NISTEP RESEARCH MATERIAL
No. 74

The Comparative Study of Regional Innovation Systems of Japan and China

Su Jing

Department of Policy, Regulation and System Reform
Ministry of Science and Technology
15B Fuxing Road, Beijing, 100862, China

Report on Research Undertaken at the
Third Policy-Oriented Research Group
National Institute of Science and Technology Policy
Science and Technology Agency, Japan

November 2000

The Comparative Study of Regional Innovation Systems of Japan and China

November 2000

Su Jing

Department of Policy, Regulation and System Reform
Ministry of Science and Technology, China
15B Fuxing Road, Beijing, 100862

Third Policy-Oriented Research Group
National Institute of Science and Technology Policy
Science and Technology Agency, Japan

The author, Dr. Su Jing has been in NISTEP as a STA Fellow for one year from November 10, 1999 to November 09, 2000, this report is based on author's research during this period of time. Any opinions, findings, conclusions, or recommendations in this report are those of the author and do not necessarily represent the official views of Ministry of Science and Technology of China or the National Institute of Science and Technology Policy, Science and Technology Agency of Japan.

The comparative study of regional innovation systems of Japan and China

Content

The comparative study of regional innovation systems of Japan and China

INTRODUCTION

With the 21st century is just ahead of us, with the coming of the "Knowledge-based Economy", world economic activities are becoming more global. The competition is becoming more and more intensive, while the innovation capability is the basis and core of competitiveness. Under the globalization of world economy, the role of region is much more significant, the development of the region, bring forth the development of the nation. Some famous knowledge intensive regions of the world shaped in the past decades had clearly showed this point. For example, in Europe, four major regions, Lombardy of Italy, Baden-Wuerttemburg of Germany, Rhones-Alpes of France and the Catalonia of Spain have grouped together as loosely tied association to market themselves internationally as "The Four Motors for Europe"[1]. In USA, the Silicon Valley in California and Boston's Route 128 are much familiar to us. In Asia, the industry cluster in Tokyo area and the Technopolis Program of Japan, Xingzhu of Taiwan and Singapore had attracted much interest of the world.[2] Regional innovation system, which concerns regional innovation network and activities, is one of the very important components and supplement of national innovation systems, provide a framework to research regional economy development and technology and business innovation. Studying of regional innovation systems can map out the factors and their role in innovation systems, further recognize the technology innovation in region, and yield policy implication for the local government and enterprises.

As a developed country, Japan has distinct characteristics on technology innovation, Japan's government and their industry policies had played a important and efficient role on promoting innovation. The concept of National Innovation Systems which is the hot topic of science and technology policy research was firstly put forwarded by Freeman on his studying on Japan's innovation systems. There are some world famous science parks and industrial clusters in Japan, and they are suitable cases for the regional innovation systems studies. Japan had made great effort on regional science and technology promotion and research. The National Institute of Science and Technology Policy of Science and Technology Agency (NISTEP), had finished a series of regional science and technology promotion study, many important research result were reached. [3,4]

China is a developing country, but it has tremendous developing potential, with the establishment of 53 national High-tech Zone and more than 120 Province level High-tech Zone, the development of regional economy and science and technology had been greatly promoted. Many regions with tremendous potential had emerged, such as Beijing Zhongguanchun, Shenzhen high-tech industry zone and some other regions and parks[5]. But some of the High-tech zone's development does not so successful, that is why? Under almost same preferential policy and national support, why some of them are successful, while some others are not. This is a question for many people to think about. One of the important reason maybe is that lacking of a system to support their development, because any progress of science and technology, especially the technology innovation need a sound system to support it. So how to recognize the regional innovation system, how to construct and perfect the regional innovation system had become an important issues for China. Through the comparative study of regional innovation of Japan and China, we can view the question from a different viewpoint, and get some elicitation from each other, facilitate the formulation and implementation of regional science and technology policy.

This research will compare the regional innovation systems of Japan and China, from the viewpoint of both physical and no-physical mechanisms, for non-physical mechanism, it will focus in the policies include industrial policy, science and technology policy, and the regional development policy. For physical mechanisms, the paper will discuss the programs which promoting regional development and some component of innovation systems. These policies and programs had greatly promoted the regional development and technological innovation, through the policy and program analysis, it can be clear that the characteristic, advantage and disadvantage of these policy and programs, benefit our future's policy making and implementation. As the enterprises is the core of innovation system, this paper will analysis the Small and Medium Enterprise policy of Japan and China. At the last, several of typical regions both from Japan and China were analyzed as the case.

PART 1 GENERAL BACKGROUND OF REGIONAL DEVELOPMENT AND SCIENCE AND TECHNOLOGY POLICY

1. Economic Development and Industrial Policies of Japan

Firstly let's look at Japanese economic development and industrial policies in the postwar period. The postwar period of Japan can be divided roughly into three parts from the economic point of view. The first period is from the late 1940's to the late 1950's. In Japan this period to be considered as the reconstruction and domestic consolidation. The second period is usually called "the period of rapid growth" through 1960's. The third period began in the early 1970's is referred to as the period of shift in the industrial structure. [6]

The first period, immediately following World War II, industrial facilities were almost completely destroyed by the ravage of war, and conditions for production were in terrible disarray. Production had fallen to one sixth of prewar levels. In such an environment, the rapid recovery of key industries such as electric power, coal, iron, and steel, and fertilizer was imperative in order to rebuild the economy and to ensure a minimum standard of living for the people. To this end, a "priority production system" was adopted. It allocated the limited raw material, capital, and foreign exchange resource to such key industries. By the mid-1950's, the Japanese economy had almost recovered, enabling the country to emerge from its period of material shortage.

The 1960's can be characterized as a decade of remarkable economic growth. During this decade, Japan stepped forth with an open economy to establish itself as a full member of the international community.

In the field of international trade, Japan became a contracting party to GATT in 1955. By 1964, the rate of liberation had reached 93%. In that year, Japan became an Article VIII nation in the IMF and also joined OECD. The first steps towards capital liberalization were taken in 1967, and almost complete liberalization was effected by 1973. During this period of transition, the primary task was to strengthen industry's international competitiveness in order to overcome constraints on economic growth related to the international balance of payments and catch up with the developed countries as quickly as possible.

With the development of the heavy and chemical industries, Japanese industry became more internationally competitive, and the nation sustained a surplus in the international balance of payments throughout the latter part of the 1960. But this was accompanied by pollution and environment problems that became more serious as the population and plant facilities were concentrated in the Pacific Belt Zone.

This pointed up the need to reexamine Japan's industrial policy. In 1971, the industrial Structure Council submitted "the Vision of MITI Policies in the 1970's". In the mean time, in 1973, Japan was hit by the oil crisis, and the nation's economy entered into a period of stabilized growth. The average annual GNP growth rate fell from more than 10% in the 1960's to less than 5% in the 1974.

In the 1980's in addition to matured industries such as automobiles, growth was accelerated in the high-technology assembly industry. This industry is exemplified by computers and numerically controlled machine tools that are extremely dependent on research and development efforts. From 1970 onward, the industrial structure of Japan has been changing into one led by the high-tech sector.

2. Japan's science and technology policy

The Japanese government has been promoting science and technologies in order to make people's life in the country active and comfortable by the way of such as expansion of economic frontier, to solve various global problems, and to establish a society that is secure and profitable. [7]

In order to achieve the objectives above, the steady promotion of research and development has been going on for space development, ocean science and technology, materials science and technology, aeronautical technology, life sciences, nuclear energy, and so on. In recent years, the budget has been emphatically allocated to the areas such as the Human Genome Analysis, brain science researches, information science and technology, and global environmental science and technology.

Based on the lesson from the Great Hanshin-Awaji Earthquake, the research developments that are closely associated with people's everyday life in the country have been promoted in the areas such as disaster prevention and security measures. Special coordination funds for promoting science and technology has been steadily expanding for the promotion of special promotional coordination for important research work and other policies.

An establishment of open research system has been emphasized through the recent use and support for post-doctors, in addition to the various special researcher system that was introduced more or less 10 years ago. The basic research is especially promoted by the recent expansion of competitive funding.

The center of excellence that is available to a wide range of domestic and foreign researchers has been prepared, as has been seen in the plan for the Next-Generation Synchrotron Radiation Facility. Also in recent years, an effort has been paid to make science and technology easier to understand for the people in the country, and the policies have been developed to conduct a fair evaluation of research institutions.

