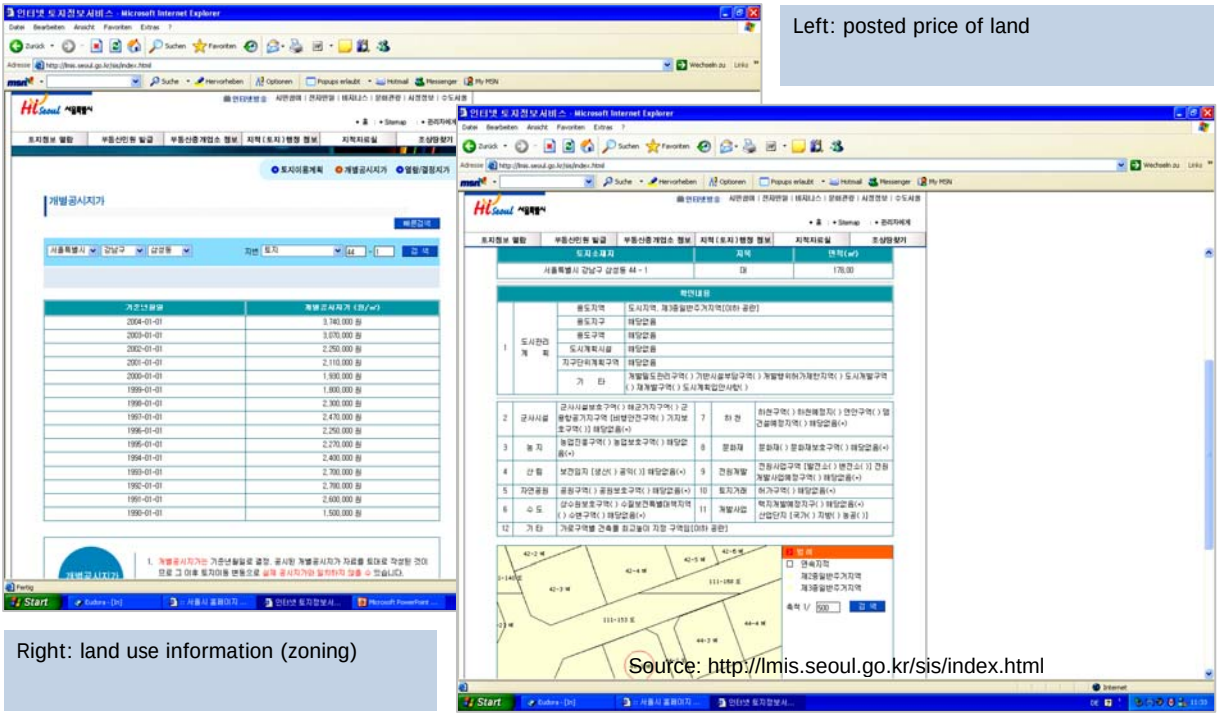


Fig.5-16 Land information service (Seoul)

A well-planned new town project can manage undesirable urban expansion and reduce urban congestion. Currently the central government launched additional five new-town projects in the region Seoul. The five additional new towns will provide qualified affordable houses and work places, particularly in a filed of IT-industry. These self-sufficient new towns will help to relieve the heavy polarization in the region Seoul and stabilize the housing market.

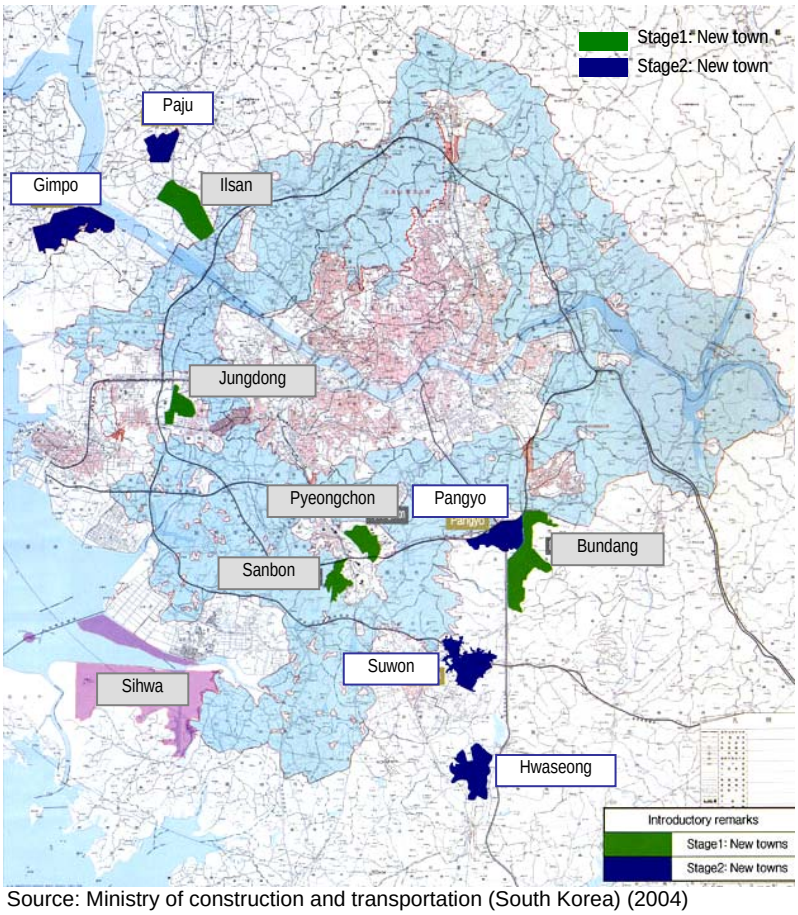
	Pangyo (Seongnam)	Hwaseong	Gimpo	Paju	Suwon
Area (ha)	938	904	1,647	908	1,114
Population	89,100	121,000	210,000	132,000	60,000
Housing units	29,700	40,000	70,000	47,000	20,000
Construction period	2003-2009	2002-2007	2004-2010	2003-2009	2004-2010
Developer	KLC, KNHC, Gyeonggi provincial gov., Municipality of Seongnam	KLC	KLC	KNHC, Municipality of Paju	Gyeonggi provincial gov., Municipality of Suwon

Source: Ministry of construction and transportation (South Korea) (2004)

Note:
(1) KLC: Korea Land Cooperation
(2) KHNC: Korea National Housing Cooperation
(3) Now due to the military security problems, the size of Gimpo new town is reduced by 1/3.

Tab.5-7 Plan on the construction of five additional new towns (2nd stage) in the region Seoul

With Hwaseong new town, Pangyo area (Seongnam) will share the burden of housing demand in the wealthy southern area of Seoul. Paju (a neighboring city with Goyang) and Gimpo new towns will provide houses and function as a growth pole for the northwest region Seoul bordering North Korea. A new town in Suwon, a provincial capital, will take the administrative function for southern region of the Gyeonggi province.



Source: Ministry of construction and transportation (South Korea) (2004)

Fig.5-17 Location of new towns in the region Seoul

The first five new-town projects in the 1980s could shift serious housing crisis in Seoul and improve overloaded urban infrastructure in the region Seoul. However insufficient planning time and lack of communication with local authorities segregated the new towns from their neighboring old cities. In opposition to the original intention to construct self-contained suburban cities, the new towns became bed-towns of Seoul and the reach of Seoul extended to the 30-km-radus zone. Even though most of settlers came from Seoul, they couldn't have same level of welfare-relevant opportunities with Seoulites in these huge new towns.

Considering lessons from the former new-town projects, first the transportation connections with Seoul should be improved, at least until people move in the new towns from Seoul. It will avoid traffic congestion in the sections between Seoul and neighboring built-up areas. Five additional new towns are planned as self-contained ones. However the connections with Seoul are still necessary, because the new towns are located still in the reach of Seoul and one of major aims of new-town projects is also to supply houses for Seoulites. Meanwhile the well-equipped transportation connections with Seoul can encourage the demographic and industrial migration from Seoul, but the networks with other regional centers and neighboring local centers in the periphery will contribute to mutual interchange of diverse urban services and relieve functional dependence on Seoul.

A large-scaled planning approach supported by inter-communal communication can help inter-regional cohesion between new towns and neighboring communities. To prevent the capacity overload of infrastructure in built-up areas, the development of new towns should be made, following the principle of concurrency, in the unit of neighborhood with marginal urban service.

Administrative and financial incentives by central- and local authorities will encourage settlement of business sector and construction of self-sufficient new towns. Local authorities

should intermediate cooperation with neighboring industrial parks and universities to intensify regional economic base.

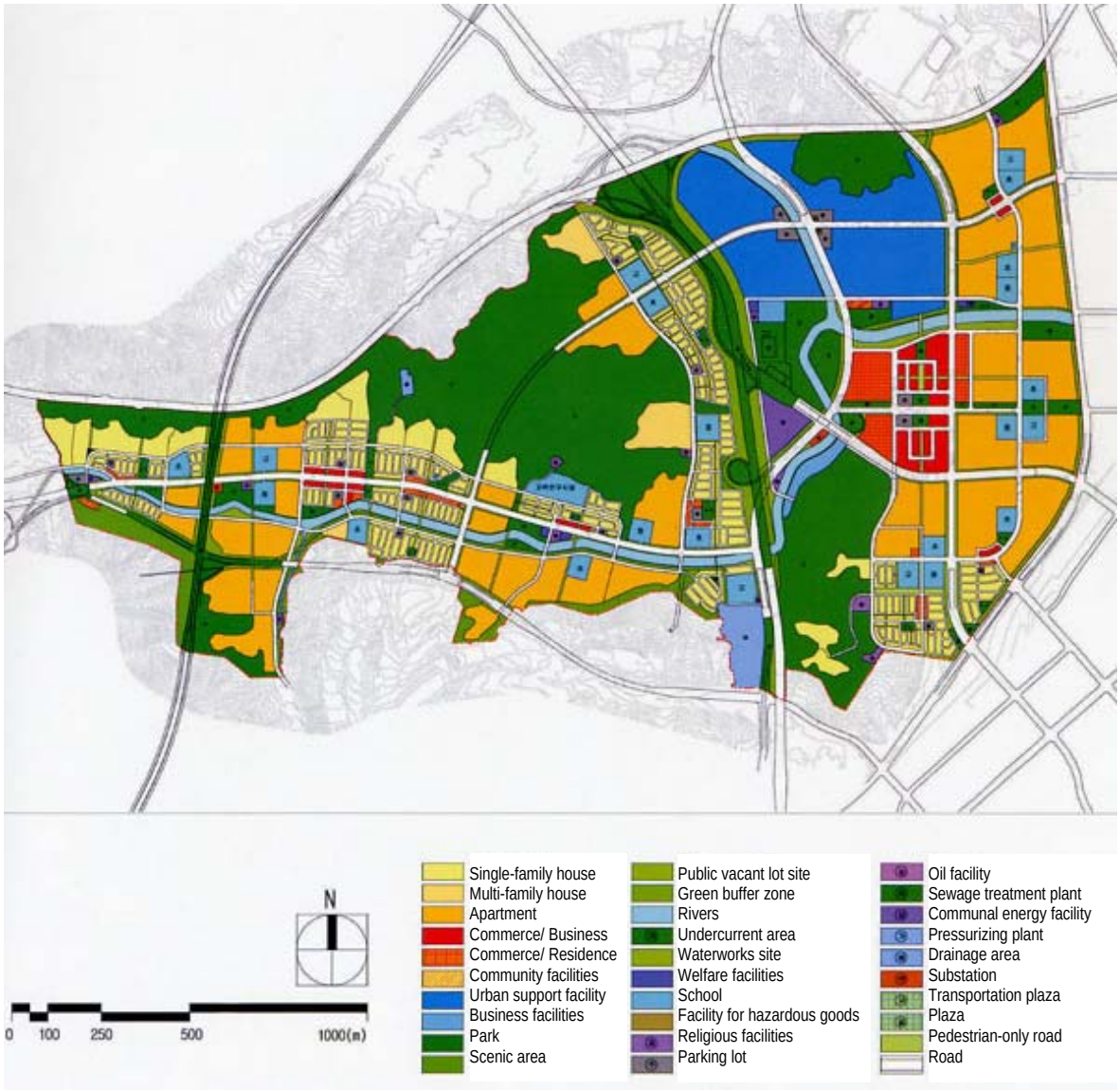
Two of five new towns will be located in the cities designated here to regional centers: Pangyo new town (Seongnam), and Suwon new town. Focusing on two new town plans, the requisitions for urban networks in Seongnam and Suwon were checked out.

① Pangyo new town (Seongnam)

- Outline of plan

The development of Pangyo new town was decided to promote rational urban growth in a green belt area and supply plots for housing in the region Seoul. Pangyo area is located close to Bundang new town and people can arrive within 30-minute at Yeongdong district, a sub-center of Seoul by road.

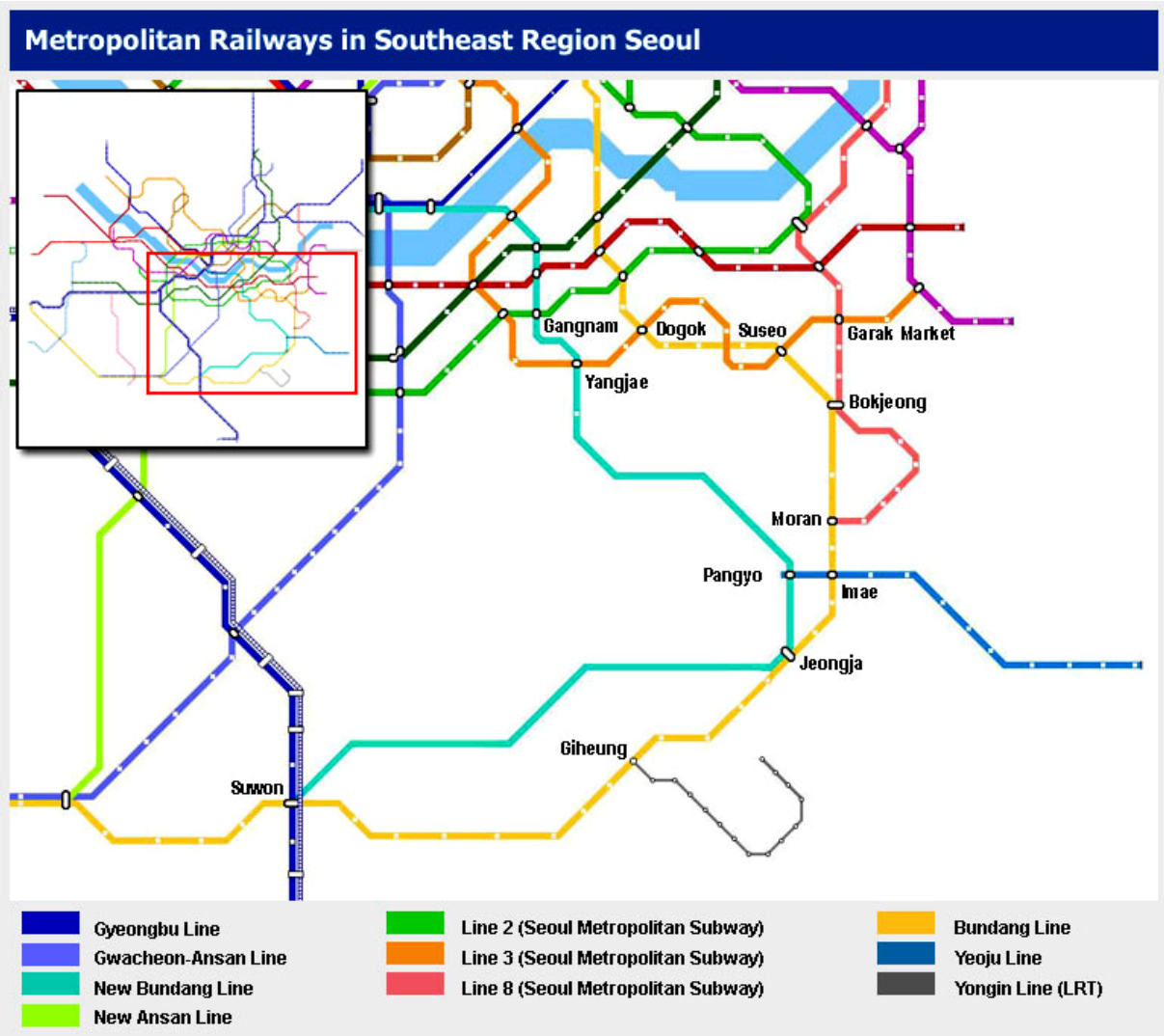
To reduce the development impact on the nature this new town plan is focused on the construction of an environment-friendly town with self-sufficiency. The density of residential area is 257 persons/ha and there will be built a business park for start-up companies.



Source: Ministry of construction and transportation (2004a)

Fig.5-18 Zoning plan (Pangyo new town)

The transportation network around Pangyo new town consists of highway No.1, five inter-regional roads and two planed railroads that connect Seoul and neighboring cities. New Bundang line (express line) will link this new town with Seoul, Bundang (Seongnam), and Suwon, while Yeoju line connects Pangyo and Bundang (Seongnam) with local centers in the southeast suburban area of Seoul. To promote the use of public transportation, Pangyo station conjunct with new Bundang line and Yeoju line will be integrated with BRT system as well as P+R. (Ministry of Construction and Transportation, 2004a)



Source: Metro planet (2004) (modified)

Fig.5-19 Metropolitan railways in southeast region Seoul (inclusive of lines under construction or planed one)

- Suggestions

The accessibility to Seoul is now well equipped through the construction project of Bundang new town in the late 1980s, but rail road service still needs to be improved. Even though new Bundang line planed as a regional express line is expected to reduce the current commuting time by detouring Bundang line and Seoul metropolitan subway line 8, the construction of this express line should be completed at least in 2009 when the settlement starts in Pangyo new town. The delay of new Bundang line connecting Seoul and Bundang/Pangyo will stir up the car-based life style and bring out the extreme congestion on inter-city express roads, as new settlers experienced in the late 1980s in Bundang new town.

Now Seongnam is linked with other regional centers in the region Seoul by intercity express buses except Suwon, despite of increasing traffic volume between two neighboring cites. The

travel time by public transits takes more than that by personal cars and this situation makes potential patrons turn their back on public transport.

The uncontrolled residential development in Yongin bordering with Bundang new town (Seongnam) makes roads in this new town highly congested. At last the weighted negative externality resulted in so-called “a war against road congestion” between two citizens in 2004. - For 5 months residents in Bundang new town blockaded an entrance to obstruct the road connection between Bundang and Jukjeon (Yongin).

To meet increasing inter-regional trips and reduce through-traffic volume from neighboring cities mostly by motorized vehicles, therefore diverse BRT services should be offered in the section Seoul- Bundang (Seongnam)-Yongin-Suwon, until the construction of new Bundang line and the extension of Bundang line as well as the construction of additional by-pass routes.

Now the suburbanization of the region Seoul develops to the 50km-radius zone and the roads in Seongnam are overloaded by the through-traffic from the periphery in the southeast of region Seoul. A project on the construction of Yeoju line connecting Seongnam with southeast region Seoul will be able to relieve the overloaded road capacity in Seongnam and intensify the regional centrality of a potential one-million-population-city Seongnam as well.

The beneficial areas of this line feature still rurality, therefore it can save the construction cost to make only a section going through a district center an underground route. Meanwhile the introduction of Express service enables to transport commuters to Seongnam fast in rush hour. In a long-term perspective the Yeoju line can be extended to Wonju and connect with a planned rail line between Wonju and Gangleung, a resort city on the east coast. It can be help to reduce a capacity overload on highway No.50 on weekends and in every vacation season. It can share the trips between the region Seoul and Wonju with the exsitng Chungang line (national railway; Seoul-Wonju-Gyeongju), too.

However a section of the Yeoju line between Pangyo and Imae (Bundang) should be first completed with the construction of Pangyo new town. Through linking Pangyo new town with Bundang line connecting major district centers in Seoungnam, a new settler can access easily to a high-rank urban service in Seongnam, not in Seoul.

The qualified residential milieu in the nature and the good accessibility to Seoul can attract enough the knowledge-based start-up companies in Pangyo new town, but to give an impulse to regional development of Seongnam, this start-up company complex developing and marketing a new idea needs to cluster with universities researching and studying a new idea scientifically, and manufactories producing in commercial quantity. The current well-equipped physical and virtual connections can bolster it up.

By the principle of concurrency, the development of a new town should be phased on in the unit of a neighborhood offering marginal urban services. This development project should start from the high density residential area around the Pangyo station conjunct with new Bundang line and Yeoju line and then proceed step by step to the west, where one family housing area will be constructed. It can prevent the deficit of marginal urban service in a new town which makes new comers return to Seoul and urban facilities in Seongnam overloaded.

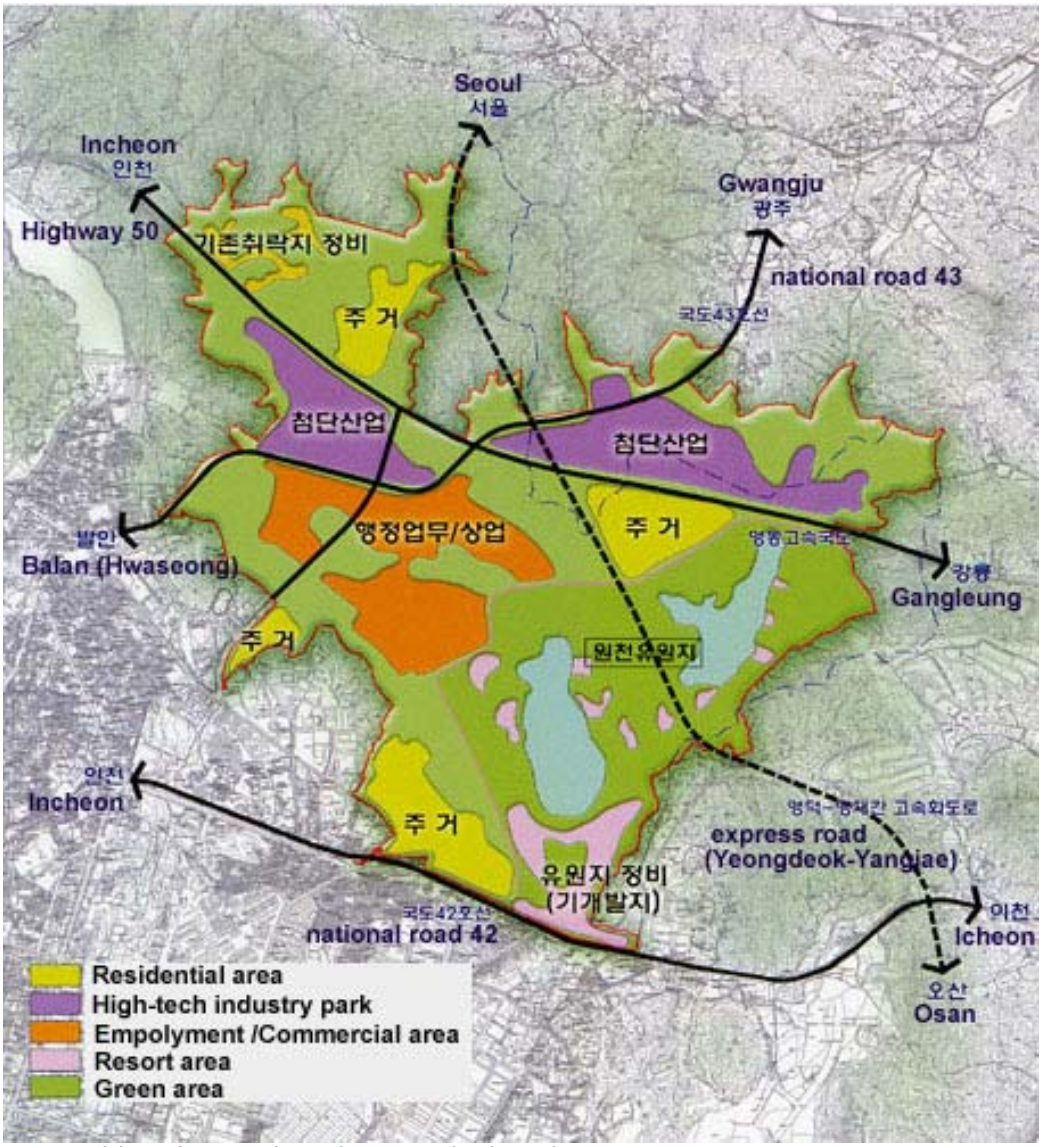
To avoid functional conflicts with Seohyeon, the neighboring commercial center in Bundang, the Seongnam municipality planned that the town center on the Pangyo station is a district center in the functional hierarchy.

② Suwon new town

- Outline of plan

Suwon new town can contribute to reducing the current overloaded administrative functions in the old city area, improving the transportation system in the vicinity and managing the small-scaled and scattered urban development around the provincial capital city, Suwon.

To keep the self-containment of a new additional administrative complex there will be constructed a environment-friendly residential area as well as a hi-tech industrial park on the highway No.50 along which a IT-belt is now formed connecting Incheon-Suwon-Wonju.



Source: Ministry of construction and transportation (2004a)

Fig.5-20 Zoning plan (Suwon new town)

Inter-city transportation network in the vicinity of Suwon new town consists of highway No.1 and No.50, five trunk roads and regional rail roads which include the national rail road Seoul-Busan, extending Bundang line (Seoul-Seongnam-Bundang-Suwon) and planed regional rail lines, new Bundang line (Seoul-Pangyo-Bundang-Suwon) and Suin line (Suwon-Incheon). P+Rs will be available around the new built train stations to promote use of public transit, in addition to introducing BRT service. (Ministry of Construction and Transportation, 2004a)

- Suggestions

Suwon is the provincial capital of Gyeonggi province and a provincial entrance connecting Seoul and Busan. Due to that this old city constructed in the 18th century is well linked with major cities in South Korea as well as in the region Seoul. But Suwon is meanwhile one of highly congested cities in South Korea.

From 2008 the increasing inter-regional trips between cities in south region Seoul and of course with Seoul will be shared by Bundang line connecting Suwon with southeast region Seoul and Suin line linking with southwest region Seoul inclusive of Incheon and Ansan. The new Bundang line all section of which will be completed in 2015 is planed to connect Seoul with Seongnam and Suwon via Suwon new administrative town, yet the section Suwon-Suwon new administrative town should be constructed at least with staring the settlement in 2009 in order to accommodate the expected increase of traffic from this new administrative town. This express line can reduce the congestion in Bundang line and connect fast between two cities, Suwon and Seongnam respectively with over 0.9 million population. It will also contribute to the depolarization in the region Seoul by making network cities of two cities which can serve as a counterweight to Seoul.

While the overload of administrative functions in the old town center is relieved through the construction of a new town in the east side of Suwon, the highly congested traffic condition cumulatively in the front of central railway station Suwon should be improved by constructing a inter-modal transit terminal like the model that was built at the square of station Cheongyangri in 2005.

Source: Seoul metropolitan government (www.seoul.go.kr)

Fig.5-21 Perspective of an inter-modal transit center at the station Cheongyangri (Seoul)

The new town area will be constructed in the well-conserved green belt area as well as the highly congested south region Seoul. So, the hi-tech industrial park to be established should be focused on an environment friendly R&D park, not a manufactory causing pollution and demographic immigration in particular from the non-region Seoul. The hi-tech industrial park might be also able to cluster with universities in Suwon as well as a neighboring industrial belt on the yellow sea and a start-up company complex planned in Pangyo through highway No.50.

By the principle of concurrency, the new administrative town of Suwon should be constructed in the unit of a neighborhood supplying the marginal urban service. The district center of new town can be developed as a new sub-center of Suwon to relieve the congestion of cramped old city center and supplement its functions.

New growth pole over the reach of metropolis

Arguments on the relocation of the capital city are not strange to Korean. It was proposed first by former President D.J. Kim in 1971. Dictator J.H. Park instructed a white paper plan on the construction of a provisional administrative capital city in 1977 and a comprehensive report were set out in December 1979, even though the assassination of President Park made this plan go down the drain.

In December 2002 this old argument held spotlight again, because it was one of main issues in the president election. President candidate M.H. Roh who proposed the relocation of the capital city won the presidency and the National Assembly passed a special law on the construction of a new administrative capital in January 2004, despite of the opposition of local authorities of region Seoul including Seoul. (Ministry of Construction and Transportation 2004b)

Considering effects on the decentralization, developability, and necessity of conservation, the presidential committee on administrative capital relocation selected four candidate areas for a new capital city, Gongju/Yeongi, Gongju/Nonsan, Cheonan, and Eumseong/Jincheon in June 2004.

According to the result of assessment by 80 specialists and hearings, Gongju/Yeongi was finally announced as a new administrative capital city in August 2004. The committee on administrative capital relocation made it public that a new capital city will be developed as not an extended built-up city but a new town due to the symbolic meaning of a new capital city. (Presidential committee on administrative capital relocation 2004a: 5-7, Presidential committee on administrative capital relocation 2004b)

In October 2004, the Korean Supreme Court judged a plan on the construction of a new capital city is against the existing constitution accepting Seoul customarily as the capital of South Korea and in April 2005 the parliament passed a plan on the construction of a new administrative town as an alternative of this failed plan. However the contents of this alternative are not greatly different from the former.

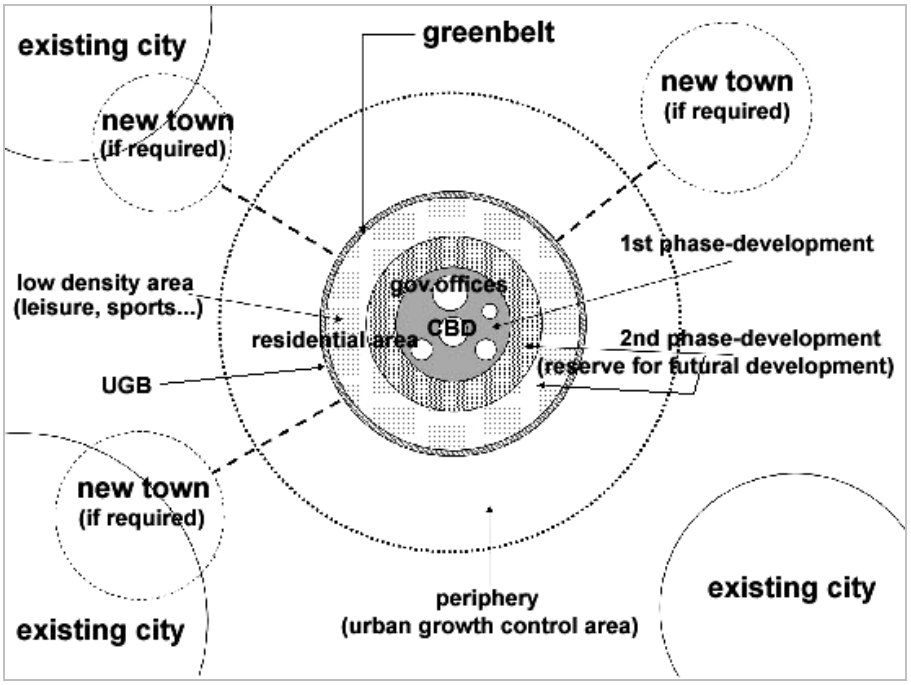
A new administrative town is located linearly with 120 km-distances from Seoul to the South and it takes about two hours from Seoul by cars. Now this area can not be accessed directly by KTX, but a KTX train starting Seoul station arrives at Cheonan/Asan station in about 20 minutes and from there to the candidate area it is about one-hour-distance by cars. The construction of a new KTX station Osong on KTX line Seoul-Busan however will be completed in 2010 and then the travel time (Seoul-Gongju/Yeongi) can be reduced to about one-hour. If a new KTX section (Cheonan-Gongju) is finished in 2015, it will take about 40 - 50 minutes from Seoul. (Ministry of Construction and Transportation 2005)

The size of a new administrative town will be a city with 300 - 500 thousand persons and the density of residential area is set as 300 inhabitants per ha, which is lower than the current average of major cities in South Korea (368 inhabitant/ha). (Presidential committee on administrative capital relocation 2003: 12) However it is a reduced size in comparison of a failed new administrative capital with 500 thousand inhabitants. - In 2003 it was surveyed within specialists what is the suitable size of a new capital city to maximize the effect of decentralization and keep the self-containment. A proposal on a city with 500 thousand persons had the backing from 40% of them. Considering networks with neighboring cities, on the other hand, about 3.5 million people will make their lives in this regional boundary, i.e. the Chungcheong province, in the near future. (Presidential committee on administrative capital relocation 2004a: 8-11, 15):

- Cheonan (now a 300,000-inhabitant-city, but it will be grown to a half-miliion-population-city in 2015, when a new plant of Samsung electronics and several universities from Seoul settle down here),
- Cheongju (500,000 inhabitants),
- Gongju (300,000 inhabitants), and
- Metropolis Daejeon (1.4 million inhabitants).

According to a time table of the current participatory government, the construction of a new administrative town will begin in 2007 and from 2012 up to 2014 government offices will be removed from Seoul except the Blue House (the Korean presidential residence), the National Assembly, the Supreme Court, and six ministry departments relevant to military, foreign and domestic affairs. (Presidential committee on administrative capital relocation 2004b, Chosun-ilbo 2005)

After the international competition the detailed urban plan will be drawn up, but the main urban structure is like the following schematic design issued by the presidential committee on administrative capital relocation.



Note: modified plan from a plan on the construction of a new administrative capital (Presidential committee on administrative capital relocation, 2004a: 14)

Fig.5-22 Schematic design of a new administrative town

To accommodate the unexpected needs in the future, the reserved area is set up around this administrative new town. A greenbelt and a UGB in the outskirts of a new administrative town will control not only urban sprawl of this new town but also functional smoothing from the bordering metropolis Daejeon. (Presidential committee on administrative capital relocation 2004a: 12-14)

Considering urban growth and demands of diverse urban services in the future, however this development project should proceed step by step in the unit of a neighborhood and the high-rank urban services have to be shared with neighboring cities to avoid functional conflicts and an undesirable waste of resources. While government offices start to settle down, migrants should be supplied with qualified urban services substitutable for urban services of Seoul, in particular highly qualified education facilities. Otherwise only fathers will commute from Seoul by their own cars or KTX making this new town accessible within 40-50 minutes in 2015.

5.2.3 Regional connections

The inter-nodal connections in the region Seoul contribute to the complementation of metropolitan functions in the urban networks. They include links between alternative economic centers and suburban areas as well as connections between the metropolis and regional centers and tangents between regional centers in the metropolitan region.

Metropolitan region

In order to remove the disadvantages from the dichotomized regional structure and share the diverse urban functions with neighboring areas, regional centers should be connected not only with the metropolis (vertical connections) but also with each other (horizontal connections). However these urban connections need to be developed through communication, coordination and cooperation with the interested and have to be compatible to functional correlation among regional centers and existing transportation networks. Now Seoul is connected with neighboring cities in the region Seoul by six main railroads and six arterial roads, but these transportation networks are still remarkably radio-centric, even though two highway lines, No.100 and No.50 horizontally link the cities in the southern region Seoul. These transportation connections have formed seven radio-centric transportation corridors, of course linking Seoul and its regional centers and the urban development along them has evolved distinctively reflecting the change of national development policies since the 1960's. (Tab.5-5)

First, the Gyeongin-axis and the Gyeongbu-axis are two major development axes not merely in the region Seoul but also in South Korea. The railways and roads on them are always congested by commuting trips and freight vehicles.

The 2nd Gyeongbu-axis and the Gyeongui-axis link Seoul with two representative new towns constructed in the late 1980s in the 30km-radius zone from Seoul: Bundang and Ilsan. Since the late 1980s these two development corridors have been developed actively. However the small-scaled and sporadic residential development activities stand out cumulatively in Yongin near Bundang new town, where the urban facilities are well-equipped and the accessibility to Seoul is good. This uncontrolled residential development impedes now the sustainable development and overloads the infrastructure capacity of neighboring built-up areas, cumulatively Bundang new town.

The Gyeongwon-axis covers areas bordering with North Korea and the Gyeongchun-axis develops along the Han-river which is water source for residents in the region Seoul. Theses military and environmental factors have restricted regional development in the north and east region Seoul, but the geographical closeness to Seoul - within one hour by automobiles - and the beautiful scenery near at Han-river and mountains attract the residential suburbanization which can endanger well-conserved nature. So it is necessary to monitor and control small-scaled and scattered urban development activities along these development axes.

The Seoul-Ansan-axis is one of major industry belts in South Korea. To reduce congestion problems along the Gyeongbu-axis and the 2nd Gyeongbu-axis and make a pan-yellow sea industrial belt connecting Chinese east coast areas, the development proceeds now cumulatively along Highway No.15 and around Pyeongtaeck harbor as one of national strategic seaports in South Korea.

In the short term, the construction of by-pass and the extension of existing streets can help to reduce traffic congestions from commuting trips, cumulatively in bordering sections between Seoul and Gyeonggi province. However these methods of road capacity addition can attract additional motorization and congestion by it, therefore the increasing commuting trips must be absorbed gradually by improving public transit facilities and services, cumulatively in the sections between Seoul and suburban cities in 30km-radius zone, where suburbanization

encourages the emigration from Seoul and weak rail connections with Seoul increase the modal split of automobiles.

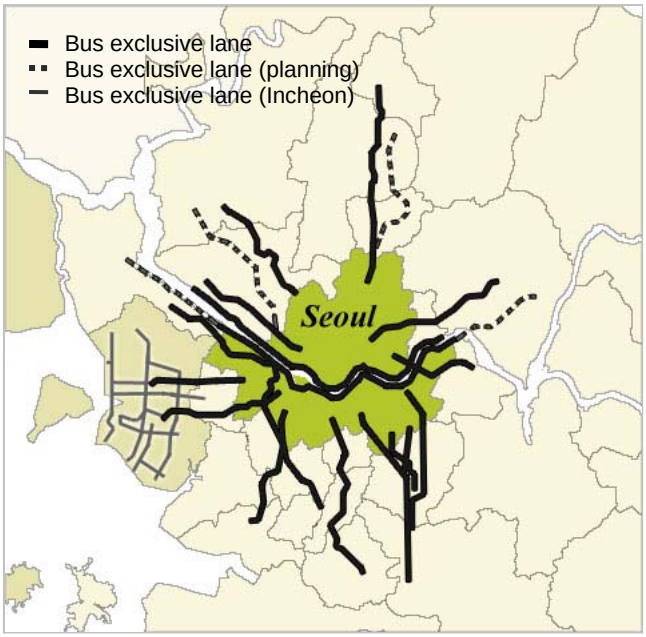
Now in sections Gimpo-Seoul and Hanam-Seoul there is no rail service but the necessity of rail service is backed up by the construction of a new town with 75,000 persons in Gimpo to solve the housing shortage of Seoul. The priority of projects for rail connections in two sections can be determined, depending on the expected commuting trips in the future. Here is not considered a population growth by constructing a new town in Gimpo and commuting volume aimed at the year 2020 is estimated by linear model based on the development patterns of commuting trips between 1995 and 2000 in the respective sections. Depending on this projection of commuting trips, a planed Gimpo LRT project may precede an LRT project connecting Sangildong (Seoul) and Hanam. Before a new town is constructed in 2010, Gimpo LRT should be completed to accommodate the trips between Seoul and a new town in Gimpo. (Refer to Tab.14 in Appendix 2)

unit: person

destination / origin	Seoul	Hanam	Gimpo
Seoul		31,937	31,975
Hanam	19,012		
Gimpo	44,218		

Tab.5-8 Projection of commuting trips in 2020 in the bottle neck sections not connected by rail roads

To increase the modal split of public transportation, it must be faster and more punctual than private vehicles. Now lots of public transportation services are introduced to connect Seoul with regional centers more swiftly and punctually. Among them BRT service that is from July 1, 2004 in operation reorganizes the bus system of Seoul into integrated one with short- and long distance transit modes and shortens the travel time particularly in the sections between the inner city and suburbs. BRT system improves now the efficiency of existing transportation facilities (intercity express motorways, bus special lanes in the inner city, multi-modal transit facilities) and it is supported by integrated tariff system and well-equipped IT-technology (real time traffic information service through internet and cellar phones, payment by smart cards). In the inter-regional BRT network planning, however it is still one of difficult problems to communicate, coordinate, and cooperate with neighboring authorities of metropolis Incheon and Gyeonggi province.



Source: KRIHS & Ministry of Construction and Transportation (2004: 26) (modified)

Fig.5-23 Plan on the BRT system in the region Seoul

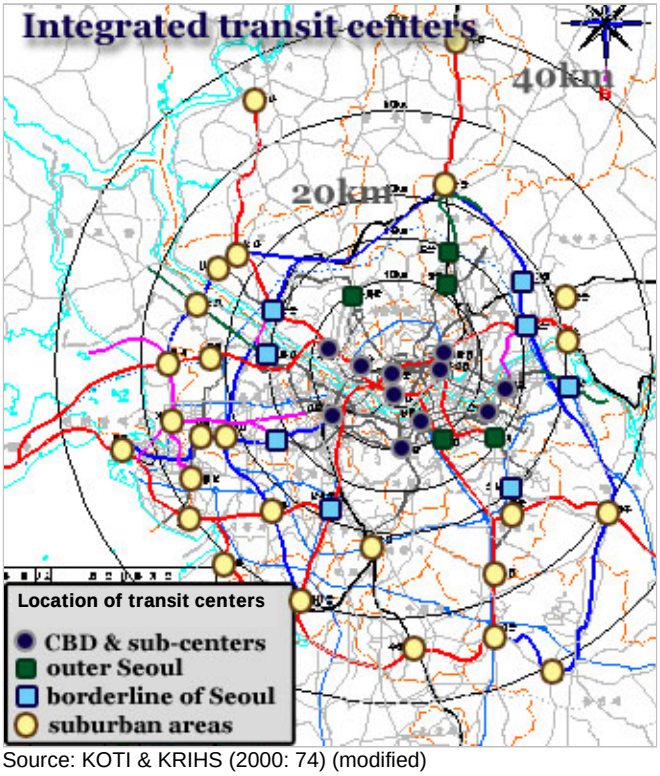
Meanwhile the introduction of express rail service in rush hour can reduce travel time and return commuters to express public transits in the region Seoul. Express rail service should be not competitive with bus service in the region Seoul, but supported by it.

Line	Section	Length (km)	Note
Gyeongin	Seoul(Guro)-Incheon	27.0	In operation
Gyeongbu	Seoul(KTX)-Suwon-Cheonan	78.8	In operation
Gyeongui	Seoul(Yongsan)-Paju(Munsan)	48.6	Plan
Jungang	Seoul(Cheongyangri)-Namyangju(Deokso)	20.9	Plan
Gyeongchun	Seoul(Cheongyangri)-Chucheon	57.8	Plan
Incheon int'l airport line	Seoul(KTX)-Incheon(✈)	61.5	Plan
New Ansan	Seoul(Cheongyangri)-Ansan	39.5	Plan
New Bundang	Seoul(Yongsan)-Seoungnam(Bundang)	26.7	Plan

Source: Ministry of construction and transportation (2002: 82-83)

Tab.5-9 Express rail service between Seoul and regional centers in the region Seoul

Simultaneously to reduce avoidable mobility by automobiles, measures must be introduced not just for improving public transport service but also for restraining use of private vehicles. Now considering location, developable land mass, public transport connections, capacity of roads, traffic volumes per a day, etc., 50 multi-modal transit terminals and 10 P+R facilities are planed and some are in operation. (KOTI & KRIHS 2000: 73-74) However the utilization of several P+R facilities is still poor and it shows the necessity of sticks in TDM policies as well as carrots. Even though maximized parking standard for traffic generating development activities, road pricing, carpool, parking toll, parking control, etc. are in operation, they need to be more strengthened. For commuters using public transport the employer's subvention can be introduced like Japan, as well.



Source: KOTI & KRIHS (2000: 74) (modified)

Fig.5-24 Plan on P+R facilities in the region Seoul

With improving the efficiency of vertical connections, the introduction of additional BRT service between regional centers in the Gyeonggi province can accommodate increasing horizontal trips outstandingly in the 30km-radius zone in a short term. But it has to be coordinated with the express rail service between Seoul and suburban cities.

Even though rail transit modes can transport lots of passengers at a time and fast and lessen ecological impacts by emission gas, railway connections spend more time and more money in construction. They aren't elastic to changing demands, too. Before completing the horizontal rail road connections therefore BRT service connecting regional centers in the region Seoul can substitute for horizontal rail links and after the construction of tangential railway lines BRT service should support railway connections.

Circular railway lines connecting regional centers around Seoul can accommodate increasing demands of inter-regional trips and restructure current concentric urban structure. However it is still in needs to extend and improve the capacity of vertical connections to Seoul, comparing with demands for horizontal connections. So the construction of railway out-rings is now just a long term plan in the region Seoul.