3. Science and technology expenditure of Japan

As a unitary state, the local government system is created by the central government, in other words, the direction of authority runs clearly from the center to the regions, Even though regional governments have considerable latitude in how they conduct their affairs. The salient feature of local government finance in Japan is the high degree of dependence on the central government for funds. Because local government actually deliver most government service to citizens, their share of total public sector expenditures is twice that of the central government. In other words, on a final expenditure base, the ratio of national to regional is roughly 1 to 2.[8] On the

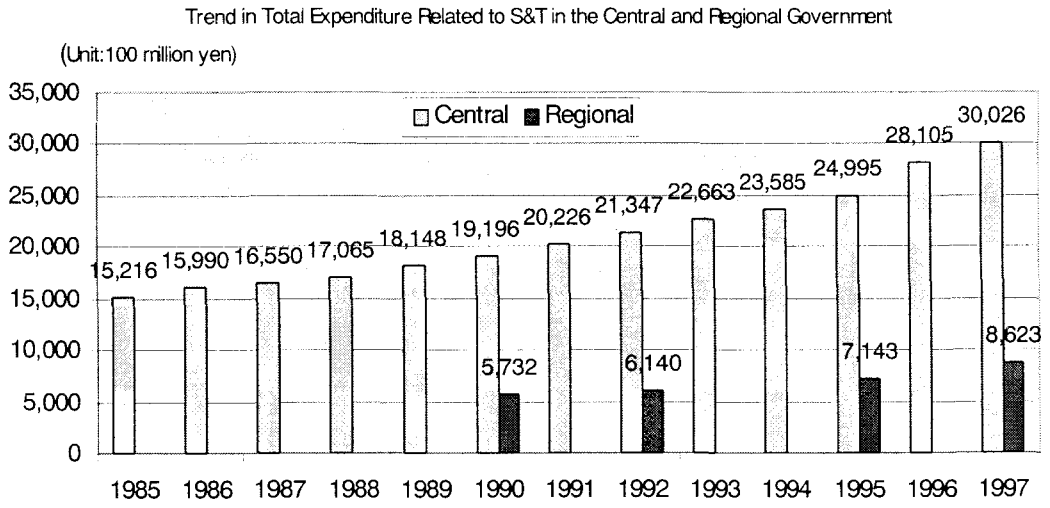


Fig.1-1 Trend in the S&T expenditure of Japan

other side of ledger, most local governments supply less than half of their own funds through taxes or other source of revenue, the rest comes from the central government

in the form of revenue sharing and subsidies. In other words, on a tax revenue basis, the ratio of national to regional is roughly 2 to 1, exactly the reverse of the expenditure ratio.

As for the distribution of government expenditures for promoting science and technology, regional governments pay out a far smaller portion of the total than does the central government. In 1997 regions spent 862 billion yen on promotion of science and technology, which was 28 percent of the amount spent by the central government. However in most other expenditure categories regional governments pay out considerably more than does the central government.

4. Relevant ministries and agencies concerning science and technology

In Japan, relevant ministries and agencies have set up a variety of measures in order to promote science and technology. [9]

1) Science and Technology Agency

The science and technology agency, using Special Coordination Funds for Promotion of Science and Technology from FY1990, has implemented a regional mobility research program (renamed Joint Research utilizing science and technology potential in region as of FY1992) that assembles at regional research organizations, top researchers from within and outside the region and employs the special characteristics of the region.

Basic Research for Life and Society has been implemented since FY1995 to further advance the above system and to promote research and development closely linked to regional society and people's needs. This system comprehensively promotes research and development for improvement in the quality of life and development of regions, using the research potential of both national and local governments.

Since fiscal year 1996 the Regional Science Promoter Program has worked through the regional research and development centers to seek to expand research coordination functions between national and public experimental and research institutes, universities, and has assisted in promoting science and technology in regional areas.

Furthermore, the national government and the regions have since FY1997 been joining together in priority research domains that the national government should be promoting. And in the regions' own research domains, to conduct joint-research

project for the regional-intensive for the purpose of promoting the formation of regional network COE that can bring the potential of science and technology sectors together in both personnel and organizational terms.

As for the development of Research facilities, in FY1996, the Science and Technology Agency commenced a project for development of residential and regional science and technology research facilities, in support of science and technology related facilities (research facilities for promoting advanced particle radiation therapy, experience centers of advanced science and technology, and earthquake research and seismic observation facilities) operated by local authorities. And beginning in FY1997, the agency is supporting development of advanced and basic research and development of facilities that contribute to invigoration of regional characteristics and to upgrading of regional research potential.

2) Environment Agency
Since FY1993, the Environmental Agency has been performing environmental research closely related to local regions as joint research together with national research institutes and public research institutes into issues which are of strong concern to regions and which should be examined as a result of the characteristics of the regional environment.

3) Ministry of Education, Science, Sports and Culture
The Ministry of Education is working to make national universities places for joint research and consignment research with the private sector, etc., to train technicians from corporations, etc., to conduct technical consultations for research and development, and to develop center for Cooperative Research for alliances and cooperation with industry. This program is contributing to alliance and reinvigoration of regional industry, and has to date been established at 49 national universities in 42 different prefectures.

4) Ministry of Agriculture, Forestry and Fisheries
Since FY1995, in the Ministry of Agriculture, Forestry and Fisheries, national, prefectural and private-sector research capabilities have been combined for comprehensive research and development to promote the development of technology that leads directly to the fields of the agricultural production.

Moreover, to promote still more practical research that can be of use in developing regional industry, the Regional Joint Research and Development Promotion Project

was implemented in fiscal year 1996 for joint research between industry, academia and government that incorporates university and private-sector research and development skills as well as those of the national and public experimental and research institutes.

5) Ministry of International Trade and Industry
Since FY1982, the Ministry of International Trade and Industry has implemented the Priority Regional Technology Research and Development System. In this program, the Agency of Industrial Science and Technology's test laboratories, local government research institutes and private companies join together to conduct research and development themes which meet regional needs or take advantage of regional research and development potential.

In FY1997, the Ministry implemented a regional consortium research and development program through promoting basic research and development of regional joint research groups to contribute to the creation of new industries.

5. General background of China's economic development
Since the establishment of People's Republic of China, the economic development of China can be divided into two parts taking the 1978 as the watershed. Before 1978, China took the planning economy, economic system follows that of the Soviet Unions, nation's industrial emphasis was concentrated on the heavy industry and agriculture, state's development is unbalanced. [10]

From the end of 1970's, China carried out the Reform and Opening up policies, gradually adopted the market economy, the economy got the rapid development, the GDP of China increased from the 362.4 billion Yuan of 1978 to the 7955.2 billion Yuan, the average increasing rate during the 20 years is 9.71%. The industrial structure also changed greatly, the proportion of first industry decreased from the 28.10% of 1978 to the 17.97% of 1998, the proportion of second industry decreased from the 41.32% of 1978 to the 18.06% of 1998, the proportion of tertiary industry increased from the 24.77% of 1978 to the 32.8% of 1998. From the end of 1970s, China's foreign trade also developed very quickly. In 1998, the total amount of import and export reached 323.9 billion US dollar, it is the 15.7 times of 1978. The increasing rate was 24.15%, it is higher than the growth rate of GDP. The industrial increasing value increased from 160.7 billion Yuan of 1978 to the 3354.1 billion Yuan of 1998, the increasing rate was 11.84%. agriculture increasing value increased from the 101.9 billion Yuan of 1978 to the 1429.8 billion Yuan of 1998, the

increasing rate during the 20 years was 4.96%. The increasing value of tertiary industry increased from 86.1 billion Yuan of 1978 to the 2610.4 billion Yuan of 1998, the growth rate during 20 years was 10.47%, it is higher than the growth rate of GDP.

China had experienced the Asia financial crisis, and undergoing the state-owned enterprises restructure, the success reform of state owned large enterprises is very important for China's economic development. Nowadays, China is actively developing the high technology and high-tech industry, had achieved great development. China also can join the WTO soon, this will also greatly promote the development of China's economy.

6. China's science and technology policy

The basic guideline of Chinese government for science and technology is that science and technology constitute the foremost productive forces that economic development must rely on science and technology while science and technology must be geared to economic development. Efforts are called for to scale the heights of science and technology. The prime mission of scientific and technological undertakings is to tackle important problems arising from economic and social development. Generally, scientific, technological and economic project should work in coordination with each other.

In line with the principle and strategic objectives set for China's science and technology development, China's S&T efforts are strategically deployed at three tiers. That is R&D activities aimed at tackling major S&T snags encountered in the nation's economic construction, effort to develop high and emerging technologies and high-tech industries, undertakings in basic research and applied basic research.

At the first tier, through the organization and execution of the "National Program for Key S&T Projects", the "Industrial Experiment Program", the "Spark Program", the "National S&T Achievements Dissemination Program", and the "National Program for Science and Technology for Sustainable Development", efforts are under way to accelerate technological innovation and product regeneration in traditional industries, to develop and exploit advanced science and technology, and to harmonize the economic and social development with nature by upgrading the technological and labor performance level in industry and agriculture.

At the second tier, under the "National High Technology Research and Development Program (863 Program)" and the "Torch Program", these efforts are designed to place the nation at the frontiers of the world's high technology development in certain fields, the S&T manpower is concentrated on key projects and limited objectives, and

the commercialization, industrialization and integration of world of high and emerging technologies are vigorously pursued.

At the third tier, by launching the "National Program for Key Basic Research Projects (the Scaling the Heights Program") and establishing the National Natural Science Foundation mechanism and key national laboratories, the nation's basic research is expected to be greatly strengthened and provide a solid basis for the long-term scientific and technological advances as well as for the economic and social development.

As regard the priority areas for China's science and technology, the first one is the R&D for a high-speed, healthy and sustainable development of the nation's economy. Including the acceleration of agriculture and rural modernization, which objective is to increase greatly the quantity and quality of agricultural products, to improve the farmer's incomes, upgrading of the capability of industries to innovate, and the development of high and emerging technology related industries. Torch Program which is still in effect encourages research institutes, universities and firms to commercialize new and high technologies to develop new and hi-tech related industries.

The second one is to harmonize economic growth and social progress for sustainable development. China's Agenda 21, a report on the strategy, measures and programs of China for a sustainable development, is issued in 1994 by the State Council to guide the medium and long-term plans on economic and social development. R&D projects for social development have been carried on in priority areas includes environmental protection, Clean production, Sustainable and recycling use of natural resource, Public health care and family planning, Construction of suitable residential district, New medicine development, Labor protection, Natural calamity defense, Business Efficiency, Public safety, Social security and social service, Art, sports, tourism and preservation of cultural relics.

The third one is high technology research and development. in 1986, the State Council issued high technology research and development program, in which 7 priority areas were set as: information technology, automation technology, biotechnology, energy technology, advanced materials, space technology, and laser technology. In July 1996, ocean technology had been added as the 8th priority areas. After 10 years of implementation, 863 Program, has yielded about 1,500 significant achievements, a number of which have already been applied in economy and national defense. Some achievements are comparable to the best of the world, such as high performance computers, artificial intelligence, CIMS, biomedicine, program-

controlled switch board, optical fiber telecommunications, robotics, carrier rockets, satellites, advanced materials, laser technology, etc..

The fourth one is reinforcement of basic research. Chinese government recognized that basic research is of very importance but subject to be inadequately supported without the intervention of government. National Natural Science Funds had been founded by the State Council to support basic research, as well as some apply research, with mainly the allocation from national finance, and additionally non-governmental denotation from domestic and overseas resources.

7. Science and technology expenditure of China

Science and technology expenditure include the expenditure for R&D, R&D achievement application and science and technology service activity of research and development institutes which belong to government sectors, university and colleges, and enterprises.

From 1991 to 1998, the science and technology expenditure of China increased steadily, calculated in comparable price, the increasing rate is 7.29% annually. The science and technology expenditure of 1998 is 112.85 billion RMB Yuan, increased by 7.5% than 1997. But the proportion of science and technology expenditure to GDP is still very low. In 1993, the proportion is 1.8%. Therefore affected by economic adjustment and states financial conditions, in 1994, the proportion of science and technology expenditure to GDP decreased as 1.6%, and in recent years it keep about 1.4%.[11]

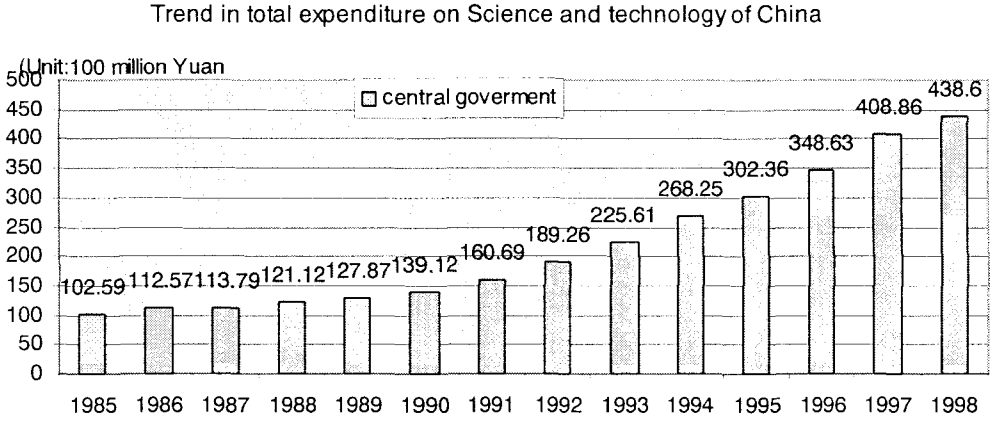
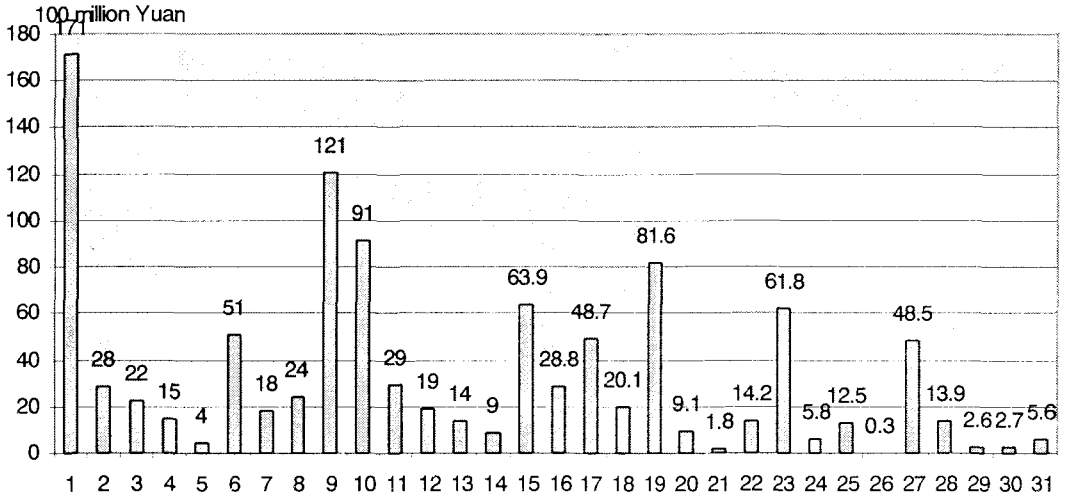


Fig.1-2 Trend in the S&T expenditure of China

Enterprises and research and development institutes are the two major implementation sectors of science and technology activity of China. In recent years, the general conditions of enterprises and research and development institutes accounted for half of the total keep unchanged. In 1998, the science and technology expenditure of enterprises was 47.87 billion RMB Yuan, accounted for 42.4% of the science and



1.Beijing, 2.Tianjin, 3.Hebei, 4.Shanxi, 5.Neimenggu, 6.Liaoning, 7.Jilin, 8.Heilongjiang, 9.Shanghai, 10.Jiangsu, 11.Zhejiang, 12.Anhui, 13.Fujian, 14. Jiangxi, 15.Shandong, 16.Henan, 17.Hubei, 18.Hunan, 19.Guangdong, 20.Guangxi, 21.Hainan, 22.Chongqing, 23.Sichuan, 24.Guizhou, 25.Yunnan,26. Tibet, 27.Shaanxi, 28.Gansu, 29.Qinghai, 30.Ningxia, 31.Xinjiang.