This plan should be approached section by section thoroughly on the basis of demands, because the limited finance source of public infrastructure authorities restricts the poor investment and requests the benefit analysis now. In this point, the projection of commuting trips in each section connecting regional centers can be one of indicators to determine the priority of individual sectional projects constituting an inner-circular railway line in the region Seoul. Here sectional commuting volumes aimed at the year 2020 are calculated by linear model based on the development patterns of commuting trips between 1995 and 2000 in the respective sections. The section connecting Incheon, Gimpo, and Goyang in the outer circular railway line is expected to be accomplished next to the construction of inner circular railway line in the region Seoul. (Refer to Tab.15 and Tab.16 in Appendix 2)

unit: person

destination / origin	Incheon	Suwon	Seongnam	Anyang	Bucheon	Ansan	Goyang	Uijeongbu	Guri/ Namyangju
Incheon		19,459	3,285	13,876	74,349	18,167	17,117	969	207
Suwon	5,536		16,763	17,016	2,239	17,950	1,117	870	900
Seongnam	3,279	11,849		4,237	-2	1,965	362	752	434
Anyang	5,367	11,324	8,603		588	6,258	1,705	324	344
Bucheon	29,735	7,051	1,391	6,108		4,476	5,649	218	379
Ansan	3,010	9,796	2,325	9,378	991		1,343	624	352
Goyang	10,334	2,628	2,463	1,937	5,561	2,548		1,570	376
Uijeongbu	1,156	189	1,041	570	137	606	3,259		2,647
Guri/ Namyangju	1,996	2,196	4,946	363	931	505	1,100	3,121	

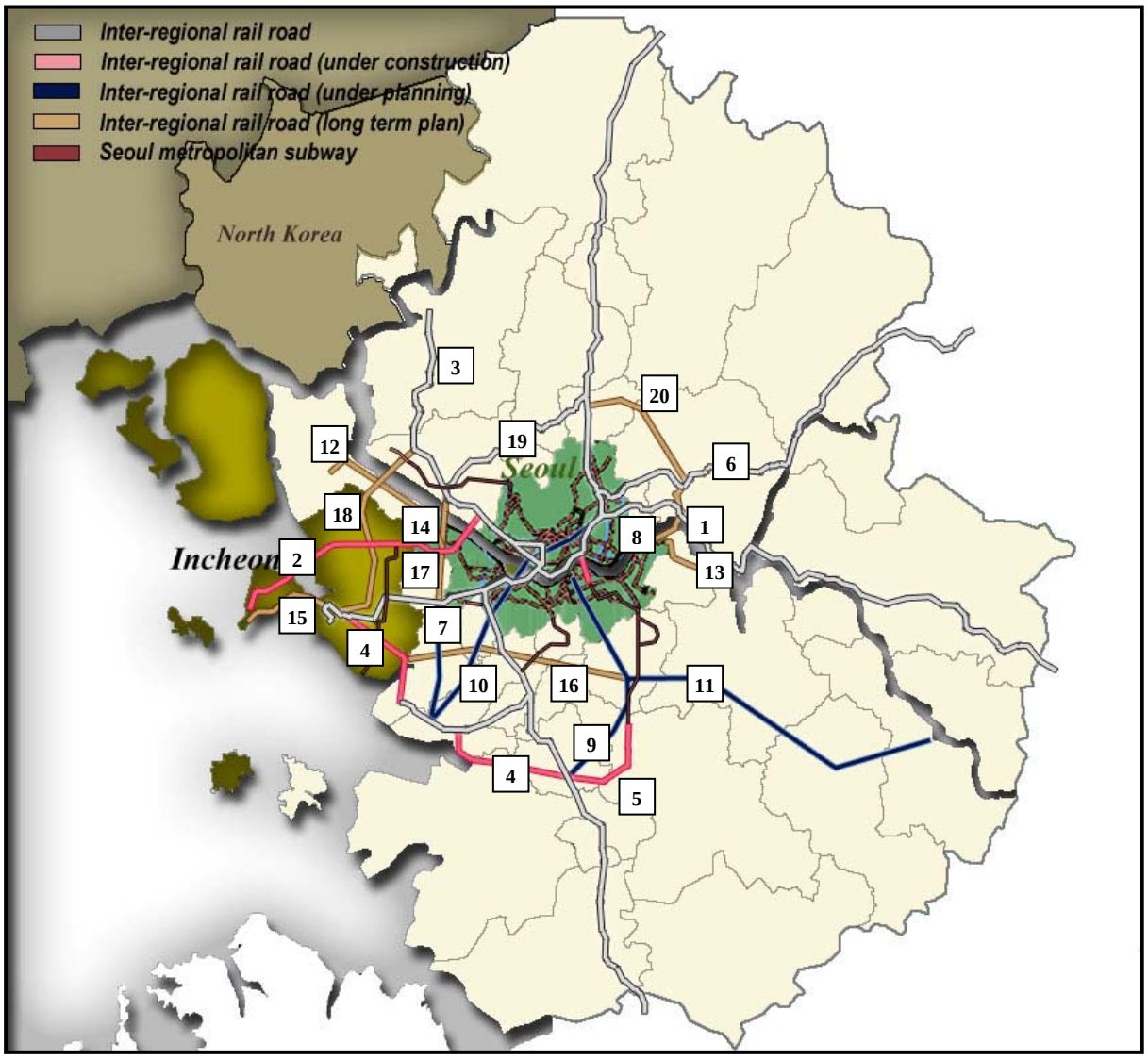
Tab.5-10 Projection of commuting trips in 2020 between regional centers in the region Seoul

unit: person

destination / origin	Incheon	Gimpo	Goyang
Incheon		36,674	
Gimpo	10,784		4,622
Goyang		7,306	

Tab.5-11 Projection of commuting trips in 2020 for an outer circular rail line (Incheon-Gimpo-Goyang)

Depending on the projection of commuting trips in the horizontal sections as well as the aforementioned vertical sections Gimpo-Seoul and Hanam-Seoul, the priority of projects is suggested with figures in brackets (Tab.5-12), but except the projects which are in construction or whose finial reports are already set out.



Line		Section	Length (km)	Construction (year)	Note
1	Jungang line	Seoul(Cheongyangri)-Guri(Deokso)	18.0	2005	Electrification Slow/Express
2	Incheon international airport line	Incheon(✈)-Seoul(✈)-Seoul(KTX)	61.5	2008	Slow/Express
3	Gyeongui line	Seoul(Yongsan)-Paju(Munsan)	48.6	2008	Electrification Slow/Express
4	Suin line	Suwon-Incheon	39.0	2008	Slow/Express
5	Bundang line	Seongnam(Bundang)-Suwon	18.2	2008	Slow/Express
6	Gyeongchun line	Seoul(Mangu)-Nayangju(Geumgock)	17.2	2009	Electrification Slow/Express
7	Sosa-Wonsi line	Bucheon(Sosa)-Ansan(Wonsi)	23.1	2009	
8	Seoul subway line 8	Seoul(Amsa)-Guri/Namyangju(Donong)	7.1	2009	Extension

9	New Bundang line	Seoul(Yongsan)-Seongnam(Bundang)-Suwon	17.0	2015	Express
10	New Ansan line	Seoul(Cheongyangri)-Gwangmyeong(KTX)- Ansan	39.5	2015	Express
11	Incheon subway line 2	Incheon	35.4	2008-2011	Light rail connection
12	Gimpo line	Seoul(✈)-Gimpo	20.0	(1)	Light rail connection
13	Hanam line	Seoul(Sangildong)-Hanam	7.8	(2)	Light rail connection
14	Seoul subway line 9	Seoul(✈)-Goyang(Daegock)	7.9	(3)	Extension
15	2nd Incheon international airport line	Incheon(✈)-Gwangmyeong(KTX)	49.3	(4)	
16	Southern circular line of region Seoul	Gwangmyeong(KTX)-Anyang-Seongnam(Pangyo)	20.5	(5)	
17	Inner circular line of region Seoul	Seoul(✈)-Bucheon(Sosa)	9.9	(6)	
18	Outer circular line of region Seoul	Incheon(Gyeongseo)-Gimpo-Goyang(Ilsan)	20.0	(7)	
19	Suburban line	Goyang(Neunggock)-Uijeongbu	28.0	(8)	Electrification
20	Outer circular line of region Seoul	Uijeongbu-Guri/Namyangju(Donong)	20.6	(9)	

Note: Project priority was suggested depending on the projection of commuting trips in 2020 and it is indicated with figures in brackets

Tab.5-12 Construction procedure of inter-regional rail connections in the region Seoul (suggestion)

Meanwhile this rail system connecting Seoul and regional centers vertically and horizontally should be supported by a 4X5 metropolitan highway system proposed in a report on the establishment of metropolitan transportation network in the region Seoul. (Fig.4-17) This integrated transportation system will connect regional centers fast without going through Seoul and restructure current radio-centric spatial structure to decentralized one.

Green networks in the metropolitan region should be approached at the regional level or on an occasion at the over-regional level. Now the green infrastructure in the region Seoul develops like a wheel. Green corridors intersecting Seoul in two directions of north-south and east-west reach to the green belt around Seoul. Over this circular corridor the green networks of Seoul stretch out radially along the regional green axes formed between seven transportation corridors. Regional green corridors connect in the east with the Baedudaegan, the spine of national green infrastructure system and in the west they arrive at tideland areas on the Yellow sea. On the other hand, green axes meet in the north with DMZ which is now not only a military buffer zone between two Koreas but also a well-conserved eco-belt crossing the Korean Peninsula.

The current green networks in the region Seoul have to be secured by the concentration of development activities along current transportation corridors in form of a pearl necklace. Besides planning regulations diverse financial methods can help to re-construct regional green networks. Lands for conservation and recreation can be purchased for a part of a real estate transfer tax and gained through transfer of development right, land dedication by developers, etc.

Suburban area

The urban networks in the suburban area should be approached in two different ways:

- Improvement of accessibility to regional centers from their effect zones and county centers in suburban areas
- Development of connections between peripheral areas outside the effect zones of individual regional centers and their neighboring county centers

To find out the effect zones of individual regional center, their commuting zones were investigated. Here the areas, where more than 5% of employees and students commute out toward a regional center in 2000, are defined as the effect zone of a regional center and the rest considered its peripheral area. Depending on this statistical analysis the suburban area of region Seoul was divided by effect zones of individual regional centers and their peripheral areas. (Fig.5-25: Refer to Tab.17 in Appendix 2)

Most of neighboring counties with individual regional centers correspond to their effect zones, but an effect zone is not yet developed around Guri/Namyangju which are still in the reach of Seoul and show a weak regional centrality in the study of centrality index by Benson's method, (Guri (28.16) and Namyangju (32.93): Refer to Tab.5-4) The peripheral areas of individual regional centers correspond to the 30-50km-radius zone from Seoul, where a self-contained spatial structure was found out by the investigation on the mobility patterns in the chapter 4.

In the effect zones of regional centers, it is critical not only to attract businesses to regional centers but also to improve accessibility to regional centers from their hinterland areas and county centers in suburban areas by diverse transit modes meeting user's demands, for instance LRT, bus, taxis and individual transit modes such as foot, bicycles and personal cars. They contribute to the intensification of regional centrality and the depolarization in the region Seoul by converting lots of destination trips to Seoul into regional centers. Meanwhile these short-distance transit modes should be integrated with long-distance express transit modes for Seoul at multi-modal transit terminals in regional centers.

Peripheral areas of individual regional centers feature now a self-contained spatial structure but they could be victims of metropolis' smoothing process. To keep the self-sufficient structure, it should be reflected to improve access to neighboring county centers from peripheral areas of individual regional centers with more importance than access to regional centers.

On the other hand, peripheral areas of individual regional centers are developed in most cases as rural residential areas with low density and relatively high dependent on motorized vehicles, so commercial functions in these areas have to be linked with residential areas through convenient pedestrian and cycling road networks and district-bus service. Residential development activities should be made compactly within the walkable distance from transit stops. The transit stops integrated with P+R facilities encourage the use of public transportation and reduce motorized trips to county centers, regional centers or even Seoul. Surface parking areas will be also able to serve as developable land stocks, when their real estate values increase enough to attract development.

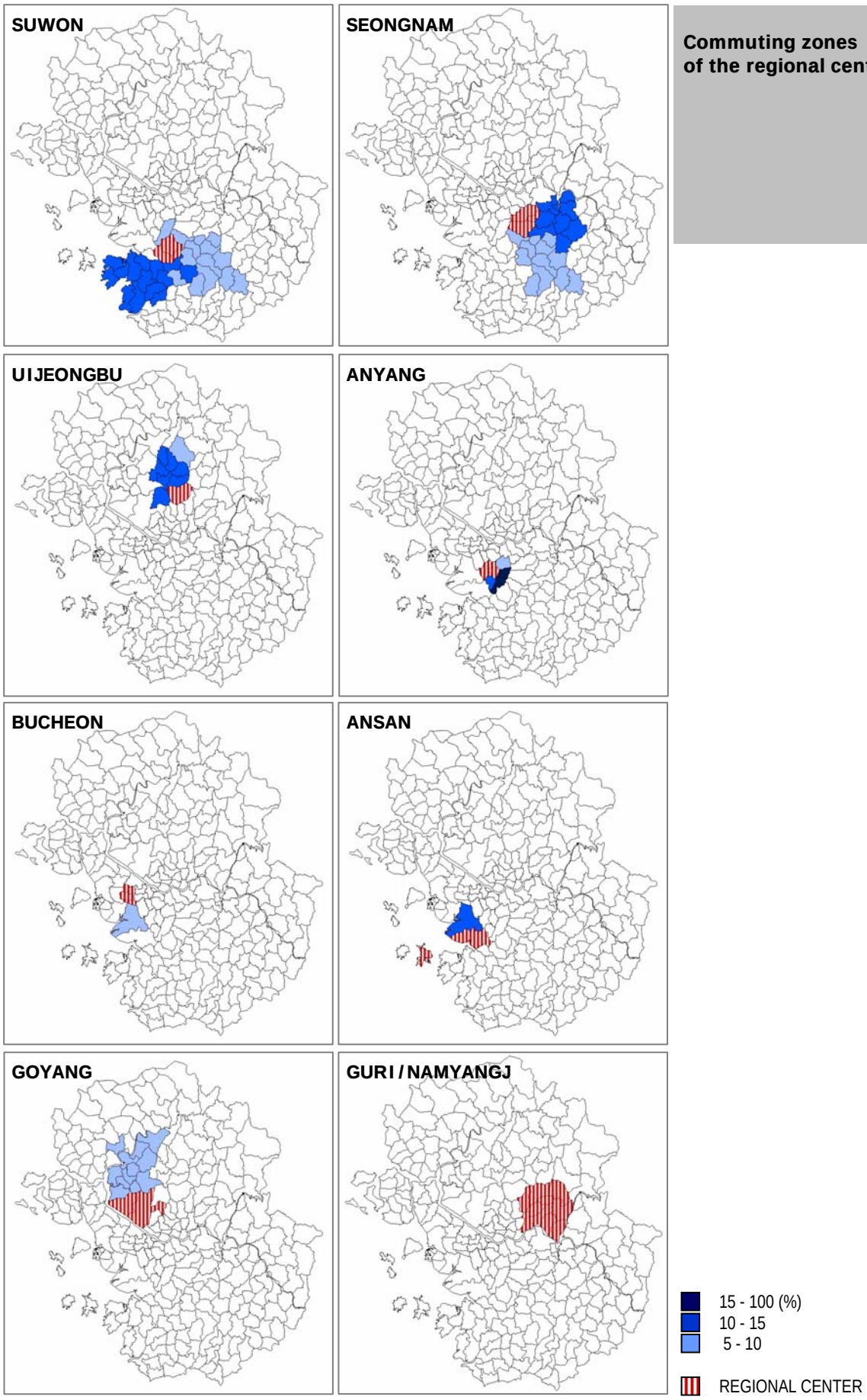


Fig.5-25 Commutating zone of the regional centers

5.2.4 Over-Regional connections

While organizing the urban networks in the region Seoul, a new administrative town should be connected with the region Seoul in particularly by the KTX as well as national highways. BRT or LRT (Light Rail Transit) can play a role in linking the new town with neighboring regional centers and urban facilities with regional- and international significance in the neighborhood. This vertical and horizontal networking can encourage the settlement of persons and organizations related with removed government offices from the region Seoul and it will help to grow a new administrative town into not a just satellite city of Seoul but a self-contained city encouraging regional development outside the region Seoul.

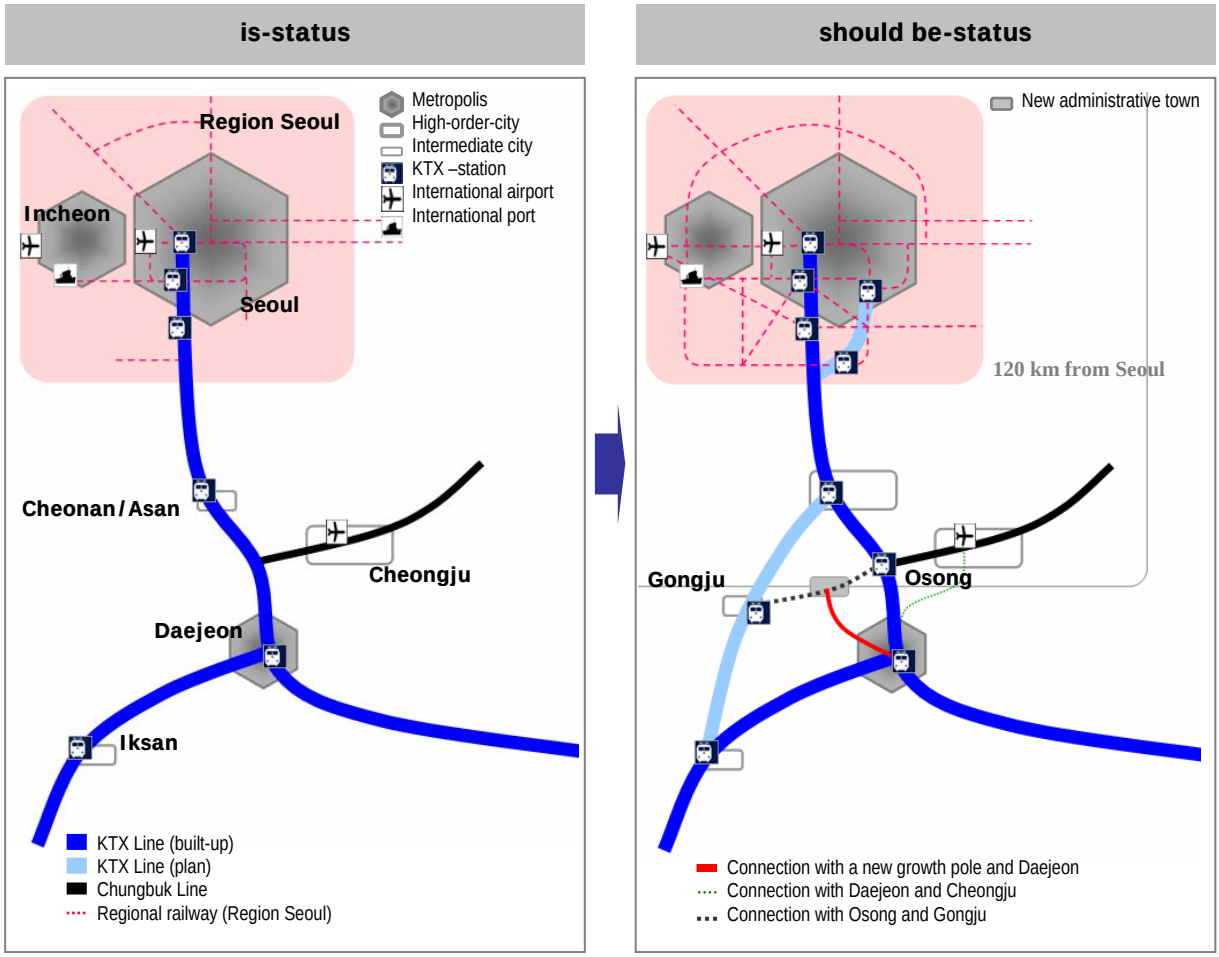


Fig.5-26 Schematic design on the city network at the over-regional level

First, the accessibility to Seoul should be improved by the KTX and it will encourage the migration from Seoul, even though Gongju/Yeongi area was chosen considering the accessibility from not only Seoul but also major cities in all South Korea. Now no one can arrive at this area easily by the KTX and it takes over one hour from a neighboring KTX station by personal cars.

Up to 2012 when government offices start to settle down, the construction of a new KTX station Osong nearest from the new administrative town should be finished and the access to the new town from this new station be improved temporarily by a BRT line.

In the first phase of settlement, based on the experience of the new administrative quarter in Daejeon, only a father could move and commute weekly. In this scenario, the poor access to a new administrative town by public transits might trigger the utilization of automobiles and increase the congestion cumulatively of highway No.1 (Seoul-Busan) that is now over the capacity.

In 2015, when the new section of KTX line (Seoul-Mokpo) connecting Cheonan/Asan and Iksan is completed, the time distance from Seoul will be shortened to 40-50 minute and travelers from southwest region can save about one-hour.

On the other hand, the regional networks encourage neighboring cities to share their regional and international functions. It can make double investments on the urban facilities avoidable and the efficiency of existing ones improved.

Until a new administrative town grows to a self-sufficient town, this new town is necessary to be functionally supported by the neighboring metropolis Daejeon. Daejon metropolitan subway line 1 should be extended at least in 2012 to this new town, in order to avoid the disqualification of urban lives from the deficit of urban services, which was experienced by new comers to five new towns around Seoul in late 1980s. The express service linking KTX station Daejeon-City hall Daejeon-Government office Daejeon-a new administrative town can help to strengthen the functional connections between two cities.

Regional transportation networks can be more intensified by two long-term alternatives:

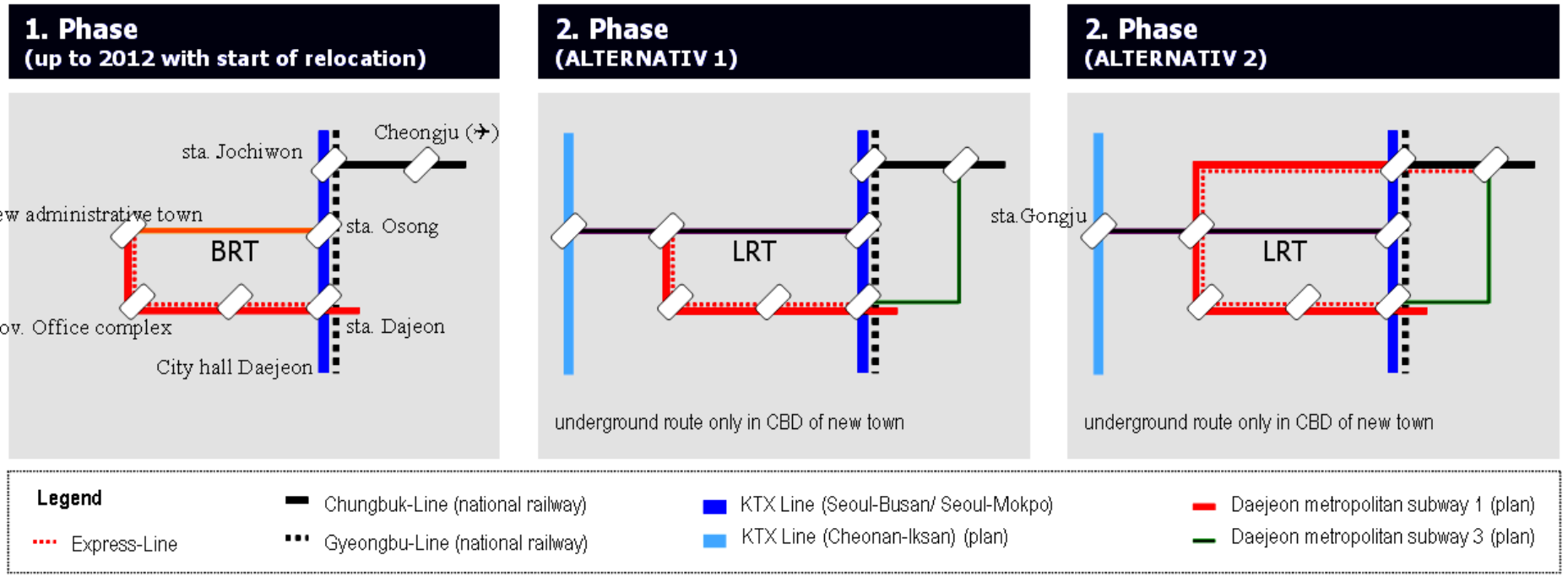
(1) LRT connection (KTX station Gongju-a new administrative town-KTX station Osong) connecting the Chungbuk line (national railway), if necessary, directly without transferring
(2) Extension of Daejon metropolitan subway line 1 to the station Jochiwon and direct joint with the Chungbuk line connecting Cheongju and Cheongju international airport and an additional LRT connection (KTX station Gongju-a new administrative town-KTX station Osong)

Alternative 1: The aforementioned BRT line can be replaced with a LRT line between an administrative town and a new KTX station Osong. It will help to improve accessibility from a new KTX station Osong connecting Seoul and the southeast region and this line can be extended in the long term to a new KTX station Gongju which will be constructed in 2015 on the new section Cheonan/Asan-Iksan. This LRT line constructed with standard track, even if it depends on demands, can connect via station Osong directly the city Cheongju with the international airport Cheongju and the metropolis Daejeon without transfer.

Alternative 2: It can be considered to extend the Dajeon metropolitan subway line 1 to the station Jochiwon. This extension project can make a direct connection with the Chungbuk line toward Cheongju and the international airport Cheongju. And the express service in the section of Dajeon, a new administrative town, and Cheongju can trigger urban coalition with these three cites in the Chungcheong province. In the central district of a new administrative town this subway line intersects, on the other hand, with an additional LRT line connecting with two KTX stations Gongju and Osong.