Source: "China S&T Statistic Data"

Fig.1-2 Science and technology expenditure by region of China

technology expenditure of enterprises was 48.49 billion RMB Yuan, accounted for the 43.0% of total.

Research and development is the core of science and technology activities, since 1990, R&D expenditure of China increased steadily. In 1998, R&D expenditure was 55.1 billions Yuan RMB, increased 14% by the last year, calculated by comparable price, from 1991 to 1998, the R&D expenditure of China increased as the average rate of 10.1%.

Table1-1 R&D expenditure and its proportion to GDP (Source: "China S&T Statistic Data")

Year	1991	1992	1993	1994	1995	1996	1997	1998
R&D fund (billion Yuan)	15.08	20.98	25.62	30.9	34.9	40.47	48.19	55.1
Increased by (%)	-	29.0	6.6	0.6	-0.2	9.51	17.55	10.13
Proportion to GDP (%)	0.70	0.79	0.74	0.66	0.60	0.60	0.64	0.69

During 1991 to 1997, China's GDP was in the high speed increasing period, the annually increasing rate was 10.9%, the increasing rate in 1998 was 7.8%, so the increasing of GDP was in the same trends. But the proportion of R&D fund account for the GDP had no obvious changes, kept 0.65%, in 1998, it was 0.69%. There was a large gap from many industrialized countries and many newly industrialized countries.

In the R&D expenditure of 1998, basic research was 2.9 billion Yuan RMB, accounted for 5.3% of the total, application research was 12.46 billion Yuan RMB, account for 22.6%, experimental and development was 39.75 billion Yuan RMB, accounted for 72.1%. China's research and development mainly concentrate in research and development institutes and enterprises. In 1998, the proportion of research and development institutes that belong to government sector and enterprises was 42.6% and 44.8% respectively. The major basic and application research implementation institutes is the research and development and university, in 1998, their expenditure of basic fund accounted for 95% of China's basic research fund, and 80.1% of the application research fund. The major experiment and development implementation institutes was the enterprises. In 1998, more than half of the experiment and development fund concentrated in enterprises, especially in the large and medium sized industrial enterprises.

Government financial science and technology allocation fund is government to realize the management to science and technology and important measures to adjust the science and technology activity according to the national objective, and it is the important source for the science and technology at present.

In 1998, national science and technology financial allocation fund is about 46.65 billion Yuan RMB. Thereinto central government financial science and technology allocation fund is 31.76 billion Yuan RMB, it accounted for 10.2% of the central government financial expenditure. Local government science and technology financial allocation fund is 14.89 billion RBM Yuan, account for 1.95% of the local government financial expenditure. From 1991 to 1998 the average increase rate of financial science and technology allocation fund was 6.0%.

After 1995, local government increased their investment in science and technology. From 1995 to 1998, the annually average increasing rate of financial science and

technology allocation fund exceed that of central government. In 1998, the allocation fund was 14.98 billion Yuan RMB, increased by 12.1% than that of last year.[12]

Table1-2 Local government S&T allocation fund and its proportion to total expenditure

Year	1994	1995	1996	1997	1998
Local S&T fund (billion Yuan)	6.93	8.68	10.58	13.40	14.89
Increased than last year (%)	-0.32	10.67	15.11	25.07	12.61
Local financial expenditure (b.)	403.82	482.83	577.27	673.99	777.93
Proportion	1.72	1.8	1.83	1.99	1.91

Among 31 provinces of China, in 1998 there were 14 province had the science and technology financial allocation fund exceed 0.4 billion Yuan RMB, in which Guangdong Province was the highest, 1.79 billion Yuan RMB, the second was Shandong Province, 0.99 billion Yuan RMB. The total amount of science and technology financial fund of these 14 provinces accounted for 75.6%.

PART 2: THEORETICAL FRAMEWORK OF REGIONAL INNOVATION SYSTEMS

1. Regional Innovation Systems

Before the detailed comparative study of the regional innovation systems of Japan and China, let's look at the regional innovation systems. Innovation, according to the definition of OECD, is the sum total of the activities of institutions (the corporation that are the main actors, and the public research institutions, universities, etc that supply knowledge) that are engaged in the innovation process, the flow of resources (knowledge, personnel etc.) between these institutions, and external factors such as government regulations, incentive measures, financial policies, employment policies, education and human resource training policies that affect these activities.[13]

The term "Regional Innovation Systems", describing the complex mixture of institutions and policies that influence the innovation process at the regional level. The region is a territorial unit and its innovation system is not a single systematic mechanism but rather a cluster of various internal and external policies and institutions operating in that space. So, generally speaking, the regional innovation system consists of enterprises, universities and research institutions that participate in technology development and dissemination, the policies and programs, is a regional innovation network system with market intermediary and government take part in and for the creation, reservation, and transition of knowledge, skill and new products.

The development of innovation systems is a learning process, just as technological is the result of a cumulative learning process as a system and is generated by accumulating knowledge and know-how derived from within the system, knowledge and know-how accumulated by planners in the local region.

For understanding the whole complexity of innovative potential of a region, it is necessary to consider the process of innovation in its regional context. In such a region, the vision of innovation defined as a linear sequence between inputs and outputs appears rather inadequate. As suggested by Marius et al, innovation has primarily a collective dimension, implying various forms of shared knowledge and learning, especially for SMEs.[14] The concept of regional innovation system can thus be viewed in terms of institutional infrastructure (specific interfaces between the different partners, such as firms, educational and research organizations, centers of technology transfer, etc), inducing firm's innovation. But innovation should be understood in a broader sense, having in mind that improvement of managerial skills

and organizational methods, better access to different areas of general knowledge, etc. are as important as R&D or technology transfer, particularly for SMEs, one of the typical actors of the regional scene.

Furthermore, the non-linear model of innovation developed by the evolutionists, then enriched by the new approach of the knowledge creation and the approach of the learning economy shows the crucial role of scientific knowledge and general culture at every stage of the chain leading to innovation. It is not sure that the design of policies has completely taken into consideration that vision- no more than the current indicators of innovation and the methodology of evaluation.

The regional innovation system is not a coherent closed system and, particularly, knowledge supply and demand are not internally balanced. The situation is not obviously an economic problem, the region is doing relatively well. The scientific institution is not obviously an economic problem, the region is doing relatively their own relevant cognitive networks across all administrative borders. Most of the innovations are not directly linked to a scientific output or a formal transfer of technology.

In this way one can view a regional innovation system as the innovating firms surrounded by a number of actors who are all in one way or another linked to the innovation process of the focal firm and to each other. The conceptual framework and institutions of a regional innovation system can be illustrated as the Fig.2-1 and Fig.2-2.

Regional innovation systems have been largely determined within the national systems of innovation, because the central government had a considerable influence in shaping the long-term pattern of structural change of the national economy and therefore retained control over the problem of industrial location. Since the economic effects of technology-industrial innovation have always been accompanied by a spatial change in the regional structure of economic development, regional innovation systems have depended on the regional policies, as well as industrial policies of the national government.