All two alternatives contribute to sharing specialized urban functions on the basis of inter-city transportation connections in the Chuncheong province. In particular the alternative 2 may be substituted for the Daejeon metropolitan subway line 3 connecting Daejeon and Cheongju, which is planed in the long term. Comparing the latter, the alternative 1 has an advantage in the construction cost and time but it is detouring line. Alternative 2 is expensive, even if it can connect directly three major cities in the Chuncheong province without any transfer and by express rail service. After the relocation of government offices and the stabilization of settlement from Seoul, suitable one should be chosen in the consideration of demands.

Fig.5-27 Alternatives on the connections with regional centers in the Chungcheong province



- Extension of Daejeon metropolitan subway line 1 to new administrative town
  - Introduction of express rail service in rush hour
  : sta.Daejeon (KTX)-City hall-Gov. Office Daejeon-new administrative town
- Construction of a new KTX sta.Osong
  - BRT-connection bet. sta.Osong (KTX) and new administrative town

- LRT-connection bet. sta.Gongju (KTX) new administrative town, and sta.Osong (KTX)
- Introduction of express rail service in the Daejeon metropolitan subway line 1
: sta.Daejoen (KTX)-new administrative town

- Extension of Daejeon metropolitan subway line 1 to sta. Jochiwon
  - direct connection with Chungbuk line
  - Introduction of express rail service
  : sta.Daejeon (KTX)-new administrative town-sta.Jochiwon Osong –sta.Cheongju (✈)
- LRT-connection bet. sta.Gongju (KTX) new adminsitrative town, and sta.Osong (KTX)

- advantageous in the construction cost and time comparing alternative 2
- detouring line

- advantageous in connections with regional centers comparing alternative 1
- substitutable with Daejeon metropolitan subway line 3

If a new KTX line (Cheonan/Asan-Iksan) is constructed in 2015, KTX can link a new administrative town in 10-20 minute with a new town Asan, where a university and company city with 500,000 persons will be constructed until 2015 around the junction of KTX line Seoul-Busan and KTX line Seoul-Mokpo.

At last, two KTX lines connecting southeast and southwest regions and regional railroads can make a 3 million-inhabitant-urban-Konzern of the four major cities in Chungcheong province: a new administrative town, Daejeon, Cheongju, and Asan. It can be supported by the 7X9 national highway system of national basic transportation plan 2000-2019. (Fig.5-1)

5.3 Planning implementation for network cities

Securing regional competitiveness and interest balance between not only regions but also generations, the concept of “balanced spatial structure” is characterized by similar level of welfare-relevant opportunities. On the contrary of its wide reference however the operation of this concept is difficult. Such a balance requires cooperation with agglomerations, cities and towns, and even rural areas and should be supported by bottom-up initiatives. The inter-regional autonomous cooperation promotes polycentric and sustainable development. It can be achieved in a form of network cities. The urban networks based on mutual cooperation improve inter-regional accessibility and functional complementation.

5.3.1 Process of planning (Organizational networks)

In the first phase, the central government needs to guide inter-regional communication, coordination and cooperation for city networks and mediate potential conflicts between participants. Projects that constituent cities commonly interest encourage inter-regional cooperation. The inter-regional communication should contribute to reducing the gaps of understanding and finding out the symbiotic solutions based on regional- or national consensus.

The organizational networks for inter-regional communication, coordination and cooperation can be realized by a presidential committee on balanced national development and current regional development committees. A presidential committee on balanced national development in the national context and regional development committees at the macro- and micro-regional level should suggest long-term but informal guidelines for urban networks. Based on a beneficiary principle the national- and regional committees should distribute fairly the administrative- and financial responsibility for joint development programs to all network partners.

In a working level conference working-level officials from municipalities participating joint projects establish general action plan and coordinate sectorial plans from working groups in the frame of a long-tern perspective by a development board. Sectorial working groups design applicable planning instruments to individual joint projects and control their execution. Here periodic meetings contribute to coordination of individual joint projects and experience and information exchange.

The suitability and priority of all project applications should be assessed by a planning advisory council. To examine project applications on a wide basis its member consists of experts from different fields. In case of several key projects, if necessary, the participation of other advisory groups and the holding of thematic workshops may be considered to exchange experiences regarding organisational and other practical problems and increase the efficiency of the program implementation. The periodical monitoring on the progress and results of implementation by a program monitoring committee should ensure the quality and effectiveness of implementation and accountability of the program operations. The results of assessment are to reflect decision of funding distribution and amendment of following programs.

On the other hand information technology can be utilized to improve trust in the transparency of decision making process and encourage bottom-up initiatives, too. For this the current well-equipped e-governance is to make more actively use of together with conventional instruments such as forums, public hearings, publicities, etc.

5.3.2 Contents of planning

Spatial development planning for urban networks however have to be tuned up with not only higher-order-regulatory plans but also regional plans of participating regions and even

neighboring non-partner regions' through cross-acceptance process. Consistency of planning encourages reducing functional conflicts and double investments and promoting functional sharing with neighboring communities.

The concept of network cities does not mean simply physical connections but it can deal with economic-, social- and cultural problems. Therefore urban network planning may include all sectional policies and particularly it needs an integrated approach with spatial-, transportation- and environment planning. Lots of individual subventions have to be integrated in the frame of this comprehensive planning, too.

5.3.3 Execution of planning

Diverse incentives can draw out without regional frictions the functional decentralization from the region Seoul to peripheries and impulse the structural change of region Seoul to an international finance and information center. However the urban network activities for decentralization and restructuring of region Seoul should be made in the context of sustainability with instruments following the development principles of concurrency, containment, and conversion. They include development agreement, development certificate, developers' contributions or land dedications, establishment of green-belt or urban growth boundary, transit-oriented development, compact and mixed use development, transfer of construction right or land parcels, etc. The progress of development activities and their impacts have to be monitored periodically and this land use surveillance can be supported by the current land information system equipped to control land speculation.

The cooperation between central- and local authorities and private economic actors will reduce the financial burdens of projects for network cities by public sectors and make market-based use of regional potentials to establish the strong and competitive economic position within not only the East Asian- but also the World market. The participation of private sector can be activated by the equipment of infrastructure in the strategic areas and one-stop administrative services and financial supports for potential SME (small and medium enterprise) as well as conglomerates. Local authorities can intermediate SME mangers, entrepreneurs, universities and institutions, business consultants and even central government to make an industrial cluster, a functionally identified node of urban networks.

5.3.4 Finance of planning

Along with diverse public-private partnerships the private sector can involve itself indirectly in the development of network cities through the REITs (Real Estate Investment TruSt). It was first introduced since 2001 in South Korea. The obtainability of large floating funds reduces the financial risk in the construction market and helps to revitalize obsolete but unique urban functions in inner city areas, where capital is more required for urban development than that in suburbs.

Network cities improve the regional accessibility and encourage the location of businesses in the periphery, but the development of urban networks pushes up development pressure in neighborhoods. It aggravates the speculative land purchases and sporadic development. To stabilize land markets and manage sustainable land use, therefore urban network planning should suggest a long-term comprehensive perspective as well as introduce diverse short-term restrictive instruments, e.g. continuous monitoring and alarm system of land speculation, interim sanction of land trade, declaration of land trade, specialized tax, etc. – Such regulations may hurt the individual property right stipulated in the constitution and drop a desire of development down, but they can support sound trades in the real estate market. Meanwhile the expected growth of tax revenues generated by development activities for urban networks and a part of development benefits should ensure the bond to finance the very development projects and programs.

5.4 Remarks

To convert the current mono-centric structure of region Seoul and strengthen the functions of other metropolises as global gateways, here were suggested strategies for network cities in South Korea.

The importance of urban nodes in a network structure is identified by attracting industrial investment, revitalizing indigenous industrial heritages, and networking specialized competitive companies, universities and public institutes (industrial cluster). The links as rods of network cities proceed in a three-layered way, connection between the agglomerations, between the major cities with regional importance, and inside an agglomeration region i.e. the connection between metropolis, its metropolitan region and rural areas. Hereby the road networks in a grid form should complement functionally the railway connections.

However physical transportation connections for network cities should be supported by operative integration with long- and short-distance transportation services. Prior to the construction of new transportation lines, the efficiency of existing and even resting connections also has to be raised up by the facility improvement. The secured punctuality and the reduction of travel time by those operative efforts can bolster the urban coalition more strongly.

The concept of network cities with an example of South Korea was developed from national and regional requirements. To investigate more exactly influences of the regional urban network system, its effects were separately represented at the micro- and macro-regional level. Through these multi-layered approaches three differentiated models of network cities could be presented:

- Network cities for the decentralization of a consolidated area by a national access,
- Network cities for the management of urban sprawl by a regional access, and
- Network cities for the development of structurally weak rural areas by an over-regional access.

City networks of South Korea in 2030

Following the aforementioned urban network concepts, here city network of South Korea in 2030 was sketched. (Fig.5-28) By constructing industrial clusters based on potentials of individual metropolitan regions urban nodes are functionally identified: Seoul as an international financial center, Incheon and Busan as international logistic centers, Dajeon as an administrative and research center, Daegu, Gwangju and Ulsan as industrial centers, respectively a textile and electronic industrial center, a culture and optical industry center and an automobile and ship-making industrial center.

Agglomerations, cities and towns are hooked up each other by railways and motorways. The high speed transportation networks connecting agglomerations play a role as high-order urban links to support decentralization of metropolitan functions and interchange of high-ranked urban service. The construction of new KTX line in section between Seoul and Gwangju/ Mokpo and the linearization and electrification of current Gyeongjeon which made possible running of KTX trains in the section between Busan and Gwangju complete an urban triangle in the south of Korean peninsular. This triangle connecting Deajeon, Daegu, Ulsan, Busan and Gwangju plays a role to compete functionally with region Seoul as a counterweight and supplement metropolitan functions of Seoul. The increase of inter-Korean cooperation requires the extension of current KTX lines to the North Korea and the capacity addition of KTX line in section Daegu-Busan speeds up the time distance between Seoul and Busan and reduces the congestion of existing KTX line Seoul-Busan caused by the construction of international high-speed line between Geojae and Simonoseki (Japan).

Motorways between Seoul and major cities on the South coast and five national rail trunks connect national- and regional gateways with major cities and towns to facilitate logistic flows as well as passenger trips. They relive capacity overloads of urban links by KTX, too. On the other hand, the insufficient East-West urban links are intensified by constructing the new rail sections, Gwangju-Daegu and Seoul-East coast. Along with motorways connecting cities on the East and the West coast, they support the North-South urban links and help the regional understanding between Gyeongsang and Jeonla province always in the competitive relation. They also impulse regional development in the periphery by improving regional accessibility, which encourages the relocation of industrial plants from congested metropolitan regions.

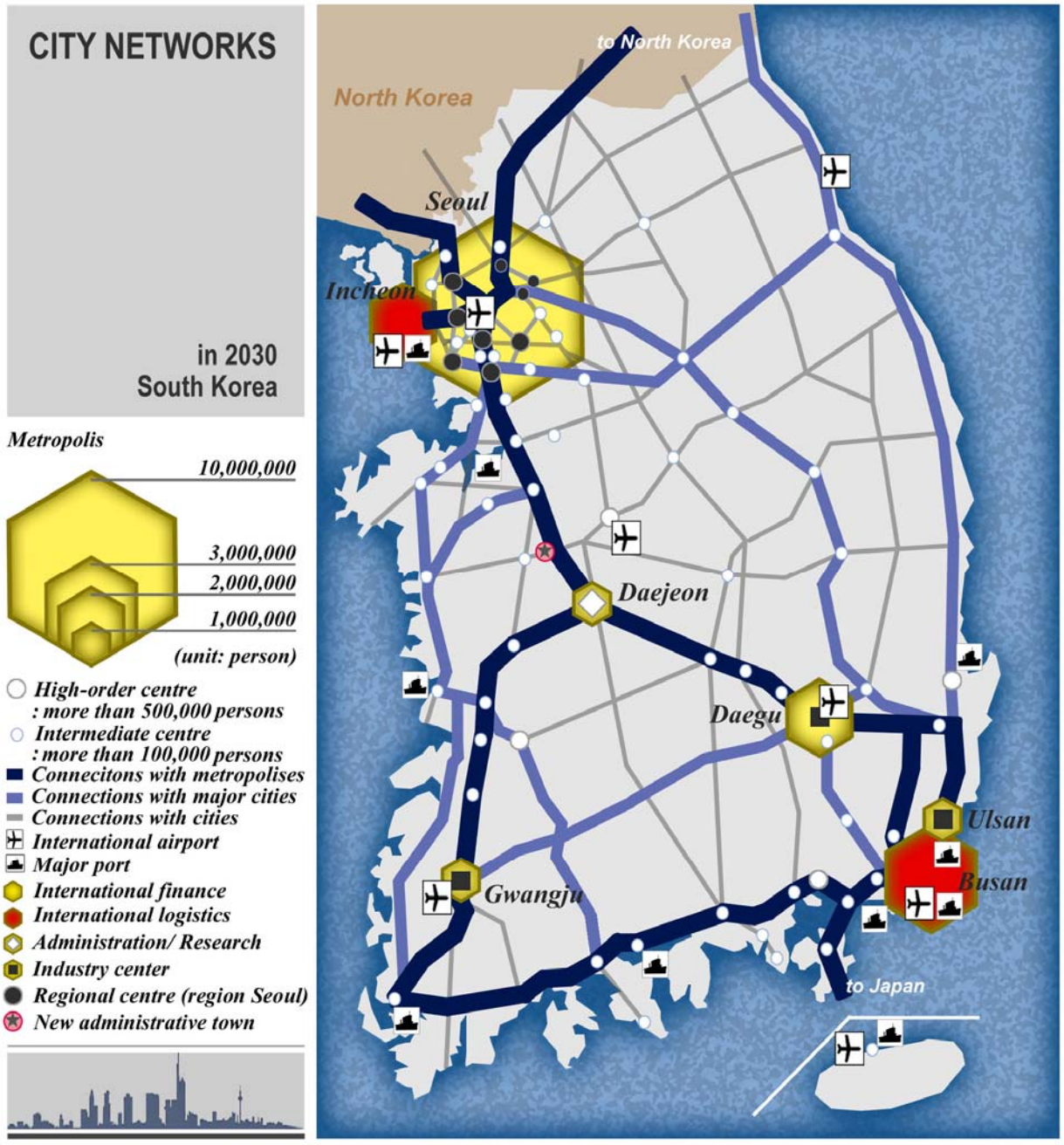


Fig.5-28 City networks in 2030, South Korea (suggestion)

Urban networks in the region Seoul which focus on the constructions of regional centers (Suwon, Seongnam, Anyang, Ansan, Bucheon, Goyang, Uijeongbu, and Guri/Namyangju) in the reach of Seoul, their tangential rail connections, and interregional road system in a grid form restructure this extremely concentrated metropolitan region to a poly-centric structure

which relieves urban congestion, intensifies regional competitiveness and ensures qualified diverse urban life in sustainable ways. Meanwhile a new administrative town in the Chungcheong province contributes to the decentralization of metropolitan functions. Mutual complementation with not only the region Seoul but also neighboring metropolis Daejeon and major cities, Cheongju, Cheonan and Gongju are facilitated by railway and road connections, inclusive KTX connections.

Effects of city networks in South Korea

Ministry of construction and transportation estimated the construction of metropolitan circular rail lines and the introduction of additional express rail service to bolster up vertical and horizontal urban networks in the region Seoul can increase the current modal spilt of rail roads in the region Seoul from 24% to 40% and improve the speed of rail service from 35km/hr to 50km/hr. (Chosun-ilbo 2004a, 2004b)

The aftermath from the construction of a new administrative town was here prognosticated, referring to results of development effect assessment on a failed construction plan of new administrative capital (Presidential committee on administrative capital relocation, 2004a: 25-29). In this research the decentralization effects of a new administrative town were estimated at the 60% level of a new administrative capital's, in that a new administrative town will be constructed to a new town with 300-500 thousand people, differently from a new administrative capital with 500 thousand inhabitants.

Up to 2015 when central government offices are relocated completely from the region Seoul, about 140 thousand migrants will settle down to a new administrative town and the demographic decentralization will amount to 300 thousand persons in 2030. On the other hand, about 400 thousand people will move in 2030 into the Chungcheong province, where a new administrative town is constructed.

unit: person

year	Emigrants from the region Seoul	Immigrants to the Chungcheong province
2015	141,945	178,275
2020	180,847	228,762
2025	237,742	301,555
2030	307,947	390,931

Note: The population increase in the Chuncheong province is estimated with 80% from the region Seoul and 20% from the non-region Seoul

Tab.5-13 Effect of the construction of a new administrative town on the demographic decentralization

The location of a new administrative town in the geographic central region of South Korea will also reduce the time budget from major Korean cities to central government offices. On the average, 16.6% can be reduced by road and 1.4% by a train, comparing the travel time between Seoul and major cities mostly located in south of Korean Peninsular. However the time-distance from the region Seoul and the Gangwon province will increase on the contrary.

The decentralization of administrative functions contributes to congestion relief in the region Seoul. This project will reduce 2.0% of total current traffic volume in the region Seoul. The reduction of traffic congestion in the region Seoul can save yearly about 1.68 billion US $ and improve the environmental quality as well. On the contrary of inner-traffic reduction in the region Seoul (-2.5%) however the total traffic influx from non-region Seoul will increase by 1.0%, because the traffic increase from the Chungcheong province is expected to surpass the decrease from the non-regions Seoul except Chungcheong province. Therefore the increased traffic volume between the Chungcheong province and the region Seoul must be accommodated with public transportation and the self-sufficiency of a new administrative

town should be intensified by a city-networking with neighboring regional cities to reduce the traffic influx from the Chungcheong province to the region Seoul.

unit: thousand trip /day

	Traffic volume in the region Seoul				
	Region Seoul ← Region Seoul (1)	Region Seoul ← Non-region Seoul			Total (1)+(2)+(3)
		Chungcheong prov. (2)	Others (3)	Total (2)+(3)	
Before	23,343	1,370	2,736	4,106	27,449
After	22,757	1,474	2,673	4,147	26,904
Increase	-586	104	-63	41	-545
Increase (%)	-2.5	7.6	-2.3	1.0	-2.0

Tab.5-14 Change of traffic influx to region Seoul before and after the construction of a new administrative town

The construction project of a new administrative town will affect to national economy, too. In 2010-2011 when the construction procedure almost arrives to the finial phase, GDP is expected to increase maximally 0.25% and yearly 220 thousand construction workers can be newly employed up to 2030.

6 Development concept for network cities

Depending on the theoretical and practical studies with an example of South Korea, the development criteria for network cities were suggested and the development procedure generalized. This concept for network cities can be an alternative to prevent urban polarization and restructure or maintain a balanced and sustainable spatial structure. It can be applied not only to countries or regions carved deeply with mono-centricity but also to decentralized areas in danger of polarization. In this research the approach for network cities is on the focus of physical urban networks and interchange of metropolitan functions between constituents in the network system supported by transportation connections, where the railway connections are complemented by road networks.

Six criteria for network cities here are a synthesis of ideas from existing planning concepts. They include TOD (transit oriented development), UGM (urban growth management), urban renewal, MXD (mixed land use development), compact city, transportation corridor design, ABC policy, TDM (Transportation Demand Management) and green infrastructure. The emphasis of development criteria focuses on both centers and their connections.

The procedure to construct network cities can be made in two-layered approach including the national- and the regional access. In the complementation with urban networks accessed at the national level, network cities are to develop in the regional context. The national approach of urban networks encourages the interchange of metropolitan functions with agglomerations and major cities, whereas the network cities in the regional context helps to increase mutual complementation between urban and rural areas and carry out sustainable development by managing urban sprawl and promoting compact and integrated development. And the macro-regional approach can be additionally taken in a case of constructing a new economic center outside regional boundary to decentralize congested urban functions in the metropolis and develop the periphery.

A project for network cities should proceed so-called by the package approach which is integrated with mixed land use planning, multi-modal transportation planning in particular oriented to public transport connections, and ecologically systemized environment planning. It must be tuned up with sectoral- and higher-order spatial plans as well as land use plans of neighboring communities and carried out within the developable capacity. At that time a development organization can be established to help the communication, coordination and cooperation between decision makers. For the flexibility of operation it may be in an informal and ad-hoc form.

6.1 Development criteria

Develop the brown filed prior to the green field

To control the undesired urban encroachment into the green field worth to conserve for the qualified urban life and the natural system, first the integrated approach with land use-, transportation- and environmental planning should be introduced. Based on this comprehensive planning, development activities must be performed compactly within urban development boundaries and around public transportation stations along transportation corridors like a pearl necklace.

The introduction of bonds for the inner city development and the open space conservation by central- and local authorities can help to utilize the limited resources more compactly and protect ecologically sensitive areas from urban sprawl. However the access to funds should be limited against the development activities which do not meet the minimum performance standards for the efficient land use or the land conservation.

With financial measures the political instruments such as the adoption of urban development boundary, the designation of urban priority area and the conservation priority area will give priority to the investment in the built-up area and the conservation of ecological milieu securing the healthy urban life and sustaining natural resources. On the other hand, individual projects inducing urban dispersion must be controlled through the development certifications by communities. When their development impact reaches over a jurisdictional boundary the projects can be managed by a regional organization that

- makes a regional plan through trade-off with stakeholders,
- gives communities advice to keep the planning consistency with regional plans,
- distributes the development grants equally, and
- mediates conflicts between local authorities. (Kim, Won 2004, Kim, Jae-Kuk & Lee, Sang-Dae 2001)

The GIS-based surveillance system can also help to perceive the developable land stocks in the inner city areas and guide the undesired development in the green fields.

Drive land use development in the conjunction with infrastructure provision

The spatial development has to be compatible to the existing infrastructure capacity and otherwise it must proceed in conjunction with the infrastructure provision. The approach of UGM can make a sound and balanced urban development supported by marginal urban services and keep the qualified urban milieu from the highly densified development activities in the inner city areas or small-scale and sporadic development activities in the green field near at built-up areas.

By beneficiary-pay principle developers ought to be responsible for the provision of infrastructure through paying charges for their use of the publicly invested infrastructure or providing infrastructure at their own cost. Balancing with the capacity of existing or additionally providable infrastructure, the development density should be controlled, too. - Without the available infrastructure the development can’t be allowed.

However the development impact fee should be levied, considering land use type and FAR (Floor Area Ratio) of a building and following the explicit regulations which define kinds of infrastructure, standard for cost estimation, cost share, financing methods, concerned municipalities’ support, etc. (KRIHS 2002)

Make transportation corridors supported by public transits

The road- and rail road networks connecting the central city and its regional centers form transportation corridors in the metropolitan region and the urbanity expands along them. However the vertical connections with the metropolis and regional centers may bring up the spatial dichotomy composed with a center and its hinterland.

On the other hand, the transportation networks between regional centers in the metropolitan region help to overcome the dichotomized spatial structure smoothing regional characters and build up a basis for active exchange of people, materials, and information. This inter-communal interchange supported by transportation networks prevents the monopolization of regional services by the metropolis and facilitates sharing natural and cultural heritage in the metropolitan areas.

Sharing multiple urban services through the transportation corridors increases traffic volume and encourages various transport services. Convenient connections also facilitate to develop diverse activities along the metropolitan corridors, which can be interpreted as a spatial decentralization process. However the most of trips along the corridors should be made by various public transportation modes responding a wide range of users' demands. It can reduce the traffic congestion by the automobile and lessen the impacts on the nature.