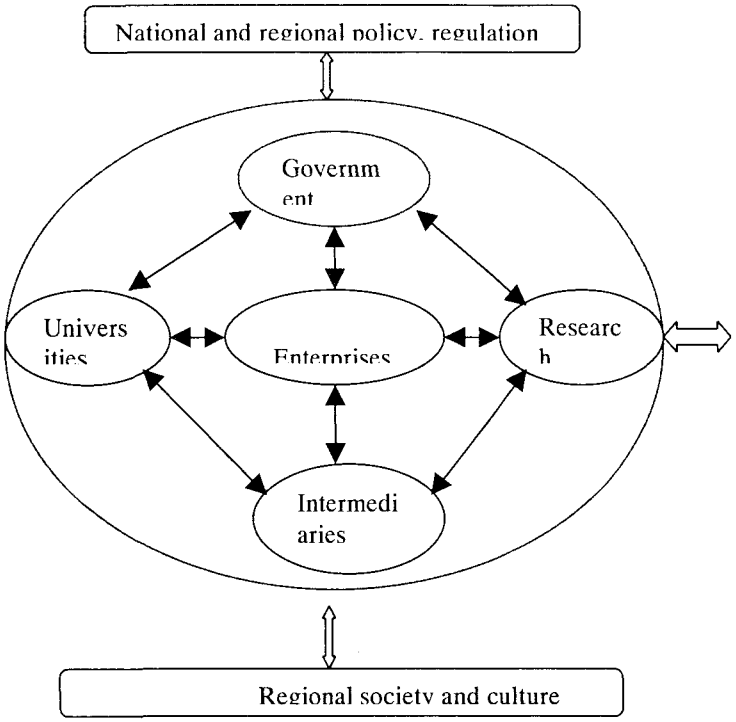


Fig.2-1 The conceptual framework of regional innovation system

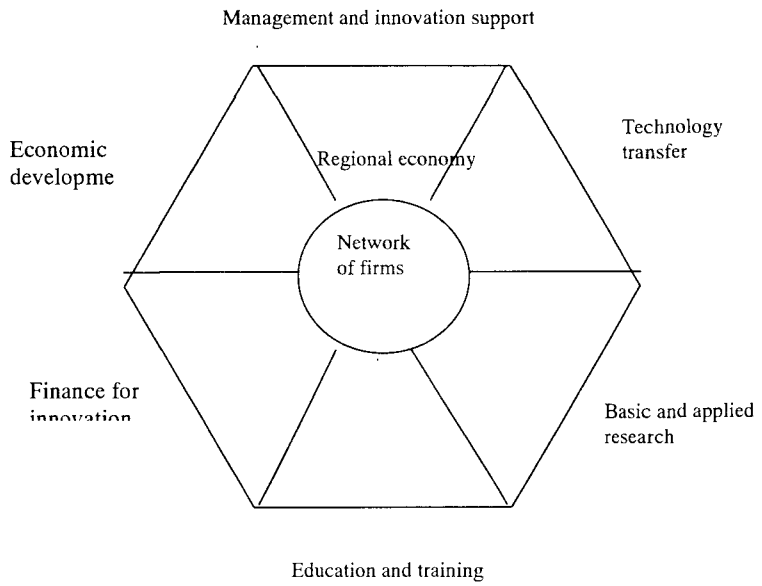


Fig.2-2 The institutions in a regional system of innovation

There are both close link and essential difference between national innovation system and regional innovation, national innovation system is a real existing. But it also a framework for the research of science and technological policy and economic policy, much attention was paid on how to take the efficiency of the whole system. But the regional innovation system research pay much attention on the institution setting and policy setting of a special region with enterprises as the core.

2. The typology of regional innovation systems

From the viewpoint of the technology transfer mode, the regional innovation systems (RIS) can be categorized into three modalities: grassroots, network and dirigiste. These can be further elaborated by inclusion of modes of business interrelationship, into three kinds of innovative milieu as the following.

Grassroots RIS

In terms of technology transfer action, the initiation process in this modality is locally organized, at town or district level. Funding will be diffuse in origin, commerce capital, grants and loans. The research competence is likely to be highly applied or near market. The level of technical specialization will be low and generic problem-solving is more likely than significant, finely honed, technological expertise. Finally, the degree of supra-local coordination will be low because of the localized nature of the initiation.

Network RIS

Initiation of technology transfer action in the network modality is multi-level, meaning it can encompass local, regional, federal and supranational levels as appropriate. In consequence, funding is more likely to be guided by agreement among banks, government agencies and firms. The research competence in a networked innovation architecture is likely to be mixed, with both pure and applied "blue-skies" and near market activities geared to the needs of large and small firms. System coordination is likely to be high, because of the many stakeholders and the presence of associations, forums, industry clubs and the like. Specialization within such a system is likely to be flexible rather than dedicated, because of the wide range of system demands from global to small-firm scale.

Dirigiste RIS

Technology transfer activities in a dirigiste innovational model are animated mainly from outside and above the region itself. Initiation of actions is typically a product of central government policies. Funding is largely centrally determined, although the

agencies in question may have decentralized locations in the regions. The kind of research conducted in dirigiste systems is often rather basic or fundamental, and it may be expected to relate to the needs of larger, possibly state-owned, firms in or beyond the region in question. The level of coordination in such an RIS is very high, at least potentially, since it is state-run, and the level of specialization is also likely to be high.

Complementing the governance dimension, important for providing the soft infrastructure of enterprise innovation support, is the posture of firms in the regional economy, both towards each other and the outside world, as well as relations with producers as with consumers in the market place. Clearly, firms can range from possessing global to merely local reach. But we are also interested, to the extent relevant, in the disposition of industries and, indeed, networked industrial clusters towards innovation. What is the role of lead firms? What emphasis is given by a private or in-house, over public, research activity? And what is the nature of the innovation milieu within firms operating?

Localism RIS

If we approach the business innovation dimension of the putative RIS in terms first of the extent of its domination by large enterprise, either indigenous in origin or inward investment, then a localism RIS will tend to have few or no large indigenous firms and relatively few large branches of externally controlled firms. A localism business innovation culture is one in which the research organizations capable of combining with industry clusters within the region. A localism set-up will probably have few major public innovation or R&D resource, but may have smaller private ones. Finally, there will be a reasonably high degree of associationalism among entrepreneurs and between them and local or regional policy-makers.

Interactive RIS

Here, the economy is not particularly dominated by large or small firms but rather by a reasonable balance between them, whether indigenous or FDI in origin. The reach of this combination will vary between widespread access of regional research resource to foreign innovation sourcing as and when required. There will be a reasonably balanced mix of public and private research institutes and laboratories, reflecting the presence of larger firms with regional head-quarters and a regional government keen to promote the innovation base of the economy. Such regions will be characterized by a higher than average associationalism, expressed in local and regional industry network, forum and clubs.

Globalized RIS

In a globalized RIS there is domination by local global corporations, often supported by clustered supply chains of rather dependent SMEs, meeting some of the requirements of indigenous or inward investor multinationals. The research reach in such systems will be largely internal and highly privatistic rather than public, although a more public innovation infrastructure aimed at helping SMEs may have developed more recently. To the extent that associationlism is present, it will be heavily influenced by the needs of larger firms, and conducted to a considerable extent on their terms.

3. The role of government

As one of the important composing parts of regional innovation system, the government, especially local government is not only the rule-maker for innovation games, but also the direct participants of innovation activities. With the development of market economy, the function of government gradually changed from control to service. During the whole course, regional economy development not only be guided and coordinated by the local government, but also by the central government.[7]

At national level, the central government mainly constitutes policies and plans to promote the overall development of the country according to the development level of every area. So the regional development will be affected greatly by the central government.

At regional level, as a important direct guidance organization for regional economy development, local government on one hand carries out the macro-guidance policy of central government. On the other hand, combing local practical situation constitutes various kinds of plan and mechanism promoting the development of regional economy. All the implementation of the mechanism relies on the down-to-up activity of market economy, and one of the important roles is to design the mechanism and supervise its operating under the premise of obeying the market economy rule. Therefore, the local government will play a more and more important role in regional technology innovation and economy development.

1) Government and enterprises

There is no uniform pattern for government management on the enterprises, how to manage the enterprises is quite different from each country. The management pattern of government on enterprises can be divided into two categories, namely the direct

management and indirect management. Government can also manage the enterprises through intermediaries, and through providing infrastructure and public service to create conditions for the development of enterprises.

So-called indirect management of government to enterprises refers to that the government affect the enterprises through market, rather than intervenes the inter affairs of enterprises. Sometimes there even are no direct contacts with enterprises. Generally, government manages enterprises through following measures:

- Developing market. Adapting the development of economy, government helps to develop various levels of and various kinds functions of market. At the mean time, put forward special demand and running rules for the developing of special market, such as the time-bargain market and security business market.
- Constituting laws and regulations. Markets always full of random factors and out-of-order movement. But the market economy needs some rules to let the market economy runs more properly. On this point, government has the absolutely necessarily role. So, to build a systemic and market economic law system is the important measures for government to realize the basic function of standardizing basic relation and the principal parts of market.
- Supervising and controlling. Government can supervise market and its principle parts through justice sector or administrative sector. Controlling is that the government intervenes market through administrative sector and regulation using administrative force to save the market failure and improve economic efficiency. Such a kind of supervising and control is necessary for the stable and harmonious development of market.
- Guidance. Government can guide the market by the industrial policy, economic planning, financial and tax adjustment and information, therefor to affect the activity of enterprises.

Direct management of government on enterprises. Direct management means that government directly intervenes the inner affairs of enterprise in accordance with law or regulations. Mostly, the direct management of government to enterprise involved the enterprises in which government invested or the enterprises has cooperating relations with the government. The objective of government direct management is to protect the right and interest of the country, the common measures which government takes include:

- Organizational control. By means of establishment of directorate and appointment of director-general, government realizes the management on enterprises.

- Financial supervising. Financial supervising mainly applies to the state-owned enterprises, including supervising the investment, price, and salary.
- Running guidance. Government does not intervenes the inner running management in principle, but by means of planning contract, purchasing contract etc. to influence the running of enterprises.

Management through intermediary. In order to reduce the number of enterprises which government must directly management, and reduce the management extent, the government usually communicates with the enterprises or industries through industrial association. On the other hand, the enterprises, through the industrial association, has much more strength to negotiate with the government, and to ensure the implemented alternative is the result of arrangement between enterprise and government, therefor it is much more feasible.

Government providing infrastructure and public service. Infrastructure and public service usually does not fund by the common enterprises for the long capital callback period. But they are very important for the development of enterprises. So the government can indirectly affect the enterprises through infrastructure building and public service providing.

2) Government and university and research institute

The relation between government and university and research institute gradually changed with the change of people's recoganization to knowledge. The effect of government to universities and research institutes mainly represent as the fund support to education and research, meanwhile, as the investor, the government has the ownership of research achievement.

Previously, most of universities and research institutes were relying on the government fund, with the coming of knowledge-based economy, as important knowledge assets of society, the universities and research institutes began to change their function. At the meantime, the creation and dissemination of knowledge need more flexible investment. And as one kind of investment factor, it requests the return.

The cooperation between university and research institution and industrial circle become much tight, the value of knowledge and the potential market were gradually recognized. Under new economic situation, the manner of government fund is under changing. On one hand, government increased a large amount of money, on the other hand. With the enlarging of university system, the competition for government funds

become more and more severity. So the universities and researchers must to find other fund support for their research, science and technology research was pushed into the market. Government begins to impose its influence on the universities and research institutes through the intermediary between them. These new established intermediaries strengthen the cooperation between newly industries, universities and research institutes.

3) Government and intermediary

As one of the important components in market economy, intermediary play an active role. The development of enterprises, on one hand must rely on advanced technology, market development and management and the preferential policy of government. On the other hand, it must rely on the support of well-developed market service system to get convenient material and information service, this system consists of a series intermediaries.

Government encourages building and perfecting intermediaries in market economy, it can greatly promote the development of regional innovation activities. Management of government on intermediary includes that the government initiates the establishment of intermediary organization. With the change of government function, government sectors conduct constitutional reform, some of the government staff leave government sectors, these people can be encouraged to organize intermediaries.

The government constitutes laws and regulations in favor of establishment of intermediary, organizes seminar or other patterns of communicating mechanism, facilitate the connection between intermediary and enterprises and helping the intermediaries to survive in the fierce competition.

4. The role of university

It is considered that universities have become the driving forces in the social and economic development of the region. [15] And the roles of university in regional innovation system can be identified as: the new knowledge generator, lifelong education provider, technology transfer advocator, technology industrialization promoter, technical information disseminator, promoter of social development, incubator of high-tech enterprises, provider of trained personnel.

1) Knowledge generator

Universities and research universities in exact, are by tradition the key player of scientific research. Their scientific achievements have contributed to the knowledge

body of mankind. According to research on high education systems, the exploration of truth, creation and innovation are the basic functions of a university. It provides theoretical backup for high technology and social development through education, disseminating new technology, new scientific thinking and technical methods.

2) Technology information disseminator

In addition to knowledge generation, universities also function as important disseminator of new technology, as they posses multi-disciplinary personnel and network environment. They assume the source of new technology through many different ways, namely technology development on contracts, joint institutes, and so forth. Technology is transferred to other members of society through direct selling, education-production-research cooperation, and technology popularization.

Universities possessed big technology pool, high technology capability, language ability, and mixed technical personnel compared with most enterprises. Therefore, whenever there is technical problem to be tackled, managers of firms and administrator of governments naturally turn to universities to seek help and assistance. They become strong backup forces to assist firms to identify, understand, and digest new technology.

3) Promoter for technology transfer

Understanding its important role in technology advancement, universities are modifying or reformulating its policies to promote technology transfer. They encourage teachers and students to transfer technology into products, start education-research (E-R-P) joint projects and set up pilot production facilities. University technicians are main players in technology market and technology trading in most areas of China. They directly provide technology, sell and provide consultation to company end-user. Thus speed up the transfer and application of new technology. Good cooperative working relations have been built among university and enterprises. Now it is common to see joint laboratories on campus co-funded and joint-operated by university and company.

4) Provider for the technical and management personnel

Preparation for technical and managerial is another basic function of universities. To do it better, universities are adjusting and modifying its curriculum design to catch up with technology advancement. Most firms depend on universities to provide trained work force and managers who are well equipped with up-to-date management knowledge and skills.

5) Incubator for technology-based business

As university students and teachers are major group for technology innovation, university-run incubators have superiority to meet the needs of start-up technical firms. Assistance to them includes hardware infrastructure and business know-how. Study showed that most university-run incubators are non-profit in nature. They play important part in promoting entrepreneuship and economic development. For better development, funding, business know-how, business linkage are essential.

6) Promoter for technology-based industry

Universities have superiority in technology and personnel, and could play different roles in starting technology concentrate industry. Spin-off companies, full-ownership companies, hold-stocks, joint venture, partnership are just a few for universities to get into technology industrialization. Recent years, a new development is for universities to start their own science parks. Such park would serve as internship base for students, are good for linking university with society, and promote service. It is considered good for transforming educational system. In terms of social effects, university-run enterprises have generated reasonable economic results to contribute to the development of university.

7) Promoter for social development

Research indicated that in the dissemination process of technology, information communication plays an important role. It is also worth mentioned that information relay would be more effective via grapevine communication channels. It is interesting to find out that the alumni relation exiting among graduates from the same university is such useful or functional chain, which helps to break through many organizational barriers. Similar channels could be found among classmates, students and teachers, and relatives. It is not strange to find that all kinds of alumni activities contribute to regional development.

8) Center for continuous education

The emerging of knowledge economy has made us to think how to improve creativity of people. It is common understanding now that people need life long education. Today, universities have greatly expanded its actions in general education to include degree programs, diploma program, training, and other educational service for the society. In the era of fast development of science and technology, the obsolete rate of knowledge is higher, and technicians need to learn new skills to keep a breast of development. Back to school has become a common choice. Universities can and

should provide support both in instruction and facilities. Experience have indicated that seminars, training, workshops, conference hosted by universities are effective approaches. The emerging network based learning environment will also provide convenient methods.

PART 3: ANALYSIS OF REGIONAL INNOVATION POLICY

1. Historical change in Japan's regional policy

The historical change in Japan's regional policy was based on the macro-economy and industry development, during every period of development, there were some significant regional policies were issued, had played very important role.

Japan's postwar economy, needless to say, started when the country was in near ruins. The main task during this period was to reconstruct the country in the aftermath of World War II. Toward this end, efforts were made to repair and strengthen the foundation of existing industrial areas, particularly the big four industry areas.

Shortage of capital and resource forced the introduction of "priority production", policies that consciously favored basic industries and critical raw materials at low and stable prices, a temporary measure that encouraged translation of wartime economic thinking into peacetime practice. In the same way, the primary aim of national development planning was the reconstruction of ports, roads and railways, and the redevelopment of power and other resource.

The Ministry of International Trade and Industry (MITI) seriously began grappling with its industrial location policy in the mid-1960s, when the postwar reconstruction period had come to the end and new industrial areas had begun to appear one after another. With the advent of this new period of industrial development, MITI launched a program for promoting industrial waterworks construction first, then decided on appropriate policies for locating industries on the basis of nationwide surveys.

Meanwhile, although the Comprehensive National Land Development Law was established in 1950 and surveys on national land planning were being conducted, they were mostly for anti-flood afforestation and river improvement, energy development, and increased production of food, all patterned after the United States' TVA project. Industrial development in its real sense had yet to get on the MITI agenda.

After 1956, when the economic planing agency acknowledge that the post-war era was over, the ideology of the formulator of industry policy was symbolized by the slogans "building heavy and chemical industry" and "improving the industrial structure". The plant-based industries producing basic materials and supplies such as iron and steel, chemical and electricity were the strategic industries of the first half the

rapid growth period. To realize economies of scale based on mass-production technology was major concern of firms and industries. In the latter half, the automobile industry, the household electrical appliance industry, and other so-called assembly industries became strategic, and business strategy was geared to realize lower costs and better quality simultaneously through the learning process and development of organization structures linking mass production and mass marketing. As for as policy measures are concerned, the transition was made from direct and regulatory measures to indicative and indirect ones, which became normal as vision making- for almost every ministry and local government.