In case of highway capacity addition on a transportation corridor, travel time can be reduced and accessibility promoted in a short term, but the added road capacity facilitates to increase traffic volume cumulatively by private cars and build an auto-oriented urban form along this corridor. This auto-oriented urban development triggers motorization and gives negative impacts on the nature in form of urban sprawl that demands again the capacity increase of highway. At last the total effect by road capacity addition might be a zero-sum or even the worse.

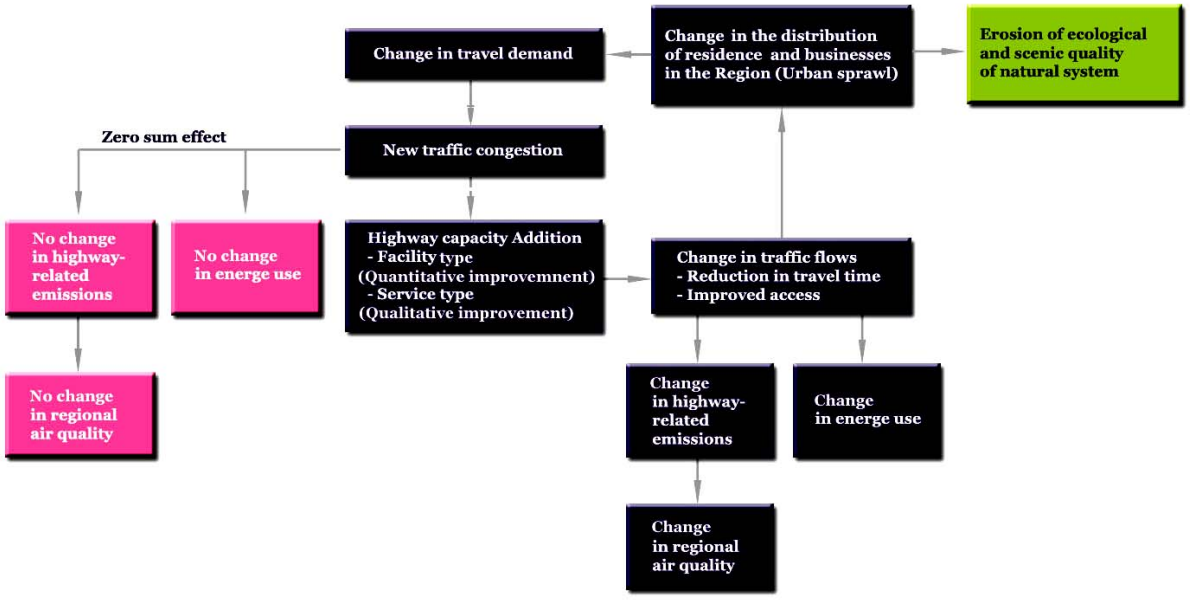


Fig.6-1 Impact of highway capacity addition

On the other hand, the capacity addition of public transportation on a transportation corridor can gain the win-win effect. It can help to make an urban form based on the TOD-principle and improves the ecological quality of the nature.

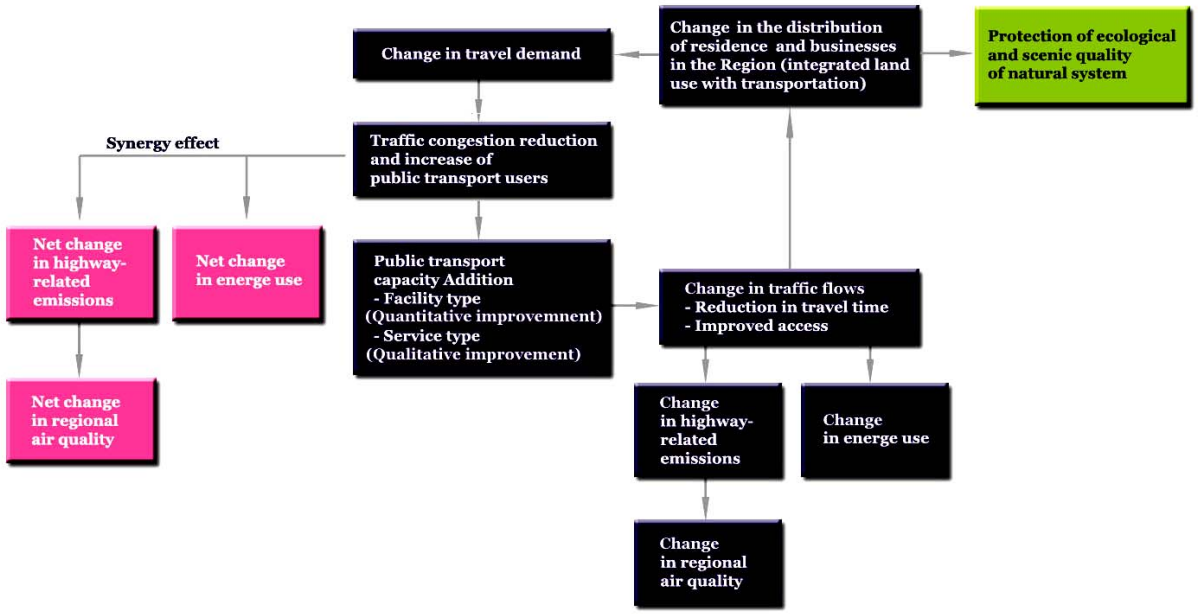


Fig.6-2 Impact of public transport capacity addition

Integrate inter-modal transportation networks with compact urban development

As intra- and inter-regional trips grow up, the needs of diverse transport services increase and the functional connections between different transit modes are more significant. Here individual transit modes interface complementarily in a hierarchically layered system. This hierarchy of transit system is derived from the hierarchy of land use pattern. That is, the important economic and administrative centers must be connected by express transit modes (long-distance oriented) and activities in neighborhoods by user friendly slow ones (short-distance oriented). (Kim, Won-Bae ed. 2003: 94)

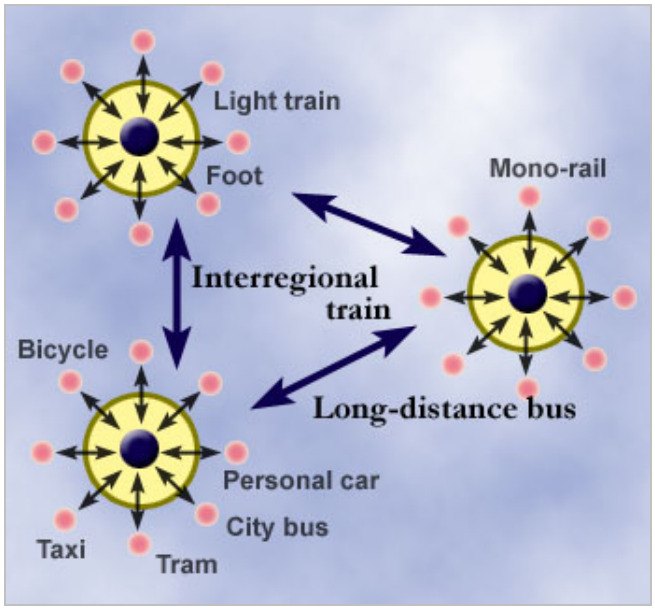


Fig.6-3 Integrated transport network in the functional hierarchy

The well-equipped transit connections between not only inter-hierarchical transit modes but also inner-hierarchical ones can increase the efficiency of current transit system and improve the speed and punctuality of public transit service. Consequently it helps to increase the attractiveness of public transport, which can support the construction and maintenance of transportation infrastructure. However the operational coherence between public transit

providers is as much important as physical integration with transit modes to ameliorate the inter-modality of public transits. Here a good example is integration of operation schedules and tariff systems through establishing a regional transportation organization.

However these inter-modal transport connections should be introduced in the conjunction with compact urban development that reduces the travel distance but increases mobility of persons and goods. This integrated approach intensifies city networks cumulatively by public transportation and contributes to the stabilization of motorized traffic volume in the cities, even if it can't reduce. On the other hand, this integrated planning encourages the urban renewal in inner city areas with well-equipped transportation connections. Therefore the feasibility to redevelop deserted rail yards, old industrial areas and other brown fields should be investigated in an early stage by a test planning[16] and available integrated approaches have to be practiced through a pilot project.

The restriction or remove of private traffic in transport nodes, such as at the front of railway- or bus stations, dose not only vitalize diverse land use activities in their neighbourhoods but it is also an appropriate measure to secure the safety of public transport users and improve the milieu of access to transit modes not by cars but on foot or by bikes: traffic calming - for all time or a limited time section -, public transit mall, B+R (bike and ride) facilities, etc.

Promote and diversify the regional economy

The improved accessibility to a regional centre will encourage and support to keep as many jobs in the area as possible, which are not merely a basis of local revenues but a catalyst of the regional development. The settlement of exogenous industries can be also supported through the education and training initiatives collaborated with local authorities, schools, businesses and developers.

However the spatial restructuring activities which ignore the regional context and increase the rental fees can make indigenous firms operate on a marginal existence or forced out, even though their growth can exploit out the regional own potentials and prevent the regional smoothing by the expanding scope of the metropolis. In order to keep the native industry and draw the investment, therefore the diverse policies for supporting the regional industry should be introduced and they are subvention, tax reduction and exemption, and deregulation, etc.

Meanwhile the development of web-based connections can contribute to clustering industries beyond regional boundaries and facilitating the cooperation with entrepreneurs, researchers marketing agents and manufacturers.

[16] Test planning is an informal planning procedure, but it can clarify preconditions and key problems to treat a difficult project. Test planning procedure is thus usually introduced for supplementing formal ones. It is particularly suitable to execute difficult interdisciplinary tasks or find integrated solutions.
Test planning differs clearly from a usual site analysis, because it makes clear which information and what kind of knowledge is necessary for clarifying and solving problems and expected conflicts.
For the success of test planning the setting of tasks and the organization of participants is important. The competitive process is also a substantial characteristic of test planning. Therewith the spectrum of possible developments can be better clarified and important questions asked from different perspectives.
A test planning should be accomplished simultaneously by at least three planning teams, because a team could be dropped out on the way of planning. It takes about 6 months inclusive of preliminary and summary phases. The central task of teams is to find out conceptual solutions and apply conceptions to a project.
The process is simple. It takes three steps, workshop, intermediate-, and conclusion presentation, supported by one or two process managers. At that time the planning committee of 5-10 specialists leads the tasks of teams. (www.isl.uni-karlsruhe.de. 2005)

Optimize the function of regional natural systems

The linier urban development along metropolitan transportation corridors can protect the ecological and scenic quality of natural systems and make green corridors. These green corridors have to connect diverse green space elements in scale and landscape types across jurisdictions, so it should enable to function as an ecological whole. However green areas don't imply only public owned lands but include private properties. The systematic green networks therefore can be achieved through the reciprocity between public- and private sector. (Benedict & McMahon 2001)

The analysis on development potentials in built-up areas encourages inner city renewal prior to development activities in the meadow destroying environmental functions. This analysis can also help to guard the ecological reserves in inner city areas and connect them with regional green networks. Meantime, development activities in the inner- and outer cities should be monitored continuously not just at a local scale but also at a regional scale and guide development along transportation corridors.

For the sustainability, the trips should be made preferentially along transportation corridors by various public transport modes and the introduction of environment friendly transit modes can reduce the negative impacts on the nature. They are LRT (light rail transits), LPG (Liquefied Petroleum Gas) vehicles, LNG (Liquefied Natural Gas) vehicles, etc.

6.2 National approaches for network cities

6.2.1 Construction of urban connections

First, the strategic areas with the economic importance to the whole nation are designated. They can be the metropolitan regions with the central facilities of international- or supra-regional significance. The urban connections - so-called the constructions of rods of network cities - proceed in the three-layered way and integrate systematically each other:

- Connections between the metropolises,
- Connections between the major cities with regional importance, and
- Inner-metropolitan connections, which should be approached at the regional level.

In particular the accessibility between metropolises should be improved by high-speed railway system that triggers to decentralize metropolitan functions through reducing the time-distance. However high-speed railway system must be well integrated with other short-distance transits for the reduction of access time to the high-speed transits. As the middle-distance transportation connecting 200-500km zones it has a comparative advantage especially against airplanes, depending on the empirical data of France, Germany, Japan and South Korea.

	Road connections (personal car)	Rail connections (high-speed train)	Air line connections (domestic line)
Accessible Zone in 30min.	30-50 km	100-120 km	200-250km
Location of a Terminal	Near at Home	City center	Outskirts of City
Boarding time	0 min	5-10 min	30 -40 min
Fare	(relatively) Cheap	Not Cheap	Expensive
Transport Capacity	3-4 persons	800-900 persons	300-400 persons
Punctuality	Bad	Good	Good
Safety	Bad	Good	Very Good
Emission Gas (NOx)	Very High	Very Low	High
Zone with Comparative Advantage	less than 100km zone (Short-Distance)	200-500 km zone (Middle-Distance)	over 500 km zone (Long-Distance)

Note:
(1) An airplane usually takes about one hour for 400-500 km zone. Based on it the distance is estimated to be reached in 30 minutes.
(2) Fare is calculated in case of one-person-travel and a special condition such as car-sharing, special tariff, cheap airplane service, etc. is not considered.
(3) Transport capacity is different from machines. Here the capacity of a high-speed train is estimated from the seat number of IEC2-vollzug (782 seats) and ICE3-vollzug (884 seats) and that of an airplane roughly calculated from the seat number of B-777-200 (388 persons)
(4) Evaluation of emission gas depends on the data by Lee, Chang-Hoon et al. (2004: 77)
(5) Zone where a transit mode has a comparative advantage against others is estimated from empirical data of France Germany, Japan, and South Korea. (KRIHS 2003)

Tab.6-1 Features of transportation connections by cars, high-speed trains, and airplanes

The networks with major cities can support the high-speed inter-metropolitan connections and reduce their functional overloads as by-pass routes. They will also impulse the regional development. On the other hand the improvement of inner-metropolitan cohesion, cumulatively by railway connections, relieves not only the transportation congestions but also the ecological impacts in the metropolitan region.

With the construction of new railway sections cumulatively for high-speed trains, on the other hands, the efficiency of resting and using railways should be also raised up by the systematically integrated transportation services and the improvement of track facilities, such

as double tracking, the linearization and electrification of rail lines, the construction of express lines, the performance improvement of railway vehicles, etc. That contributes to the improvement of punctuality and the reduction of travel time.

6.2.2 Functional identification of urban nodes

Regarding regional potentials the cities as nods of city network system are functionally identified in the long term by industrial specialization. Here the regional authorities need to engage themselves actively in these projects. However in the first stage the involvement of central government can help to pave the way of the regional specialization. It can be done in the forms of relocation of public organization related with the regional strategic industry, subvention for equipment of infrastructure in the strategic areas, and administrative service and financial supports for the location of potential SME (small and medium enterprise) as well as conglomerates.

Communication, coordination and cooperation help functionally identified regions to share and supplement their own functions with other cities and the neighboring metropolitan region and controls the interregional conflicts to attract potential companies or to locate urban facilities. At last it can maximize national competition.

Depending on the development conditions, however this procedure to make city networks can be reversed, that is, the nods can be identified functionally prior to the improvement or construction of rods in the urban mesh.

6.3 Regional approaches for network cities

Considering city networks at the national level, the urban network system is approached at the regional level and if necessary, at the over-regional scale. Reflecting physical and social factors, first regional economic centers are selected in the metropolis and its periphery. Spatial theories and statistical tools can help to choose the regional nodes: such as central place theory, Benison's centrality index and life region analysis based on the transportation corridors. In particular a new growth pole with national meaning should be suggested on the consensus not only from regional inhabitants but also from whole people to make a success.

Next, connections with regional nodes are considered by multilateral approaches: regional approaches respectively for metropolitan- and suburban area and if necessary, over-regional access. At that time the nodal connections include horizontal tangents as well as vertical ones with the metropolis. The priority of implement projects is determined on the basis of following factors.

- Expecting population increase and traffic volume between cities,
- Development impact on existing land use-, transportation- and environment patterns,
- Consistency with the local-, regional- and national land use regulations, and
- Financing measures.

This implementation strategy is applicable particularly in the situations, such as;

- the population in the metropolitan area is projected to increase in the future at the expense of periphery,
- the metropolitan area is in the mono-centric spatial structure,
- the metropolitan area is now in a suburbanization stage, so-called urban sprawl,
- an auto-oriented land use development is expected which can cause the increase of motorized travel volume between the central city and its suburban area, and
- the basic infrastructure, cumulatively road system, connects the central city radially with its suburban cities and other major cities over the metropolitan boundary.

Fig.6-4 Development process for network cities at the (over-) regional level

6.3.1 Designation of regional centers

The shortage of developable land stocks and the higher rents in the metropolis expel citizens rooting their lives in the big city to suburban areas without marginal urban service in the small-scaled and scattered pattern. The mono-centric urban structure of the metropolitan region based on functional dichotomy makes congestion in the center more weighted.

To de-polarize the concentrated spatial structure and to reduce the negative externality from urban sprawl, it is necessary to restructure current provincial and regional cities to economic centers with regional significance or construct a new one around the metropolis. While supporting and sharing the metropolitan functions, regional centers must be able to provide communities in suburban areas with diverse urban services; employment opportunities, consumer services, educational and cultural facilities, medical and welfare services, etc. On an occasion a new growth pole can be constructed over the metropolitan boundary in order to relocate a part of metropolitan functions from the metropolitan region. A functionally self-sufficient new economic center will reduce urban congestion in the metropolis and impulse regional development in the peripheral areas.

However inter-region communication is here inevitable to avoid functional conflicts between the metropolis and regional centers. This functional complementation between them affects an efficient use of the existing infrastructure and supports the sustainable development. But the mutual cooperation means neither spatial dichotomy nor functional smoothing resulted from the sprawling metropolis.

A regional center is chosen in the consideration of

- size of population,
- existing inter-regional physical connections
- developable land stocks to accommodate emigrants and metropolitan functions mainly from the metropolis
- regional centrality depending on industrial structure,
- life style of people in the metropolitan region, and
- land use plans and regulations.

For the selection of nodes, some spatial theories and statistical tools can be introduced, such as central place theory, Benison's centrality index and concept of transportation corridors.

On the other hand the spatial structure of metropolis itself should be rearranged to exploit out the effect of urban networks. In case of the mono-centralized metropolis several new sub-center might be made around the CBD to reduce the functional overload from urban congestion in the inner city area. The improvement of physical connections can facilitate to share and supplement diverse urban functions between the old city center and new sub-centers.

6.3.2 Restructure of regional centers

Restructuring regional centers is to maximize land use potentials and improve the efficiency of spatial network systems which can prevent the urban sprawl and make the decentralized concentration. Ensuring ecological networks with diverse green areas at the regional level, the inner city development is prioritized. Only in case of no alternative except the outer development, it can be done but carefully. For the sustainability the development in the meadow must functionally fill up the built-up area. As an instrument for the analysis on the developable land stocks in the built-up area, the Information platform can be introduced which is installed through the project "sustainable land use management Stuttgart".

In consideration of sustainable options regional centers are restructured through

(1) urban renewal of functionally obsolete and disharmonious areas,
(2) MXD (mixed use development),
(3) UGM by zoning and density control, and
(4) TOD (transit oriented development).

These development activities can help to

(1) create the restful and nature-rich urban milieu and supply marginal urban services
(2) offer diverse urban functions within the walking distance,
    reduce the motorized traffic volume and attract walking and biking, and
    solve the functional mismatch increasing physical distance between working places and homes
(3) regulate the intensive development overloading the capacity of existing infrastructure (e.g. roads, water supply and sewerage facilities)
(4) reduce emission gas and save fuel energy, and
    increase the attractiveness of public transportation and its patronage.

Meantime the introduction of green belt around the metropolis and the designation of urban growth boundary surrounding the metropolitan region can be considered to promote the inner city development and prevent the small-scale and sporadic residential development activities in a meadow which impede now sound and balanced urban development and degrade the quality of environment. Yet, these development containment activities can bring on some nuisances due to the concentration of development to the definite boundary; such as soaring land price, capacity overload of infrastructure, particularly housing, roads, water supply and sewerage facilities, pollution resulted from urban congestion, etc.

Considering the role of each regional center, differentiated restructuring instruments should be introduced. To help selecting suitable treatments, regional centers were categorized with three types:

- City center and its sub-centers in the metropolis,
- Regional centers in the metropolitan region, and
- A new growth pole over the reach of metropolis.

City center and its sub-centers in the metropolis

To facilitate use of public transits, improve a pedestrian environment and avoid additional demands for new road capacity in the metropolis, intensive and mixed land use development activities should be introduced cumulatively in a 500m-radius zone around a railway- or subway station connected with short-distance transit modes. To reduce the private traffic volume a public transport priority zone can be designated and at the same time diverse TDM measures should be carried out in the cooperation with neighboring authorities.

In addition, the old city center that is now obsolete not only physically but also functionally should be revitalized so-called to the ICBD (International Cultural and Business District) through intensifying the international connections yet in harmony with lots of cultural relics and its typical natural milieu. The unique urban, cultural, and natural elements in the old CBD are to interweave each other by pedestrian and bike paths. The characterized landscape in the old city center composed with the old and the new as well as the artificial and the natural can be kept by a large scaled planning approach.

An integrated approach with land use-, transportation-, and environment planning is applied to a sub-center as well as an old city center. However the function of a sub-center should be

specialized in the relation with its hinterland and the networks between them have to be made through communication, coordination and cooperation.

Regional centers in the metropolitan region

Regional centers in the metropolitan region, i.e. in the reach of the metropolis, play their role as sub-centers substitutable for the central city through providing qualified urban service to suburbs on the basis of physical linkages.

Not only residential development in regional centers but also movement of employment and commercial functions from the metropolis can solve housing shortage in the metropolis and reduce commuting time to the city center. However the implanted metropolitan functions should be supported with urban service substitutable for that of metropolis as well as physical connections to the central city, because the removed urban functions are still in the relation with the metropolis.

The necessity of physical connections and substitutable urban service in regional centers can be proven with Korean and Japanese cases. The deficit of infrastructure connecting Seoul and the importance of face to face contacts with relevant agencies, even still in an electronic modern society, make about half of government offices relocated to the countryside come back to Seoul or region Seoul. Some organizations and businesses hesitate to resettle in the business core cities around Tokyo due to the delayed urban services.

The revitalization of indigenous industries as well as the settlement of exogenous ones not merely form a basis of local revenues but also catalyze the development of regional centers. The promotion of regional industry can reduce the concentration to the metropolis, but it should be complementary and competitive with neighboring ones. The transportation and communication networks with the metropolis and other regional economic centers make easy to cluster functionally with industries in neighboring regions.

New growth pole over the reach of metropolis

To curb the urban expansion and build up the decentralized concentration over the boundary of metropolitan region, a new growth pole is constructed in the periphery which features like not a satellite city but an autonomous partner city with the metropolis. Restructuring an existing city center can cut down the cost for new additional infrastructure by sharing existing one in the old city and keep the sustainability by encouraging the development in brown fields. However a newly built up area reflecting a modernized urban life usually grows at the cost of an old city area featuring conventional urban milieu, so the development of a new town needs to be approached in the comprehensive context including an old town. Otherwise, it may give rise to functional conflicts and a regional division into an old- and a new urban district.

A new growth pole should be located so far from the metropolis to achieve the functional independence from it and pull the development of its hinterland. Even though Hennings et al. (1980: 77-115) recommended that a new growth pole be set in the 50-100km-raduis zone from the central city, but the distance depends on the reach of the metropolis which can be estimated through the analysis with O-D data of commuting trips. A 30-minute-distance area by an express train might be also recommendable. In general commuting trips generate within a half hour zone and this time distance can encourage migrants and businesses to resettle from the metropolis to a new growth pole. However the functional independence of a new growth pole has to be kept through improving connections with neighboring cities and sharing various urban functions with them.