Many policies during this period were sometimes directed towards redistribution and sometimes towards efficiency. For example, although the NICP (New Industrial Cities Promotion Law, enacted in 1962) was to promote the development of selected regional cities as industrial centers in counterbalancing 3M, Japanese business invested substantially more heavily in the Special Industrial Consolidation Areas established in 1964, which were all in the Pacific Coast Belt close to the major urban centers.

From the middle of 1960's, the Japanese economy entered a high growth period, and concurrently the neighborhood protest movement against pollution and environmental destruction intensified. The protest against industrial pollution was particularly strong. The Basic Anti-Pollution Law was established in 1967, and solving the pollution problem became the most urgent task for the location of industry.

While industrial pollution was becoming a major social problem, the Japanese economy continued to grow at a rate of more than ten percent, ushering in the longest period of prosperity since the end of World War II, known as the "Izanagi Economic Boom". This made it necessary for the Japanese government to establish new location of industry policies.

In 1968, while trying to solve the problems of urbanization and pollution MITI announced a scheme for future location of industries geared to economic growth, titled "Industrial Development Scheme". The following year the "New National Comprehensive Development Plan" was adopted.

In 1971, immediately after being appointed Minister of International Trade and Industry, Mr. Kakuei Tanaka ordered the industrial relocation policy to be strengthened. Steps were taken at MITI to establish the Industrial Relocation

Promotion Law and the Factory Location Law, as well as to draw up the Plan for Creating Cities with the Population of 250,000. Then, in 1972, based on these measures, Mr. Tanaka published The Plan for Remodeling the Japanese Archipelago, marking the beginning of an expansionary period for MITI's industrial relocation policy. During this period, the industrial relocation subsidy system was established, various of programs were expanded, and a large budget was obtained for their implementation. The program included the creation of industrial parks through the establishment of the Japan Regional Development Corporation and requiring factories to plant trees as stipulated by the Factory Location Law.

From the mid-1970s, with the remarkable success of Japanese industry, the content of industrial policy changed greatly and a new pattern of Japanese technological innovation clearly emerged. Already in 1971, well before the oil crisis, a new Vision of MITI policies in the 1970s (MITI) proposed "a shift to a knowledge intensive industrial structure, which would place smaller burdens on the environment ". The government began to place major policy emphasis on promotion of high-technology industries as a means of sustaining economic performance. MITI chose to focus its attention on high-technology industries, because they are able to increase their efficiency and international competitive ability by rapidly increasing productive capacities. At the same time, MITI placed greater emphasis on the other aspect of industrial policy: assisting in the structural adjustment process of major un-competitive and declining industries. The typical example of the former was joint basic research project to promote R&D in high-tech industries (domestic R&D expenditure began to increase in the late 1960s and expanded rapidly after 1975), for the latter, both the Structurally Depressed Industries Law of 1978, and its revision, the Industrial Structure Promotion Law of 1983, were introduced.

The period since 1970 can be grouped into two sub-periods: a decade of frenetic catch-up and the period of state of the art technology development. Until the 1980s, the Japanese R&D system was geared to "latecomer catch-up". However, as Japan reached the frontiers, it strove hard to adapt its later-comer system to one better suited to pioneering breakthroughs, while retaining its strengths in process technology. To innovate at the frontiers, Japan had to overcome some glaring deficiencies, such as lack of synergistic interaction between universities, corporations and government. This required the nation to upgrade its upstream activities in basic scientific research and pre-commercial development. This was what promoted national government to organize an ambitious series of national research project aimed at pushing Japan

beyond the frontiers of technology, although none of them has yet achieved momentous breakthroughs in generic state-of-the art technology.

At the same time, since the early 1980s, Japan has begun to develop new forms of assistance to provincial regions to promote high technology or information industries and regional development simultaneously. The former was the Technopolis Plan based on the notion that there are advantages to be gained from concentrating facilities for research and development, manufacturing, marketing and services in compact centers of high technology, such as Silicon Valley. The latter was the Teletopia Plan (MPT) and New Media Communities Plan (MITI).

From the mid-1980s, efforts were made to realize the technopolis plan. Among other things, "Third-sector" (formed by the national government, local government, and private business) were established in technopolis regions and technological exchanges were promoted. The Japan Technomart (Foundation) was established by MITI as a clearinghouse of technological information. In accordance with the Private Participation Promotional Law, MITI tried to promote a "Research-Core Program" consisting of four facilities: an open-type test and research facility, a human resource development facility, a facility for promoting exchange, and an incubator of new business.

Meanwhile, the appreciation of the yen was accelerated dramatically in 1985 as a result of the Plaza Agreement by the G5 nations. This, in turn, spurred Japanese companies to begin locating their plants and other facilities overseas. Consequently, this raised the fear that the so-called hollowing phenomenon might occur in the Japanese economy, promoting the publication of the "Maekawa Report" on industrial restructuring in 1986. But thanks to the concerted efforts of Japanese companies to overcome the impact of strong yen and the government's policy of expanding domestic demand, the economy, which started to grow in December 1987, continued to expand. This ushered in a sustained period of prosperity surpassing even the "Izanagi Economic Boom" that lasted for 57 months.

In 1987, the government adopted the "Fourth Comprehensive National Development Plan". The main theme was "Multipolar Patterns National Land Formation". In response to economic progress, and greater emphasis on software and the service sector, MITI enacted the "Brains-of-Industry Location Law". It promoted the concentration of the knowledge functions of industrial firms in local regions by

supporting the dispersion of 16 business categories (the brains of industry), including research institutes, the engineering industry, and the software industry.

With the advent of the Heisei period in early January 1989, the government adopted the New Industrial Relocation Plan. In 1990, the "MITI Vision for the 1990s-Towards the Creation of Human Values in the Global Age" was announced. In the vision, MITI advocates the creation of a new space for industrial activity. It respects human beings by effectively responding to the needs of a new age which are not met by conventional factories and industrial estates with their emphasis on production. The MITI vision also points to the future direction of relocation policies including the spread of dispersion-type offices to alleviate the over-concentrated condition in Tokyo.

The Japanese economy managed to weather the rapid appreciation of the yen that occurred immediately in and after 1985, and the economy started to grow by the end of 1987. Signs of recovery began to appear in basic heavy industries, which had been depressed since the recession triggered by the 1970s oil crisis. Iron and steel returned to the 100 million-ton production level, plans were adopted in various to substantially expand facilities for producing ethylene, and the automobile industry accelerated the acquisition of large-scale waterfront plant sites.

As a result, coastal industrial sites, whose sales had been sluggish up to then, began to sell throughout Japan. As for the inland industrial parks, location of industrial remained active. According to a MITI survey on factory location trends, the number of newly built factories returned to the 4,000 mark in 1988.

In contrast to economic expansion, the shortage of labor in Japan has become a serious problem. The industrial location policy of the future will be faced with many problems that reflect the demands of the new age, and its importance will increase more and more. These problems include determining ways to solve the over-concentrated condition in Tokyo, promote regional location of the brains-of-industry, and create industries and industrial parks that respect human beings, and in concert develop the commercial service and leisure industry. The problems also include formulating a principle of cooperation for international location of industry.

2. Regional science and technology promotion policy of Japan

The S&T policy in Japan is carried out in accordance with the Science and Technology Basic Law, which was enacted by the Diet in November 1995. [16] With

respect to regional government, the basic law states explicitly that local and regional governments have a responsibility to establish and administer S&T promotion policies. In the basic Law, the responsibility of regional government was stimulated in Article 4 as: "Regional governments shall be responsible for establishing and implementing independent policies that activate the distinctive character of their respective regions in accordance with national guidelines". And in Article 5 as "regarding the establishment and implementation of measures related to promotion of science and technology, central government and regional governments must give due consideration to the important role of government in promoting basic research."