Based on the German central place theory its population size should be at least that of an intermediate center, but the dynamic urban interchange supported by physical connections makes the size of city unpredictable, now.

The development activities on this pole must be progressed step by step within the capacity of existing or constructing infrastructure and be monitored not only at the local level but also at the regional level to prevent small-scaled and sporadic residential development in a green field. On occasions, the urban growth boundary should be drawn around a new growth pole. However this urban growth management can bring on some nuisances, such as soaring land price, capacity overload of infrastructure, particularly in housing, roads, water supply and sewerage facilities, pollution by extreme congestion, etc.

A city center and its sub-centers in the metropolis	Regional centers in the metropolitan region	New growth pole over the reach of metropolis (Entlastungsstadt)
Restructure based on the area around an integrated transit node - MXD - Integration of transit modes (in the spine of a railway and subway station) - Designation of pubic transport priority zone - Improvement of pedestrian milieu - Introduction of diverse TDM measures - Network of green areas Revitalization of the old city as ICBD (International cultural and business district) - Intensification of international connections - Network of open space and cultural relics - Design of urban silhouette in harmony with historic heritage Centrality intensification of sub-centers considering the functional correlation with their hinterland	Function as sub-centers in the metropolitan region Located in the reach of the metropolis: still importance of relation with the metropolis Decentralization of metropolitan functions supported by good accessibility to the metropolis and high-ranked urban service Promotion of regional industry in cooperation and competition with neighboring ones	Not a satellite city but an autonomous partner city of the metropolis Establishment condition: - with 50-100km distance from the metropolis - Outside of the reach of the metropolis - Access within 30min.-distance by the high speed connections (general commuting time zone) Size of city: over that of intermediate center (Mittelzentrum) Keeping the concurrency of development (Necessity of the introduction of UGM)

Tab.6-2 Design of regional centers

6.3.3 Regional connections

Regional centers should be connected vertically and horizontally with the metropolis and neighboring economic centers. The inter-regional links can improve the access to varied urban functions inclusive of employment opportunities and share their own urban functions with other regional centers. The land use development along these inter-regional corridors contributes to curbing the dispersed urban expansion.

The networks must be compatible to not only the functional correlation between regional centers but also the existing physical connections. The network planning conjunct with land use planning can exploit out the limited land stocks efficiently and reduce commuting time and distance. To preserve the ecological and scenic quality of nature system the urban development has to be guided along transport corridors with varied pull- and push measures. It should be also controlled through the continuous monitoring of developable and developed land stocks at both a local- and a regional scale.

Along with that, the regional green network can be made through connecting ecologically lots of parks in a built-up area and linking them with regional green infrastructure formed between transport corridors.

Metropolitan region

To solve the congestion from the increasing commuting trips between the metropolis and regional centers in the metropolitan region, two different approaches can be introduced: positive methods for public transit commuters and negative ones against car users. These two approaches should be integrated in order to maximize the efficiency of transportation policies and facilitate the land use development around public transit stops and along transportation corridors.

First, as positive methods the followings can be considered.

- Construction of by-passes in bottle-neck sections
- Employer's subvention for public transit commuters
- Improvement of the speed, punctuality and integration of public transit service; e.g. BRT (Bus Rapid Transit), express train service in rush-hour, a multi-modal transit terminal inclusive of B+R (bike and ride), P+R (park and ride), etc.

The public-transit-user-friendly policies, on the other hand, ought to be supported by negative ones against car divers in the metropolis; such as maximized parking standards for traffic generating development like ABC-location policy in Holland, parking zone control, parking toll, priority to short term parking, road pricing, gasoline tax, etc

To complete a spatial network system, vertical connections between the metropolis and regional centers should be supported not only physically but also functionally by horizontal ones between regional centers. However the railway system connecting regional centers spends more time and more money in construction. Until the construction of a circular railroad line in the metropolitan region, provisionally the horizontal traffic volume between regional centers has to be accommodated by a BRT system and it should be coordinated with other public transit modes not merely at a local level but also at the regional level.

The radial and orbital railway system transport lots of passengers and freights at a time and fast, and lessen the ecological impacts by emission gas, whereas the rasterized highway system reduces through-traffic volume in the city center and connects with regional centers directly.

Consequently this integrated network with two systems can improve their functional efficiency as well as the quantitative capacity of regional connections. However the highway system must support the railway system functionally to discourage the motorized travels and prevent the auto-oriented land use development.

Suburban area

The urban networks in the suburban area should be approached in two different ways:

- Improvement of accessibility to regional centers from their effect zones and county centers in suburban areas
- Development of connections between peripheral areas outside the effect zones of individual regional centers and their neighboring county centers

To find out effect zones of individual regional center, mobility patterns in the suburban areas are analyzed with statistical data. Here it can be an instrument to investigate commuting zones of individual regional centers.

In the effect zones of regional centers, it is critical not only to attract businesses to regional centers but also to improve accessibility to regional centers from their hinterland areas and county centers in suburban areas by diverse transit modes meeting user's demands, for

instance LRT, bus, taxis and individual transit modes such as foot, bicycles and personal cars. They contribute to the intensification of regional centrality and the depolarization in the metropolitan region by converting lots of destination trips to the metropolis into regional centers. Meanwhile these short-distance transit modes should be integrated with long-distance express transit modes for the central city at multi-modal transit terminals in regional centers.

To keep the self-sufficient structure in the peripheral areas of individual regional centers, it should be reflected to improve access to neighboring county centers from peripheral areas of individual regional centers with more importance than access to regional centers.

On the other hand, peripheral areas of individual regional centers are developed in most cases as rural residential areas with low density and relatively high dependent on motorized vehicles, so commercial functions in these areas have to be linked with residential areas through convenient pedestrian and cycling road networks and district-bus service. Residential development activities should be made compactly within the walkable distance of transit stops. The transit stops integrated with P+R facilities encourage the use of public transportation and reduce motorized trips to county centers, regional centers or even the central city. Surface parking areas will be also able to serve as developable land stocks, when their real estate values increase enough to attract development.

6.3.4 Over-Regional connections

In order to solve the polarization causing congestion in the metropolis and regional inequity problems, a new growth pole can be suggested outside the reach of the metropolis on the over-regional or national level. A new growth pole has to be planned as a self-contained garden city like the model invented by Ebenezer Haward and share higher urban functions with neighboring regional centers by the support of vertical and horizontal transportation links.

For the success of a new growth pole that is independent functionally from the metropolis the plan should be accessed in two phases and the construction of a new growth pole has to be focused on not only resettlement of residents from the metropolis but also absorption of potential immigrants to the metropolis from peripheral areas.

The first phase is colonization by the improvement of accessibility to the metropolis. The introduction of express transportation service enables to mitigate the time distance between the metropolis and a new growth pole and encourage the get-away from the highly congested metropolis. The time distance should correspond to the average commuting time in the metropolitan region and about 30-60minute-distance is recommendable.

Even if administrative effort is a prerequisite, the improvement of accessibility encourages relocation of industrial plants which attract resettlement of institutions and demographic immigration from peripheral areas as well as the metropolis. This industrial base will make a new growth pole not a bed town but a city that is economically independent from the metropolis in the future.

In this colonization phase, however it can’t be still avoidable to depend functionally on the metropolis. While the marginal urban facilities are built up in a new growth pole, the high-order urban services might be still supplied from the mother city or the neighboring metropolis; in case of additional development of an existing city, then from an old town.

While the vertical connection with the metropolis is improved and people and industries are relocated in a new growth pole, next it should be considered to strengthen the horizontal links with a neighboring metropolis and other regional centers. It makes an urban organism

sharing diverse high–order urban functions and independent from the metropolis. This urban organism will be able to absorb potential immigrants to the metropolis, too.

Regional connections should be integrated with long-distance transport services and reduce the impacts on the natural resources. Considering inelasticity and cost of rail connections, BRT service can be temporally introduced and thereafter the rail connections including LRT might be constructed step by step depending on regional demands.

6.4 Planning implementation for network cities

An approach for network cities helps to reduce the whole nuisances of urbanization and facilitates the sustainable development through urban coalitions that share and supplement diverse urban functions. Therefore it should state clearly the limitation of responsibilities and roles shared with participants, so to prevent feasible misinterpretations between cities. On the other hand it is enough flexible to receive unexpected changes, because the city networks can't be achieved by a project and interests of communities are liable to change on the way of urban networking. So, network cities should be formed step by step considering the liaisons between the previous and the following projects.

This urban network plan might proceed on the basis of so-called 9C principles suggested by Janssen-Jansen (2004): Communication, Cooperation, Coordination, Consistency, Comprehensiveness, Concurrency, Containment, Conversion, and Carrot and Stick.

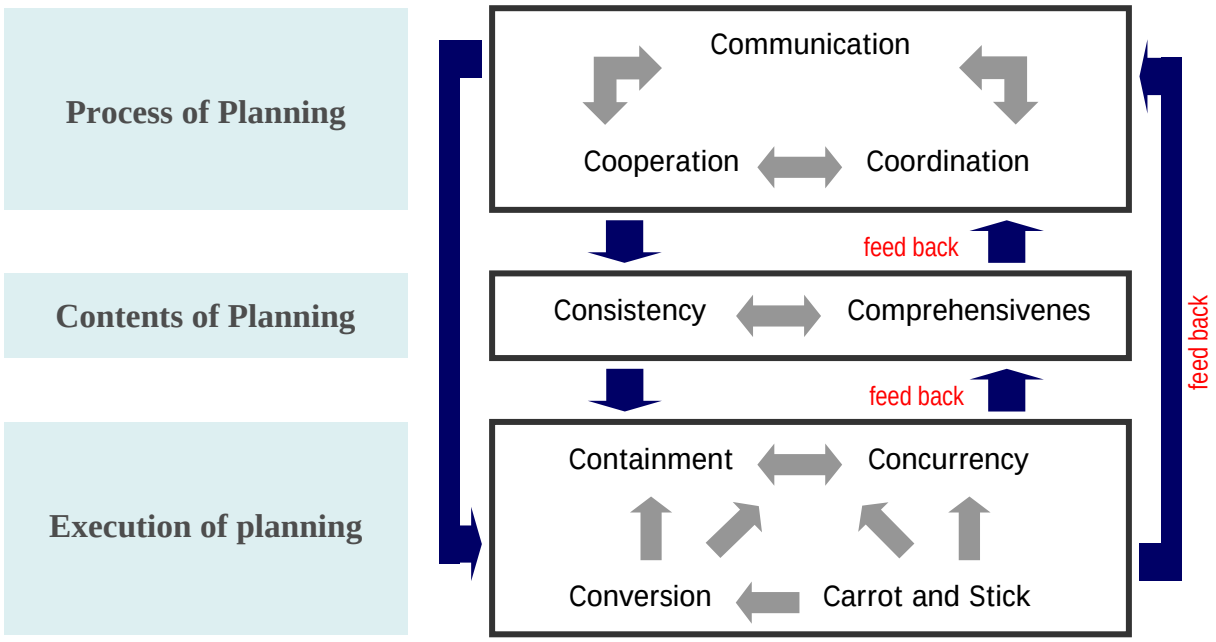


Fig.6-5 Planning implementation based on the 9C principles by Leonie B. Janssen-Jansen (2004) (modified)

6.4.1 Process of planning (Organizational networks)

In the first phase, the central government can contribute to leading the communication, coordination and cooperation between regions which participate in the field of spatial planning for network cities and intermediating potential conflicts between them. The interregional communication should contribute to reducing the gaps of understanding and finding out the symbiotic solutions based on regional- or national consensus. In this point, a development organization for network cities can be established and it consists of an urban network development board, a working level conference, sectorial working groups, a planning advisory council and a program monitoring committee. This organization may be for the flexibility of operation in an informal and ad-hoc form. An urban network development board is made of high-rank representatives from all partner regions, if necessary including

central authorities and its members meet regularly to suggest and revise long-term strategic guidelines for network cities. Based on the beneficiary principle an urban network development board decides all partner regions' share of the administrative- and financial responsibility to joint development programs, too.

In a working level conference working-level officials from municipalities participating joint projects establish general action plan and coordinate sectorial plans from working groups in the frame of a long-tern perspective by a development board. Sectorial working groups design applicable planning instruments to individual joint projects and control their execution. Here periodic meetings contribute to coordination of individual joint projects and experience and information exchange.

The suitability and priority of all project applications should be assessed by a planning advisory council. To examine project applications on a wide basis its member consists of experts from different fields. In case of several key projects, if necessary, the participation of other advisory groups and the holding of thematic workshops may be considered to exchange experiences regarding organisational and other practical problems and increase the efficiency of the program implementation. Depending on periodical reviews on the progress and results of implementation, a program monitoring committee can suggest funding distribution and amendment of following programs.

The conventional development policies by the central government could improve the physical urban milieu, but local authorities and citizens can't engage easily themselves in regional development. Different form the top-down policies, the concept of network cities requires initiatives and understandings from citizens. This bottom-up development can be triggered by the easy access to lots of administrative information on the land use development and the transparent planning procedure. In addition to conventional instrument such as forums, public hearings, publicities, etc., the internet-based e-governance can be utilized as a tool.

6.4.2 Contents of planning

Urban network planning should be supported by assessments on development effects, analyses on the cost-efficiency, and feasible financing measures. The contents of planning must be tuned up in the consistency with higher-order plans as well as regulations of neighboring communes by a cross-acceptance process, because the impacts of city networks reach not just participant cities but also a region over their administrative boundary or sometimes a whole nation in some cases.

The concept of network cities does not mean simply physical connections but it can deal with economic-, social- and cultural problems. Therefore urban network planning may include all sectional policies and particularly it needs an integrated approach with spatial-, transportation- and environment planning. Lots of individual subventions have to be integrated in the frame of this comprehensive planning, too.

6.4.3 Execution of planning

City networks must be executed step by step considering the capacity of urban facilities. The urbanization without minimal support of urban services impedes now qualified urban lives. As an instrument a development certificate can be issued which preconditions developers' contributions or land dedications for required urban facilities.

With this concurrency principle diverse carrots and sticks guide urban development activities preferentially into a developable area, which can keep the development sustainability. The containment of development can be managed by the support of an internet-based surveillance system. On the other hand the conversion of development right or land parcels

may help to conserve the ecologically sensitive areas from urban sprawl and to reconnect the regional green network sacrificed by urban expansion.

6.4.4 Finance of planning

Implementing urban networks needs diverse combinations of public-private partnership suitable to the complex and dynamic situation of today. The participation of private sector gives a chance to learn the market-based know-how and helps to share the financial burden. However the market-based development often impairs the public welfare, so the management of public authorities is necessary. One of solutions may be a development agreement between public- and private sector and this development contract can help to secure the long term benefits that are often ignored due to the short term profits. And before the involvement of private sector, if necessary, the current regulatory mechanisms should be revised, because the success of participation of private developers and its efficiency depends as much on the regulatory framework as on the capital fluidity.

Design-Build-Transfer-Operate: instead of owning the facility during operations, the private sector enters into an operating lease before the facility is operational to traffic.

Design-Build-Operate-Transfer: the private sector acquires rights-of-way on an existing facility prior to construction, makes improvements, operates and collects revenues under the terms of the agreement, and then transfers the facility back to the public sector upon the expiry of the franchise.

Design-Build-Own-Operate: this model represents a franchise of unlimited duration in that the developer is never obliged under the franchise agreement to transfer the project to the public sector.

Source: Toronto board of trade (2001: 72)

Tab. 6-3 Diverse public-private-participations

Private sector can also involve itself indirectly in the development of network cities through the REITs (Real Estate Investment TruSt). The obtainability of large floating funds reduces the financial risk in the construction market and helps to revitalize obsolete but unique urban functions in an inner city area which requires more capital than the suburban development. REITs is a company that purchases and manages real estate or real estate loans, using money invested by its shareholders. REITs trades major exchanges just like stocks. Unlike traditional real estate they are highly liquid and enable to share the non-residential properties as well, such as hotels, malls, and other commercial or industrial properties. (Investorwords.com 2005)

City networks improve the regional accessibility and encourage the location of urban facilities in the periphery, but the development of urban networks pushes up development pressure in neighborhoods. It aggravates the speculative land purchases and sporadic development. To stabilize land markets and manage sustainable land use, therefore urban network planning is to suggest a long-term comprehensive perspective with short-term restrictive instruments. Meanwhile the expected growth of tax revenues generated by development activities for urban networks and a part of development benefits should ensure the bond to finance the very development projects and programs.

7 Conclusion

To exploit out scale economy, people and industries concentrate to the big cities. However the problems of this urban concentration become gradually obvious and have limited the development of the metropolises. This spatial bipolarization between the wealthy cities on the one hand and low-income rural areas on the other hand causes various problems, which are hardly managed by current planning measures. In the diversifying social needs for heterogeneous life styles and sustainable mobility it is inevitable to adjust the sustainable space system. An approach of network cities is here an alternative to the bipolarization, which can satisfy the today's demands for a balanced but a regionally identified- and sustainable spatial development. Thereby it is not substitutive but complementary to conventional planning methods.

The concept of network cities is an approach to share metropolitan functions with existing or new urban centers by fast and reliable mutual connections rather than to concentrate international economic functions into a few metropolises. By the cooperative mechanism between cities with different industrial, cultural and natural heritage, network cities achieve dynamic synergy effects. At that time the constituent communities of network cities work together like an urban organism. The cooperative mechanism of network cities is not competitive but complementary. In opposition to conventional top-down policies therefore the city networks require intensive inter-communal communication. It features not hierarchical instructions but cooperation between autonomous communities by the bottom-up principle.

Network cities are composed with nodes and links. Urban centers as nodes supply marginal urban service to their hinterland and their links supported by transportation and communication connections promote diverse functional interchanges by which the networked cities offer more specialized services, cumulatively environment- and knowledge based ones. The approach of network cities that is integrated with spatial-, transportation- and ecological factors gives a chance to manage the increasing needs for land use development and contribute at last to the sustainable development. Network cities can be developed from national and (macro-) regional requirements. Urban networks are implemented in the form of joint development projects with constituent cities.

In this research strategies for network cities were suggested with an example of South Korea and they will contribute to

- converting the current mono-centric structure of region Seoul,
- strengthening the functions of other metropolises as global gateways,
- making more attractive urban milieu by renewing functionally obsolete and disharmonious inner city areas, and
- protecting and restoring the natural environment

Now the lowest fertility rate of South Korea in the World, 1.16 as of 2004, may relieve in the future the overpopulation problems in the region Seoul, but Korea national statistical office speculated the demographic weight of the region Seoul in the whole South Korea will increase from 46.3% in 2000 to 50.8% in 2030. The suburban region Seoul centering on the Gyeonggi province will accommodate most of demographic growth. The construction of network cities therefore may help to rearrange spatial structure in a decentralized and sustainable way not only for the region Seoul but also for the whole nation.

The concept of network cities with an example of South Korea was developed from national and regional requirements. The national approach of network cities encourages the interchange between agglomerations. Network cities in the regional context promote mutual complementation between urban and rural areas and allow though a specific management a compact and integrated land use development by which sustainability can be achieved and

urban sprawl controlled. To investigate more exactly influences of the regional urban network system, its effects are separately represented at the micro- and macro-regional level.

Urban networks were first approached in the context of the whole nation. Agglomerations, cities and towns are hooked up each other by railways and motorways. The inter-metropolitan networks supported by high-speed transportation connections can play a role to decentralize metropolitan functions from Seoul to five metropolises, Deajeon, Daegu, Ulsan, Busan and Gwangju, compete functionally with region Seoul as counterbalancing urban networks and supplement metropolitan functions of Seoul. On the other hand motorways between Seoul and major cities on the South coast and five national rail trunks connect national- and regional gateways with major cities and towns to facilitate logistic flows as well as passenger trips. They can relive capacity overloads of urban links by KTX, too.

Following the 1st regional innovation development plan, the potentials of nodes in city networks are functionally identified. This functional identification, i.e. industrial specialization can be made in the forms of industrial clustering. It can be activated by the relocation of public organization related with regional strategic industry, the equipment of infrastructure in the strategic areas by so-called decentralization fond, and the administrative service and financial supports for locating potential SMEs (small and medium enterprise) as well as conglomerates.

Next, to assist in creating more balanced development and relieving development pressure in Seoul and its surroundings, city networks were approached respectively at regional- and over-regional level by selecting nodes and linking them in the complementation with urban networks at the national level. Alternative economic centers are selected inside two metropolises of the region Seoul, Seoul and Incheon, in the region Seoul and outside of the region Seoul. However these counterweights of metropolis Seoul should be chosen in consideration of physical and social factors, spatial theories, and statistical tools can be made use of: such as central place theory, Benison's centrality index and life region analysis based on the transportation corridors. In particular a current project on the construction of a new administrative town was dealt with in the over-regional context. A new growth pole outside the region Seoul will be constructed to implant a part of metropolitan functions of Seoul and give an impulse to regional development outside of the region Seoul. On the other hand it was suggested to strengthen the functions of economic centers by the attraction of industrial investment or the revitalization of indigenous industrial potentials.

Actually individual cities and regions in- and outside the region Seoul are already vigorously improving themselves as alternative centers for investment, but an urban constellation in mutual networks will widen accessibility to high-level urban functions and promote the more efficient use of built-up infrastructure as well as sharing metropolitan economic functions. The alternative centers in the networks will act as counterweights against the economic pull of global center, Seoul.

The inter-nodal links include connections between regional centers, connections between regional centers and suburban areas, and inter-city connections at the over-regional level as well as connections with the metropolis Seoul. The physical urban links should be made by environmentally sustainable transports. They should be integrated systematically with each other to improve the accessibility to Seoul and regional centers by inter-modality and integrated transportation diagrams.

Through these multi-layered approaches applied to South Korea three differentiated models of network cities could be presented:

- Network cities for the decentralization of a consolidated area by a national access,
- Network cities for the management of urban sprawl by a regional access, and

- Network cities for the development of structurally weak rural areas by an over-regional access.

Depending on the theoretical and practical studies with an example of South Korea, finally the development criteria for network cities were suggested and the development procedure generalized. Six criteria for network cities in this research are a synthesis of ideas from existing planning concepts. They include TOD (transit oriented development), UGM (urban growth management), urban renewal, MXD (mixed land use development), compact city, transportation corridor design, ABC policy, TDM (Transportation Demand Management) and green infrastructure. The emphasis of development criteria focuses on both nodes and their links.

- Develop the brown filed prior to the green field
- Drive land use development in the conjunction with infrastructure provision
- Make transportation corridors supported by public transits
- Integrate inter-modal transportation networks with compact urban development
- Promote and diversify the regional economy
- Optimize the function of regional natural systems

The procedure to construct network cities can be made in two-layered approach including the national- and the regional access. In the complementation with networked urban system approached at the national level, network cities should develop in the regional context. The national approach of network cities encourages the interchange between agglomerations. Network cities in the regional context promote mutual complementation between urban and rural areas and allow though a specific management a compact and integrated land use development by which sustainability can be achieved and urban sprawl controlled. And the macro-regional approach can be additionally taken in a case of constructing a new economic center outside regional boundary to decentralize congested urban functions in the metropolis and develop the periphery.

Cities as nodes in a network structure are identified by attracting industrial investment, revitalizing indigenous industrial heritage, and restructuring existing industrial plants to industrial clusters in the functional complementation with neighboring ones. The links as rods of network cities proceed in a three-layered way, connection between the agglomerations, between the major cities with regional importance, and inside an agglomeration region i.e. the connection between metropolis, its metropolitan region and rural areas. Hereby the road networks in a grid form should complement functionally the railway connections.

A project for network cities should proceed so-called by the package approach which is integrated with mixed land use planning, multi-modal transportation planning in particular oriented to public transport connections, and ecologically systemized environment planning. It must be tuned up with sectoral- and higher-order spatial plans as well as land use plans of neighboring communities and carried out within the developable capacity.

To help the communication, coordination and cooperation between decision makers, in some cases a development board for network cities can be established. It is composed with a planning board, a working-level conference, sectorial working groups, a planning advisory council, and a program monitoring committee. Here the rhythmical working process of this development organization ensures on the one hand a continuous project development and contribute to coordination of individual joint projects and experience and information exchange, on the other hand.

This inter-regionally organized partnership is characterized in the point of informality, dynamicity, flexibility, selectivity, voluntary, and temporariness. This inter-regional partnership is usually bolstered by the initiatives from bottom, but may be stimulated and guided occasionally by a Top-Down-mechanism. Particularly in case of projects of the

incipient stage the state can stimulate inter-communal cooperation by financial supports and administrative advices and mediate conflicts between partners.

By the "Give and Take" principle urban functions are shared and complemented between the networked cities. Here is aimed that all participants can make profits from the joint projects and compensations for that. It is here a matter that partner cities that profit at expense of a certain city compensate that community with this profit.

A subvention can be provided for not only pilot projects initiated by the state but also voluntary initiatives. Thereby the feasibility of the voluntarily initiated development concept should be proven at the planning level and its development effects be analyzed. On the other hand, the progress of individual joint projects should be periodically monitored by a program monitoring committee and its assessments be reflected on the decisions of funding distribution and the modification of following programs.

As the urban system is satisfactorily implemented, the portion of public grants is to reduce step by step and regional authorities should involve themselves more actively in financing the joint projects for urban networks. Following the beneficiary principle, all participants have to share their administrative- and financial responsibility. The expected growth of tax revenues generated by development activities for urban networks and a part of development benefits should ensure the bond to finance the very development projects and programs. Ensuring the marginal urban service in rural areas, a distribution mechanism should be introduced in the establishment of development fund. It is not based on criteria like such as the number of population, but aims at the levy of surplus profits from the joint projects.

Appendix

1 Potential of the region Seoul as a development motor

In spite of the polarization to the region Seoul (Séoul et le désert sud-coréen), the region Seoul with relatively well-equipped infrastructure and highly qualified but inexpensive labor forces has potential as the motor of political, economic, social and cultural development in South Korea.

Depending on hard-line policies against development in the region Seoul and diverse instruments for invigorating economy in the non-region Seoul since the late 1960s, the central government has expanded the amount of investment to the non-region Seoul. It is shown in Tab.1.

		1970	1980	1990	2000
Region Seoul	Population	9,125,758	13,544,004	18,342,145	21,303,460
	Government's expenditure (billion Korean Won)	1,833.9	3,188.4	11,845.1	22,543.6
	Investment per capita (thousand Korean Won)	201.0	235.4	645.8	1,058.2
Other region	Population	22,741,309	24,108,132	24,018,392	24,599,552
	Government's expenditure (billion Korean Won)	4,755.3	5,466.9	19,812.3	36,313.4
	Investment per capita (thousand Korean Won)	209.1	226.8	824.9	1,476.2

Source: Park, Heon-Soo & Cho, Kyu-Young (2000: 16)

Tab.1 Government's expenditure per capita between 1970 and 2000

However the investment to the non-region Seoul could not reduce the relative importance of region Seoul in South Korea. The indicators in Tab.2 imply the failure of government's policies focused on regional equity since the late 1960s.

		1970	1980	1990	1998
Region Seoul	Population (%)	28.6	36	43.3	46.4
	Employment (%)	48.4	50.1	52.1	53.6
	GRDP (%)	-	42.8 *	46.1	45.7
	Industrial establishment (%)	33.9 **	44.3	58.4	53.8
Other region	Population (%)	71.4	64	56.7	53.6
	Employment (%)	51.6	49.9	47.9	46.4
	GRDP (%)	-	57.2 *	53.9	54.3
	Industrial establishment (%)	66.1 **	55.7	41.6	46.2

Source: Park, Heon-Soo & Cho, Kyu-Young (2000: 14)

Note: * : data in 1985 / ** : data in 1971

Tab.2 Relative importance differences between region Seoul and other region from 1970 to 1998

To develop the stagnated or even declined non-region Seoul and intensify the international competitiveness of region Seoul, therefore the conventional policies restricting development activities in the region Seoul need to be reconsidered. Tab.3 shows that the efficiency of government investment can be maximized by the investment in the region Seoul, cumulatively in the Gyeonggi province whose development is under the robust and numeral control of existing regulations.

	Labor force difference with that in Seoul as of 1998 (thousand people)	Impulse response of employment increase (person)	Scenario 1 (billion Korean won) *	Scenario 2 (year)	Scenario 3 (year)
Seoul	-	-	-	-	-
Busan	1,353	1.7	78,627.2	19.7	89.2
Gyeonggi	484	4.0	12,094.7	3.0	4.7
Gangwon	1,650	0.8	219,705.0	54.9	337.3
Chungbuk	1,610	0.7	240,468.9	60.1	494.6
Chungnam	1,464	3.9	37,605.8	9.4	36.9
Jeonbuk	1,598	4.4	36,705.8	9.2	48.1
Jeonnam	1,498	3.4	44,120.0	11.0	36.0
Gyeongbuk	1,190	3.8	31,179.7	7.8	19.0
Gyeongnam	1,205	3.6	33,636.9	8.4	31.6

Source: Park, Heon-Soo & Cho, Kyu-Young (2000: 49)

Note:
(1) * : based on economical situation in 1995
(2) The impulse response of employment increase is estimated in case of additional 100 million-won-investment by local government
(3) In scenario 1, the expected additional investment by local government is investigated to keep abreast of the employment level in Seoul within 5 years
(4) In scenario 2, the duration time is calculated to overtake the employment level in Seoul, in case of yearly 4 trillion-won-investment by local government
(5) In scenario 3, the duration time is projected to arrive at the employment level in Seoul, if local government makes 50% additional investment of average investment for latest 5 years

Tab.3 Impulse response by each scenario

Through a report on the external effect of concentration in metropolitan area Seoul, Park, Heon-Soo & Cho, Kyu-Young (2001) pointed out the problems of existing regulations, especially the metropolitan plan for the capital region, too. They insisted the robust and numeral development restrictions in the whole region Seoul should be regarded to exploit out agglomeration economy in the region Seoul. They studied on the external effect by the immigration of one household respectively to Seoul, the Gyeonggi province and the non-region Seoul and found out the total effect is positive in all cases. However there is not remarkable difference between the immigration effect to the Gyeonggi province and that to the non-region Seoul. In the case of Seoul, the result is positive, but comparatively small.

unit: thousand Korean Won

	Productivity			Expenditure for traffic Congestion	Revenue		Total
	Urbanization Effect	Localization Effect	Labor		National/ Provincial Government	Local Government	
Seoul	56	89	20,895	-1,444	-1,277	-695	17,624
Gyeonggi province	-18	407	30,175	-397	-421	-1,060	28,684
Other region	0	290	28,864	0	-627	-1,076	27,452

Source: Park, Heon-Soo & Cho, Kyu-Young (2001: 77)

Note:
(1) based on the economic situation in 1995
(2) the expenditure for traffic congestion is estimated based on the expenditure for traffic congestion per capita by Korean transport institute and Gyeonggi research institute and the environmental expenditure caused by exhaust gas from cars is not considered
(3) there is no expenditure for traffic congestion in the non-region Seoul
(4) one household of one employee and three dependants is immigrated from abroad into each region

Tab.4 Effect of a household immigration on productivity, traffic congestion and revenue (1)

Unlike the case of immigration of a household with its own economic base, however the total external effect becomes negative, if one jobless household moves in each region. (Tab.5) That of Seoul is the worst.

unit: thousand Korean Won

	Productivity			Expenditure for traffic Congestion	Revenue		Total
	Urbanization Effect	Localization Effect	Labor		National/ Provincial Government	Local Government	
Seoul	56			-1,444	-1,277	-695	-3,360
Gyeonggi province	-18			-397	-421	-1,060	-1,897
Other region	0			0	-627	-1,076	-1,703

Source: Park, Heon-Soo & Cho, Kyu-Young (2001: 78)

Note:
(1) based on the economic situation in 1995
(2) the expenditure for traffic congestion is estimated based on the expenditure for traffic congestion per capita by Korean transport institute and Gyeonggi research institute and the environmental expenditure caused by exhaust gas from cars is not considered
(3) there is no expenditure for traffic congestion in the non-region Seoul
(4) one jobless household is immigrated from abroad into each region

Tab.5 Effect of a household immigration on productivity, traffic congestion and revenue (2)

On the other hand, the study shows the establishment of one manufacturing company with the average size in Seoul can make its total immigration effect the greater than any other regions. That is, positive effect by agglomerating manufactories exceeds negative effect caused by congestion. (Tab.6)

unit: thousand Korean Won

	Productivity					Expenditure for traffic Congestion	Revenue		Total
	Urbanization Effect	Localization Effect	Labor	Capital	Land		National/ Provincial Government	Local Government	
Seoul	1,304	2,218	522,380	699,849	869,206	-33,574	-29,686	-16,161	2,015,536
Gyeonggi province	- 428	10,166	754,365	729,070	205,179	-9,233	-9,807	-24,640	1,654,672
Other region	0	7,262	721,605	810,421	- 163,296	0	-14,571	-25,018	1,336,403

Source: Park, Heon-Soo & Cho, Kyu-Young (2001: 79)

Note:
(1) based on the economic situation in 1995 and unit is thousand Korean Won
(2) the expenditure for traffic congestion is estimated based on the expenditure for traffic congestion per capita by Korean transport institute and Gyeonggi research institute and the environmental expenditure caused by exhaust gas from cars is not considered
(3) there is no expenditure for traffic congestion in the non-region Seoul
(4) one new manufacturing company of 25 employees and 68 dependants with 1,884 million Korean Won as capital is established on 3,818 m2 area in each region
(5) the expenditure for the establishment of a company in a region is not considered, because the contribution to regional economy by establishing one manufacturing company is focused on.

Tab.6 Effect of one manufacturing company immigration on productivity, traffic congestion and revenue

2 Data of statistical analyses

population size	city	population (2000) (person)	population increase (1995-2000) (%)	population density (2000) (person/km2)	employees (2000) (person)	distribution of employees in Gyeonggi province (2000) (%)
More than 80 thousand	Suwon	946,704	25.30	7,815.60	239,695	9.92
	Seongnam	914,590	5.23	6,448.04	179,490	7.43
50 thousand-80 thousand	Goyang	763,971	47.40	2,857.78	138,351	5.73
	Bucheon	761,389	-2.31	14,247.55	206,969	8.57
	Anyang	580,544	-1.79	9,920.44	157,493	6.52
	Ansan	562,920	10.31	3,884.35	200,125	8.28
30 thousand-50 thousand	Yongin	386,124	59.13	652.75	131,389	5.44
	Uijeongbu	355,380	28.71	4,355.68	67,363	2.79
	Pyeongtaek	345,306	10.35	763.43	107,501	4.45
	Namyangju	340,932	48.84	741.17	60,120	2.49
	Gwangmyeong	334,089	-4.79	8,677.64	57,555	2.38
	Siheung	305,268	128.76	2,322.14	106,457	4.41
10 thousand-30 thousand	Gunpo	263,760	12.13	7,256.12	64,768	2.68
	Hwaseong	189,467	19.47	275.54	99,553	4.12
	Icheon	179,719	15.70	389.72	61,546	2.55
	Paju	178,434	9.21	261.40	54,880	2.27
	Guri	160,839	13.13	4,831.45	36,232	1.50
	Gimpo	150,194	39.48	543.10	59,791	2.47
	Pocheon	138,654	16.95	167.78	53,680	2.22
	Anseong	133,421	11.06	240.68	38,532	1.59
	Gwangju	125,943	46.18	291.60	43,558	1.80
	Hanam	120,513	4.06	1,294.72	25,906	1.07
	Uiwang	117,821	8.30	2,183.49	26,626	1.10
	Yangju	110,299	16.71	355.69	49,864	2.06
	Osan	102,697	45.69	2,401.71	29,140	1.21
Less than 10 thousand	Yeoju	97,612	6.04	160.55	27,827	1.15
	Yangpyeong	75,706	7.23	86.19	16,725	0.69
	Dongducheon	73,502	2.69	768.21	19,796	0.82
	Gwacheon	66,706	-2.01	1,860.18	29,930	1.24
	Gapyeong	52,147	5.08	61.83	13,662	0.57
	Yeoncheon	49,483	-5.05	77.16	11,558	0.48

Note: data from KOSIS

Tab.7 Development of population and employment in the Gyeonggi province (1995-2000)

	commuters to Seoul (1995) (person)	commuters to Seoul (2000) (person)	increase (1995-2000) (%)	commuting rate to Seoul (2000) (%)
Incheon				
Jung_in	2,604	2,505	-3.80	7,90
Dong	3,395	2,650	-21.94	7,61
Nam	18,809	17,625	-6.29	8,55
Yeonsu	7,163	9,165	27.95	6,89
Namdong	18,689	19,770	5.78	9,87
Bupyeong	35,770	41,878	17.08	15,69
Gyeyang	18,971	26,012	37.11	16,28
Seo	13,930	17,337	24.46	10,58
Ganghwa	451	612	35.70	1,82
Ongjin	10	-	-100.00	-
Gyeonggi				
Suwon	25,272	41,923	65.89	8.67
Seongnam	148,445	142,977	-3.68	29.95
Uijeongbu	38,306	57,455	49.99	33.20
Anyang	84,070	74,663	-11.19	24.37
Bucheon	109,194	98,249	-10.02	25.02
Gwangmyeong	84,147	70,964	-15.67	43.01
Pyeongtaek	4,363	4,106	-5.89	2.45
Dongducheon	3,127	2,813	-10.04	8.10
Ansan	22,203	23,516	5.91	8.41
Goyang	120,028	146,856	22.35	40.54
Gwacheon	17,415	16,335	-6.20	49.99
Guri	25,463	27,643	8.56	34.11
Namyangju	31,601	52,621	66.52	32.90
Osan	992	2,186	120.36	4.25
Siheung	10,776	20,681	91.92	14.50
Gunpo	32,686	31,717	-2.96	23.88
Uiwang	13,234	12,482	-5.68	21.21
Hanam	26,107	24,688	-5.44	39.97
Yongin	9,145	30,904	237.93	16.07
Paju	9,545	10,263	7.52	11.63
Icheon	1,064	2,136	100.75	2.40
Anseong	1,017	1,242	22.12	1.75
Gimpo	7,188	14,594	103.03	19.93
Yangju	3,344	6,182	84.87	11.99
Yeoju	449	920	104.90	1.78
Hwaseong	1,309	2,345	79.14	2.28
Gwangju	3,506	7,804	122.59	12.56
Yeoncheon	859	638	-25.73	2.65
Pocheon	1,550	2,539	63.81	3.80
Gapyeong	882	1,079	22.34	4.63
Yangpyeong	1,202	1,849	53.83	4.65

Note: data from KOSIS

Tab.8 Increase of commuting volume to Seoul in the region Seoul (1995-2000)

	in-commuting trips in 2000 from			total cross-bordering commuting trips to a city in 2000	portion of a city's in total cross-bordering commuting trips to Gyeonggi province in 2000	increase of cross-bordering commuting trips to a city bet. 1995-2000 from		
	Seoul (person)	Incheon (person)	Gyeonggi (person)	(person)	(%)	Seoul (%)	Incheon (%)	Gyeonggi (%)
Suwon	50,200	7,523	80,302	138,025	11.00	7.89	65.74	27.11
Seongnam	56,953	1,961	41,477	100,391	8.00	11.86	20.31	148.28
Uijeongbu	26,767	889	18,799	46,455	3.70	1.19	2.30	12.06
Anyang	34,189	5,216	67,594	106,999	8.53	0.20	70.96	20.18
Bucheon	33,464	38,801	20,464	92,729	7.39	-9.38	29.71	34.60
Gwangmyeong	16,725	1,798	11,079	29,602	2.36	-9.88	-3.07	13.61
Pyeongtaek	6,579	1,167	19,326	27,072	2.16	38.74	68.16	37.59
Dongducheon	1,978	114	6,633	8,725	0.70	-14.89	35.71	1.62
Ansan	25,608	10,231	54,265	90,104	7.18	5.61	24.06	31.77
Goyang	42,497	4,965	18,342	65,804	5.25	43.57	157.65	61.99
Gwacheon	9,950	407	14,794	25,151	2.01	-14.86	60.24	10.93
Guri	13,705	175	14,640	28,520	2.27	16.92	-35.42	75.37
Namyangju	12,811	244	12,113	25,168	2.01	17.95	21.39	17.88
Osan	3,281	520	17,375	21,176	1.69	9.15	113.99	3.76
Siheung	8,335	8,142	33,623	50,100	3.99	32.55	104.98	93.29
Gunpo	6,927	1,024	26,547	34,498	2.75	5.51	52.61	16.34
Uiwang	2,627	404	13,630	16,661	1.33	7.66	59.06	21.02
Hanam	12,341	221	4,830	17,392	1.39	65.83	67.42	141.50
Yongin	28,480	2,516	54,610	85,606	6.82	38.38	116.71	56.17
Paju	7,791	1,024	11,986	20,801	1.66	42.95	174.53	63.97
Icheon	6,726	403	9,903	17,032	1.36	28.19	-0.25	24.88
Anseong	8,706	758	10,286	19,750	1.57	63.22	126.95	71.75
Gimpo	16,855	17,178	9,503	43,536	3.47	28.91	39.61	33.79
Yangju	3,526	197	13,269	16,992	1.35	34.89	222.95	19.07
Yeoju	3,149	243	4,834	8,226	0.66	65.48	84.09	50.64
Hwaseong	3,867	1,215	40,475	45,557	3.63	42.96	252.17	41.44
Gwangju	10,278	624	22,941	33,843	2.70	44.15	158.92	53.45
Yeoncheon	789	40	2,021	2,850	0.23	12.39	-44.44	16.89
Pocheon	13,316	433	14,324	28,073	2.24	58.62	22.32	43.24
Gapyeong	1,444	58	1,384	2,886	0.23	19.64	-29.27	12.98
Yangpyeong	2,089	142	2,373	4,604	0.37	19.10	0.00	30.17

Note: data from KOSIS

Tab.9 Development of commuting trips into the Gyeonggi province (1995-2000)

	1995					2000				
	F_in.j (person)	F_out.j (person)	F_in.j / F_out.j	K.j (person)	Kr.j (%)	F_in.j (person)	F_out.j (person)	F_in.j / F_out.j	K.j (person)	Kr.j (%)
Seoul										
Jongno	274,514	42,402	6.47	56,317	57.05	226,354	35,275	6.42	53,629	60.32
Jung	365,086	27,968	13.05	41,859	59.95	273,853	28,128	9.74	40,521	59.03
Yongsan	143,077	69,857	2.05	65,535	48.40	120,353	52,789	2.28	63,432	54.58
Seongdong	140,062	99,004	1.41	75,695	43.33	97,840	85,747	1.14	87,964	50.64
Gwangjin	48,672	111,950	0.43	93,173	45.42	70,060	99,529	0.70	105,786	51.52
Dongdaemun	198,967	110,430	1.80	110,515	50.02	181,955	76,277	2.39	117,313	60.60
Jungnang	49,400	127,847	0.39	96,840	43.10	44,137	117,368	0.38	113,708	49.21
Seongbuk	122,683	140,668	0.87	116,659	45.33	105,974	117,078	0.91	119,567	50.53
Gangbuk	29,709	131,526	0.23	76,477	36.77	34,053	94,661	0.36	78,254	45.26
Dobong	62,529	112,201	0.56	68,348	37.86	42,571	110,274	0.39	73,404	39.96
Nowon	79,684	169,153	0.47	121,635	41.83	74,082	166,408	0.45	143,133	46.24
Eunpyeong	52,198	137,932	0.38	110,066	44.38	41,819	109,501	0.38	116,899	51.63
Seodaemun	140,228	105,630	1.33	84,287	44.38	125,125	89,731	1.39	94,261	51.23
Mapo	118,502	111,325	1.06	97,609	46.72	109,936	89,781	1.22	106,140	54.17
Yangcheon	53,031	141,693	0.37	103,194	42.14	53,056	136,437	0.39	110,814	44.82
Gangseo	94,592	135,346	0.70	122,244	47.46	89,928	124,491	0.72	143,786	53.60
Guro	139,300	107,052	1.30	88,731	45.32	108,274	105,470	1.03	103,671	49.57
Geumcheon	39,429	85,243	0.46	66,184	43.71	41,335	70,570	0.59	71,014	50.16
Yeongdeungpo	283,540	112,136	2.53	113,374	50.27	237,537	94,208	2.52	111,906	54.29
Dongjak	80,596	147,551	0.55	83,078	36.02	72,930	113,558	0.64	98,013	46.33
Gwanak	82,444	169,025	0.49	125,746	42.66	74,667	133,453	0.56	135,718	50.42
Seocho	201,136	119,666	1.68	98,003	45.02	177,306	101,983	1.74	104,954	50.72
Gangnam	413,687	142,876	2.90	162,127	53.16	453,616	116,267	3.90	178,666	60.58
Songpa	125,183	177,591	0.70	168,292	48.66	120,630	155,474	0.78	189,328	54.91
Gangdong	65,461	128,072	0.51	130,719	50.51	56,977	123,572	0.46	132,446	51.73
Incheon										
Jung_in	65,468	14,240	4.60	20,014	58.43	39,377	10,788	3.65	20,916	65.97
Dong	36,281	36,731	0.99	16,165	30.56	25,898	15,557	1.66	19,258	55.32
Nam	105,252	106,006	0.99	109,526	50.82	79,405	74,809	1.06	131,215	63.69
Yeonsu	17,647	73,773	0.24	23,855	24.43	19,100	75,504	0.25	57,444	43.21
Namdong	79,154	85,596	0.92	103,258	54.68	74,285	81,561	0.91	118,656	59.26
Bupyeong	88,739	103,795	0.85	140,246	57.47	60,559	115,808	0.52	151,159	56.62
Gyeyang	20,332	69,742	0.29	51,556	42.50	23,890	70,818	0.34	88,947	55.67
Seo	50,353	59,911	0.84	80,216	57.25	41,684	55,025	0.76	108,814	66.42
Ganghwa	2,916	2,362	1.23	35,485	93.76	4,994	2,529	1.97	31,128	92.49
Ongjin	772	10	77.20	6,220	99.84	1,242	11	112.91	7,720	99.86
Gyeonggi										
Suwon	114,244	101,994	1.12	277,353	73.11	138,025	145,316	0.95	338,138	69.94
Seongnam	69,251	193,116	0.36	244,008	55.82	100,391	201,374	0.50	275,995	57.82
Uijeongbu	44,096	59,984	0.74	73,126	54.94	46,455	84,133	0.55	88,943	51.39
Anyang	93,415	145,615	0.64	153,052	51.25	106,999	142,561	0.75	163,843	53.47
Bucheon	82,047	167,750	0.49	221,200	56.87	92,729	162,972	0.57	229,709	58.50
Gwangmyeong	30,165	110,323	0.27	63,494	36.53	29,602	97,134	0.30	67,853	41.13
Pyeongtaek	19,482	25,538	0.76	132,648	83.86	27,072	29,188	0.93	138,146	82.56
Dongducheon	8,935	9,640	0.93	23,875	71.24	8,725	10,145	0.86	24,595	70.80
Ansan	73,676	55,841	1.32	188,817	77.18	90,104	75,194	1.20	204,546	73.12
Goyang	42,851	138,237	0.31	99,528	41.86	65,804	176,546	0.37	185,719	51.27
Gwacheon	25,277	24,064	1.05	8,996	27.21	25,151	22,322	1.13	10,356	31.69
Guri	20,341	37,172	0.55	31,501	45.87	28,520	41,344	0.69	39,700	48.99
Namyangju	21,338	44,843	0.48	60,754	57.53	25,168	78,031	0.32	81,926	51.22
Osan	19,994	13,681	1.46	22,292	61.97	21,176	21,567	0.98	29,907	58.10
Siheung	27,655	31,521	0.88	28,831	47.77	50,100	67,501	0.74	75,157	52.68
Gunpo	30,055	72,321	0.42	40,072	35.65	34,498	78,954	0.44	53,890	40.57
Uiwang	13,957	34,786	0.40	17,169	33.05	16,661	39,786	0.42	19,069	32.40
Hanam	9,574	31,537	0.30	25,931	45.12	17,392	31,702	0.55	30,061	48.67
Yongin	56,710	28,574	1.98	84,103	74.64	85,606	71,167	1.20	121,151	63.00
Paju	13,133	16,136	0.81	62,520	79.49	20,801	21,390	0.97	66,855	75.76
Icheon	13,581	5,606	2.42	66,576	92.23	17,032	10,920	1.56	78,124	87.74
Anseong	11,657	6,279	1.86	58,623	90.33	19,750	11,760	1.68	59,229	83.43
Gimpo	32,482	11,482	2.83	41,274	78.24	43,536	22,881	1.90	50,331	68.75
Yangju	13,819	14,001	0.99	29,626	67.91	16,992	18,939	0.90	32,621	63.27
Yeoju	5,244	4,371	1.20	41,441	90.46	8,226	5,556	1.48	46,249	89.28
Hwaseong	31,667	17,070	1.86	72,873	81.02	45,557	25,722	1.77	77,268	75.02
Gwangju	22,321	8,176	2.73	27,949	77.37	33,843	20,062	1.69	42,070	67.71
Yeoncheon	2,503	4,028	0.62	18,312	81.97	2,850	3,440	0.83	20,601	85.69
Pocheon	18,749	4,435	4.23	53,297	92.32	28,073	7,436	3.78	59,454	88.88
Gapyeong	2,514	2,297	1.09	17,122	88.17	2,886	3,076	0.94	20,215	86.79
Yangpyeong	3,719	2,637	1.41	33,321	92.67	4,604	3,673	1.25	36,082	90.76

Note: F_in.j: total in-commuting trips to the city, j / F_out.j: total out-commuting trips from the city, j/
K.j: total internal commuting trips in the city, j/ Kr.j: internal commuting rate in the city, j (data from KOSIS)

Tab.10 Development of in-/out-commuting ratio and internal commuting rate (1995-2000)

	1995				2000			
	F_in.j (person)	F_out.j (person)	K.j (person)	C.j	F_in.j (person)	F_out.j (person)	K.j (person)	C.j
Seoul								
Jongno	274,514	42,402	56,317	5.63	226,354	35,275	53,629	4.88
Jung	365,086	27,968	41,859	9.39	273,853	28,128	40,521	7.45
Yongsan	143,077	69,857	65,535	3.25	120,353	52,789	63,432	2.73
Seongdong	140,062	99,004	75,695	3.16	97,840	85,747	87,964	2.09
Gwangjin	48,672	111,950	93,173	1.72	70,060	99,529	105,786	1.60
Dongdaemun	198,967	110,430	110,515	2.80	181,955	76,277	117,313	2.20
Jungnang	49,400	127,847	96,840	1.83	44,137	117,368	113,708	1.42
Seongbuk	122,683	140,668	116,659	2.26	105,974	117,078	119,567	1.87
Gangbuk	29,709	131,526	76,477	2.11	34,053	94,661	78,254	1.64
Dobong	62,529	112,201	68,348	2.56	42,571	110,274	73,404	2.08
Nowon	79,684	169,153	121,635	2.05	74,082	166,408	143,133	1.68
Eunpyeong	52,198	137,932	110,066	1.73	41,819	109,501	116,899	1.29
Seodaemun	140,228	105,630	84,287	2.92	125,125	89,731	94,261	2.28
Mapo	118,502	111,325	97,609	2.35	109,936	89,781	106,140	1.88
Yangcheon	53,031	141,693	103,194	1.89	53,056	136,437	110,814	1.71
Gangseo	94,592	135,346	122,244	1.88	89,928	124,491	143,786	1.49
Guro	139,300	107,052	88,731	2.78	108,274	105,470	103,671	2.06
Geumcheon	39,429	85,243	66,184	1.88	41,335	70,570	71,014	1.58
Yeongdeungpo	283,540	112,136	113,374	3.49	237,537	94,208	111,906	2.96
Dongjak	80,596	147,551	83,078	2.75	72,930	113,558	98,013	1.90
Gwanak	82,444	169,025	125,746	2.00	74,667	133,453	135,718	1.53
Seocho	201,136	119,666	98,003	3.27	177,306	101,983	104,954	2.66
Gangnam	413,687	142,876	162,127	3.43	453,616	116,267	178,666	3.19
Songpa	125,183	177,591	168,292	1.80	120,630	155,474	189,328	1.46
Gangdong	65,461	128,072	130,719	1.48	56,977	123,572	132,446	1.36
Incheon								
Jung_in	65,468	14,240	20,014	3.98	39,377	10,788	20,916	2.40
Dong	36,281	36,731	16,165	4.52	25,898	15,557	19,258	2.15
Nam	105,252	106,006	109,526	1.93	79,405	74,809	131,215	1.18
Yeonsu	17,647	73,773	23,855	3.83	19,100	75,504	57,444	1.65
Namdong	79,154	85,596	103,258	1.60	74,285	81,561	118,656	1.31
Bupyeong	88,739	103,795	140,246	1.37	60,559	115,808	151,159	1.17
Gyeyang	20,332	69,742	51,556	1.75	23,890	70,818	88,947	1.06
Seo	50,353	59,911	80,216	1.37	41,684	55,025	108,814	0.89
Ganghwa	2,916	2,362	35,485	0.15	4,994	2,529	31,128	0.24
Ongjin	772	10	6,220	0.13	1,242	11	7,720	0.16
Gyeonggi								
Suwon	114,244	101,994	277,353	0.78	138,025	145,316	338,138	0.84
Seongnam	69,251	193,116	244,008	1.08	100,391	201,374	275,995	1.09
Uijeongbu	44,096	59,984	73,126	1.42	46,455	84,133	88,943	1.47
Anyang	93,415	145,615	153,052	1.56	106,999	142,561	163,843	1.52
Bucheon	82,047	167,750	221,200	1.13	92,729	162,972	229,709	1.11
Gwangmyeong	30,165	110,323	63,494	2.21	29,602	97,134	67,853	1.87
Pyeongtaek	19,482	25,538	132,648	0.34	27,072	29,188	138,146	0.41
Dongducheon	8,935	9,640	23,875	0.78	8,725	10,145	24,595	0.77
Ansan	73,676	55,841	188,817	0.69	90,104	75,194	204,546	0.81
Goyang	42,851	138,237	99,528	1.82	65,804	176,546	185,719	1.30
Gwacheon	25,277	24,064	8,996	5.48	25,151	22,322	10,356	4.58
Guri	20,341	37,172	31,501	1.83	28,520	41,344	39,700	1.76
Namyangju	21,338	44,843	60,754	1.09	25,168	78,031	81,926	1.26
Osan	19,994	13,681	22,292	1.51	21,176	21,567	29,907	1.43
Siheung	27,655	31,521	28,831	2.05	50,100	67,501	75,157	1.56
Gunpo	30,055	72,321	40,072	2.55	34,498	78,954	53,890	2.11
Uiwang	13,957	34,786	17,169	2.84	16,661	39,786	19,069	2.96
Hanam	9,574	31,537	25,931	1.59	17,392	31,702	30,061	1.63
Yongin	56,710	28,574	84,103	1.01	85,606	71,167	121,151	1.29
Paju	13,133	16,136	62,520	0.47	20,801	21,390	66,855	0.63
Icheon	13,581	5,606	66,576	0.29	17,032	10,920	78,124	0.36
Anseong	11,657	6,279	58,623	0.31	19,750	11,760	59,229	0.53
Gimpo	32,482	11,482	41,274	1.07	43,536	22,881	50,331	1.32
Yangju	13,819	14,001	29,626	0.94	16,992	18,939	32,621	1.10
Yeoju	5,244	4,371	41,441	0.23	8,226	5,556	46,249	0.30
Hwaseong	31,667	17,070	72,873	0.67	45,557	25,722	77,268	0.92
Gwangju	22,321	8,176	27,949	1.09	33,843	20,062	42,070	1.28
Yeoncheon	2,503	4,028	18,312	0.36	2,850	3,440	20,601	0.31
Pocheon	18,749	4,435	53,297	0.43	28,073	7,436	59,454	0.60
Gapyeong	2,514	2,297	17,122	0.28	2,886	3,076	20,215	0.29
Yangpyeong	3,719	2,637	33,321	0.19	4,604	3,673	36,082	0.23

Note: F_in.j: total in-commuting trips to the city, j / F_out.j: total out-commuting trips from the city, j/
K.j: total internal commuting trips in the city, j/ C.j: cross-commuting rate in the city, j (data from KOSIS)

Tab.11 Development of cross-commuting rate (1995-2000)

	1995			2000			1995-2000 (%)
	daytime (person)	night time (person)	day-/night time	daytime (person)	night time (person)	day-/night time	
Seoul							
Jongno	394,920	161,996	2.44	357,911	165,950	2.16	-11.48
Jung	452,750	114,659	3.95	374,747	128,340	2.92	-26.08
Yongsan	287,615	213,760	1.35	291,049	222,668	1.31	-2.96
Seongdong	316,916	275,280	1.15	330,518	317,957	1.04	-9.57
Gwangjin	249,072	312,114	0.80	345,218	374,307	0.92	15.00
Dongdaemun	437,651	348,250	1.26	466,719	360,110	1.30	3.17
Jungnang	276,467	354,765	0.78	359,675	432,630	0.83	6.41
Seongbuk	393,490	410,887	0.96	440,942	451,451	0.98	2.08
Gangbuk	222,506	324,293	0.69	273,955	334,411	0.82	18.84
Dobong	233,745	283,144	0.83	278,983	346,473	0.81	-2.41
Nowon	363,722	452,849	0.80	504,002	596,037	0.85	6.25
Eunpyeong	312,527	398,086	0.79	367,080	434,629	0.84	6.33
Seodaemun	334,190	299,059	1.12	379,357	343,341	1.10	-1.79
Mapo	331,366	323,876	1.02	380,315	359,695	1.06	3.92
Yangcheon	285,400	373,959	0.76	367,701	450,892	0.82	7.89
Gangseo	362,069	402,604	0.90	460,791	495,069	0.93	3.33
Guro	329,983	297,368	1.11	387,126	383,824	1.01	-9.01
Geumcheon	185,191	230,985	0.80	231,893	261,069	0.89	11.25
Yeongdeungpo	514,332	341,785	1.50	525,580	381,092	1.38	-8.00
Dongjak	283,920	350,555	0.81	353,538	393,711	0.90	11.11
Gwanak	370,742	456,791	0.81	437,258	495,292	0.88	8.64
Seocho	409,637	327,197	1.25	436,508	360,056	1.21	-3.20
Gangnam	726,106	453,480	1.60	851,448	511,576	1.66	3.75
Songpa	466,860	518,816	0.90	588,208	622,273	0.95	5.56
Gangdong	332,193	394,524	0.84	398,701	464,990	0.86	2.38
Incheon							
Jung_in	107,899	56,505	1.91	93,276	64,548	1.45	-24.08
Dong	84,136	84,482	1.00	81,786	71,309	1.15	15.00
Nam	346,810	347,384	1.00	406,484	401,701	1.01	1.00
Yeonsu	101,438	157,524	0.64	200,500	256,803	0.78	21.88
Namdong	291,981	298,361	0.98	382,397	389,542	0.98	0.00
Bupyeong	367,950	382,929	0.96	465,406	520,471	0.89	-7.29
Gyeyang	140,246	189,637	0.74	276,145	322,930	0.86	16.22
Seo	213,333	222,819	0.96	317,763	330,992	0.96	0.00
Ganghwa	55,544	54,980	1.01	61,774	59,268	1.04	2.97
Ongjin	11,520	10,758	1.07	14,317	13,086	1.09	1.87
Gyeonggi							
Suwon	605,081	591,263	1.02	927,627	932,465	0.99	-2.94
Seongnam	560,737	684,063	0.82	798,226	898,393	0.89	8.54
Uijeongbu	198,930	214,624	0.93	311,781	349,243	0.89	-4.30
Anyang	410,469	462,304	0.89	535,809	570,880	0.94	5.62
Bucheon	512,673	598,104	0.86	677,670	747,525	0.91	5.81
Gwangmyeong	191,413	271,490	0.71	261,854	329,329	0.80	12.68
Pyeongtaek	244,410	247,165	0.99	339,923	338,015	1.01	2.02
Dongducheon	56,954	57,659	0.99	69,815	71,179	0.98	-1.01
Ansan	395,545	377,220	1.05	565,579	549,869	1.03	-1.90
Goyang	299,108	394,364	0.76	643,971	754,378	0.85	11.84
Gwacheon	54,099	52,792	1.02	68,753	65,782	1.05	2.94
Guri	93,902	110,629	0.85	145,444	158,115	0.92	8.24
Namyangju	154,790	178,170	0.87	282,497	335,085	0.84	-3.45
Osan	61,886	55,222	1.12	101,348	101,237	1.00	-10.71
Siheung	94,977	98,813	0.96	284,393	301,681	0.94	-2.08
Gunpo	136,624	178,839	0.76	215,208	259,548	0.83	9.21
Uiwang	61,596	82,405	0.75	93,065	116,115	0.80	6.67
Hanam	68,815	90,729	0.76	104,007	118,244	0.88	15.79
Yongin	218,768	190,214	1.15	396,055	380,416	1.04	-9.57
Paju	129,168	132,139	0.98	172,850	173,324	1.00	2.04
Icheon	132,814	123,688	1.07	184,558	176,610	1.05	-1.87
Anseong	105,475	99,247	1.06	141,255	130,937	1.08	1.89
Gimpo	106,952	85,833	1.25	167,349	146,539	1.14	-8.80
Yangju	74,064	74,196	1.00	103,397	105,259	0.98	-2.00
Yeoju	76,230	74,727	1.02	99,358	95,811	1.04	1.96
Hwaseong	145,073	130,295	1.11	203,630	183,469	1.11	0.00
Gwangju	82,019	67,692	1.21	137,163	123,071	1.11	-8.26
Yeoncheon	40,808	42,291	0.96	47,180	47,739	0.99	3.13
Pocheon	108,887	94,026	1.16	154,941	133,256	1.16	0.00
Gapyeong	41,121	40,343	1.02	51,279	50,815	1.01	-0.98
Yangpyeong	59,474	58,161	1.02	75,433	74,180	1.02	0.00

Note: data from KOSIS

Tab.12 Development of the day- and nighttime population ratio in the region Seoul (1995-2000)

Year 2000	employees and students (a) (person)	out-commuters (b) (person)	commuters to Seoul (c) (person)	(c) / (b) (%)	(c) / (a) (%)
Incheon	1,237,667	502,410	137,554	27.38	11.11
Suwon	483,454	145,316	41,923	28.85	8.67
Seongnam	477,369	201,374	142,977	71.00	29.95
Uijeongbu	173,076	84,133	57,455	68.29	33.20
Anyang	306,404	142,561	74,663	52.37	24.37
Bucheon	392,681	162,972	98,249	60.29	25.02
Gwangmyeong	164,987	97,134	70,964	73.06	43.01
Pyeongtaek	167,334	29,188	4,106	14.07	2.45
Dongducheon	34,740	10,145	2,813	27.73	8.10
Ansan	279,740	75,194	23,516	31.27	8.41
Goyang	362,265	176,546	146,856	83.18	40.54
Gwacheon	32,678	22,322	16,335	73.18	49.99
Guri	81,044	41,344	27,643	66.86	34.11
Namyangju	159,957	78,031	52,621	67.44	32.90
Osan	51,474	21,567	2,186	10.14	4.25
Siheung	142,658	67,501	20,681	30.64	14.50
Gunpo	132,844	78,954	31,717	40.17	23.88
Uiwang	58,855	39,786	12,482	31.37	21.21
Hanam	61,763	31,702	24,688	77.88	39.97
Yongin	192,318	71,167	30,904	43.42	16.07
Paju	88,245	21,390	10,263	47.98	11.63
Icheon	89,044	10,920	2,136	19.56	2.40
Anseong	70,989	11,760	1,242	10.56	1.75
Gimpo	73,212	22,881	14,594	63.78	19.93
Yangju	51,560	18,939	6,182	32.64	11.99
Yeoju	51,805	5,556	920	16.56	1.78
Hwaseong	102,990	25,722	2,345	9.12	2.28
Gwangju	62,132	20,062	7,804	38.90	12.56
Yeoncheon	24,041	3,440	638	18.55	2.65
Pocheon	66,890	7,436	2,539	34.14	3.80
Gapyeong	23,291	3,076	1,079	35.08	4.63
Yangpyeong	39,755	3,673	1,849	50.34	4.65

Note: colored areas belong to the city region of Seoul (Ger. Stadtregion Seoul) / data from KOSIS

Tab.13 Analysis on the scope of city region Seoul based on the German standard

Origin \ Destination		Seoul	Hanam	Gimpo
Seoul	commuting trips (2000)		12,341	16,855
	increase (1995-2000)		4,899	3,780
Hanam	commuting trips (2000)	24,688		
	increase (1995-2000)	-1,419		
Gimpo	commuting trips (2000)	14,594		
	increase (1995-2000)	7,406		

Tab.14 Amount of commuting trips and increasing rate in the vertical sections (Seoul-Gimpo/ Seoul-Hanam)

Origin \ Destination		Incheon	Suwon	Seongnam	Anyang	Bucheon	Ansan	Goyang	Uijeongbu	Guri/ Namyangju
Incheon	A		7,523	1,961	5,216	38,801	10,231	4,965	889	419
	B		2,984	331	2,165	8,887	1,984	3,038	20	- 53
Suwon	A	2,236		4,743	8,804	835	8,178	441	254	364
	B	825		3,005	2,053	351	2,443	169	154	134
Seongnam	A	1,787	7,813		2,425	646	1,705	650	464	930
	B	373	1,009		453	- 162	65	- 72	72	- 124
Anyang	A	3,375	9,952	3,023		1,160	8,270	901	260	328
	B	498	343	1,395		- 143	- 503	201	16	4
Bucheon	A	31,203	3,143	911	2,776		4,168	2,737	310	271
	B	- 367	977	120	833		77	728	- 23	27
Ansan	A	2,594	5,940	949	6,482	1,091		451	172	200
	B	104	964	344	724	- 25		223	113	38
Goyang	A	4,310	1,456	1,179	949	2,097	868		1,154	236
	B	1,506	293	321	247	866	420		104	35
Uijeongbu	A	588	373	421	286	165	194	1,167		1,499
	B	142	- 46	155	71	- 7	103	523		287
Guri/ Namyangju	A	684	1,132	1,878	375	367	277	416	2,173	
	B	328	266	767	- 3	141	57	171	237	

Note: A: commuting trips (2000) / B: increase (1995-2000)

Tab.15 Amount of commuting trips and increasing rate in the horizontal sections (bet. regional centers)

Origin \ Destination		Incheon	Gimpo	Goyang
Incheon	commuting trips (2000)		17,178	
	increase (1995-2000)		4,874	
Gimpo	commuting trips (2000)	4,332		1,110
	increase (1995-2000)	1,613		878
Goyang	commuting trips (2000)		2,162	
	increase (1995-2000)		1,286	

Tab.16 Amount of commuting trips and increasing rate in the horizontal sections (Incheon-Gimpo-Goyang)

	portion of employees and students commuting out to regional centers in 2000 (%)							
	Suwon	Seongnam	Uijeongbu	Anyang	Bucheon	Ansan	Goyang	Guri/ Namyangju
Seoul	0.96	1.09	0.51	0.65	0.64	0.49	0.81	0.51
Incheon	0.61	0.16	0.07	0.42	3.14	0.83	0.40	0.03
Suwon		0.98	0.05	1.82	0.17	1.69	0.09	0.08
Seongnam	1.64		0.10	0.51	0.14	0.36	0.14	0.19
Uijeongbu	0.22	0.24		0.17	0.10	0.11	0.67	0.87
Anyang	3.25	0.99	0.08		0.38	2.70	0.29	0.11
Bucheon	0.80	0.23	0.08	0.71		1.06	0.70	0.07
Gwangmyeong	1.63	0.43	0.13	2.99	1.44	1.97	0.49	0.12
Pyeongtaek	1.73	0.15	0.01	0.22	0.04	0.22	0.06	0.03
Dongducheon	0.09	0.12	5.43	0.07	0.03	0.12	0.18	0.20
Ansan	2.12	0.34	0.06	2.32	0.39		0.16	0.07
Goyang	0.40	0.33	0.32	0.26	0.58	0.24		0.07
Gwacheon	2.65	1.03	0.07	5.86	0.14	1.33	0.16	0.06
Guri	0.52	0.95	0.76	0.21	0.16	0.11	0.24	
Namyangju	0.45	0.69	0.98	0.13	0.15	0.12	0.14	
Osan	9.65	0.65	0.15	0.52	0.16	0.61	0.04	0.06
Siheung	1.19	0.36	0.05	2.91	6.47	11.40	0.37	0.10
Gunpo	4.08	0.81	0.04	14.55	0.32	4.55	0.20	0.09
Uiwang	5.14	1.25	0.14	20.03	0.36	2.24	0.43	0.08
Haman	0.69	2.09	0.19	0.21	0.15	0.15	0.16	1.11
Yongin	6.03	7.43	0.04	0.55	0.08	0.41	0.06	0.09
Paju	0.32	0.13	0.59	0.17	0.19	0.07	8.56	0.08
Icheon	0.43	0.65	0.03	0.15	0.00	0.11	0.04	0.04
Anseong	0.87	0.07	0.00	0.10	0.00	0.06	0.03	0.01
Gimpo	0.35	0.17	0.11	0.40	1.33	0.15	1.52	0.06
Yangju	0.14	0.14	14.88	0.04	0.24	0.10	0.57	0.28
Yeoju	0.24	0.31	0.00	0.00	0.00	0.09	0.00	0.07
Hwaseong	14.03	0.25	0.03	0.60	0.04	1.14	0.06	0.03
Gwangju	0.89	11.60	0.03	0.33	0.05	0.09	0.07	0.23
Yeoncheon	0.06	0.05	2.80	0.11	0.00	0.00	0.19	0.04
Pocheon	0.08	0.05	3.39	0.01	0.07	0.05	0.10	0.75
Gapyeong	0.10	0.24	0.18	0.00	0.10	0.05	0.00	3.75
Yangpyeong	0.11	0.31	0.14	0.03	0.00	0.06	0.11	0.76

Note: data from KOSIS

Tab.17 Commuting zones of individual regional centers (2000)

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** The alphabetized names of Korean and Japanese authors can't be different from actual names, so their names were written additionally in Hangul, the Korean alphabet and Kanji, the Chinese characters between brackets after alphabetized ones.

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