The idea of promoting S&T at the regional level was further developed in a Prime Minister's directive dated December 1995. This was Japan's first basic plan for promoting science and technology at the regional level. The plan calls for progress in three broad areas:

(1) Promotion of creative knowledge that raises standard of economic, social, and culture activity
(2) Activation of regional economies through geographic clustering of R&D activities.
(3) Development of human resources and expansion of public awareness to ensure continuous upgrading of local economic and social conditions.

Also emphasized are principles to guide future regional policies. These include the following:

(1) Setting goals that reflect the distinctive resources, history, and existing competitive advantage of each region.
(2) Development of educational infrastructure that guarantees a steady supply of young, creative researchers.
(3) Efficient utilization of research facilities and services that meet needs of local industry.
(4) Pursuit of cooperative R&D among universities, industry, and research institutes, as well as across regions.
(5) Promotion of the technology transfer and diffusion.

These principles are to be followed at every level of government and by every agency engaged in promoting regional S&T activity.

Finally in July 1996, the Science and Technology Basic Plan was enacted by Cabinet resolution. The Basic Plan, which serves as the general blueprint for science and technology policy through the year 2000. The plan calls for regions to "activate

themselves as cultivators of economic frontiers" by actively promoting R&D based on local needs and resource. While local governments are expected to take independent actions, the central government pledges to encourage and support regional initiatives that build or improve R&D infrastructure, develop new industries, improve S&T education and training, promote public awareness of S&T, and coordinate collaborative R&D between universities, firms, and research institutes.

In December 1995, upon receipt of Report No.22 from Council for Science and Technology, the Prime Minister decided "Basic Guidelines on Vitalization of Regional Science and Technology Activities". The Guidelines aimed at vitalization of regional science and technology activities, listing those measures that should be implemented by the national government and those that were expected to be implemented by local government.

The regional S&T policy of Japan is now shift from a promotional system directed from the center toward a system in which center and regions collaborate to promote S&T, this work is still in progress, but a primary goal is to strengthen the ability of regions to use science and technology to differentiate themselves from other and develop their distinctive characteristics. [17]

More specifically, policies aim to accomplish the following:

- Provision of research facilities and training programs that strengthen the research base of regions.
- Development of region-based research and development systems that foster collaborative research and technology transfer among national universities, national and regional research institutes, regional universities, and private industry.
- Strengthening of the regional institutes to enable them to play a leading role as R&D and technology development organizations.
- Boosting the capabilities of national research institutes, while promoting collaborative research between national and regional institutes.

Generally speaking, the Japanese government at both the central and local levels has been increasing its support of science and technology activities aimed at stimulating regional economic development. The central government has made a strong commitment in this direction through the Basic Law, Science and Technology Basic Plan, and Basic Plan for supporting regional science and technology. Regional government is also boosting their efforts in this are.

The general guidelines for S&T policy rise promotion of S&T in region as one of the government's priority measures. Some of the prefectures have established committees or council for S&T promotion.

Targets of S&T policy of prefectural governments are focus on establishing a new system for regional innovation by stimulating R&D activities in small and medium enterprises through restructuring of conventional technology centers, and fostering research personnel and science education. To pursue these comprehensive promotion policy for S&T, new research institutions with different management systems have been established for development of high-technologies and international cooperation programs have also been initiated by regional government.

S&T policies for promotion of R&D can be classified into eight policies covering support for research and development operations. Eight policies classified are as follow; [18]

Technological advice and guidance for local firms,
Support for technology development and advancement of local firms
Promotion of cooperative research in private sector
Support to research consortium (industry-university-government)
Luring or incubation of R&D oriented firms
Offer of S&T information
Financial support to national research institutions
Research subsidies to hospital or medical institutes.

On fostering research personnel and science education, almost all prefectures are implementing human resource development programs in specified technology fields, include ORT programs for engineers working at small and medium enterprises, acceptance of trainee at technology center, opening lectures at university for continuous education, etc. Policy for public understanding of S&T includes promotion of understanding and acceptance of S&T by citizens, promotion of S&T education, and operation of science museum.

It is noticeable that university does not work as a key player for regional innovations in Japan because most of all are national universities, in which general perception of professors in the school engineering is that they are not responsible to contribute regional economic development. Under the strict regulation of Ministry of Education, since the research fund for the professor of national university are certified every year

with the constant annual budget, they have not incentive to join the cooperative research with regional industries. The distance between university and industry is still remained physically due to governmental policy of the ministry and its historical reasons, non-physical distance is, however, gradually being shortened.

3. Key regional innovation policies of MITI, STA and MONBUSHO

Among the government sectors which concerns regional development, some ministries are the most important ones, they are MITI, STA and MONBUSHO, these three Ministries allocated most of the budget for regional development and technology innovation and issued most of the policies which greatly promote the regional development.

1) MITI's priority of trade and industry policies [19]

One of them is to reinforcement of public-private sector ties. Includes enhancement of national research institutes. National research institutes will be enhanced so as to improve their research functions and facilitate the use of their research findings in industrial activities. Fundamental reforms to the national research system will be made in preparation for the incorporation of institutions as independent government-run corporation.

Promotion of joint industry/academia/government technology development projects. The MITI will create joint public-private research and development projects for the integrated development of advanced, basic technologies and their commercialization as a means of promoting of strategic technologies through joint efforts by industry, academia, and government. And MITI also creates a research system that seeks proposals from creative and original young researchers.

Training of technology development personnel. The MITI will enhance the environment personnel involved in new technology development so that the content of education provided at universities better meet the needs of industry. The MITI will support the development of educational programs for interdisciplinary humanities/science areas, and will also support the development of educational programs for interdisciplinary humanities/science areas, and will also support industry-academia efforts to introduce outside accreditation for industrial science education. And acceleration of enhancements to intellectual base, the MITI will reinforce the metrology standards, standard substance, biological resource information, and other aspects of the intellectual base for research and development and industrial activities.

Among policies, very important one is to promote the licensing and commercialization of technology development results, the MITI will strengthen their support for technology licensing organizations (TLOs), study the potential for relaxing regulations on national university instructors and national research institutes researchers serving concurrently in executive positions in private companies, and facilitate the matching of technology seeds and commercialization needs. The MITI will also improve systems so as to provide for smoother licensing of research results owned by the national government, and will promote the commercialization by private companies of the technology development results achieved with national funding.

2) Law for facilitating the creation of New Business by the MITI [20]
In February 1999, in order to break out of the recession in the economy and secure more employment opportunities, the MITI issued a new law, namely "Law for Facilitating the Creation of New Business". The principle of the Law base is that to provide broad support for individuals, medium and small companies, and others want to start up new business. To support business activities medium and small enterprises those make use of new technology. And to aim to develop a business environment that makes use of regional industrial resource.

The main measures incorporated in the Law includes that the law support all new business starts, regardless of whether by individual or through split-off existing companies, and regardless of the business sector. The Japan Small Business Corporation will award grants of between 1 and 5 million yen to around 1,000 cases per year for new business enterprises attempting to turn new ideas into specific business, and for test manufacture and development, sales route development, and other efforts. Creating a special debt guarantee scheme for business starters. As a trust supplementation system for business starters, the law sets up a special framework not requiring third-party guarantees, enabling the use of debt guarantees from the stage of pre-business start-up. Creating special exceptions to the stock option system, to enable smoother procurement of human resources by recently started medium and small business. The law doubles the framework for the stock option system as special exceptions. At the same time, the law also provides capital investment for starters. The law creates a system of debt guarantees (maximum\1.5 billion Yen) for business starters who can not easily be handled by the Credit Guarantee Association (such as split-off from existing companies)

The main measures also include that the law support for business activities by medium and small enterprises making use of new technology. The law requires the government and special corporations to draw up expenditure targets for the government and special corporations, including subsidies for research and development in new technology for medium and small companies. To provide comprehensive support for efforts to create new business using the result of this R&D, the law, for example, expand the debt guarantee framework and create a special framework that does not require collateral or third party guarantees.

Another measure is improving the business environment using local industry resource. As a springboard for the new business creation, the law progressively incorporates the Technopolis Act and the Brain Location Act in order to make positive use of the industrial accumulation of advanced technology now being formed under these and other laws. And the law develops a comprehensive support system (platform) for the creation of new business in regional areas, led by initiatives from prefectures and other local authorities. Existing industrial support bodies (the Technopolis Foundation, the Small Business Corporation, and others) will be unified and networked in order to create new business, and will provide comprehensive service from research and development to commercialization.

3) STA's Regional Science and Technology Promoting Policy [21]
Promotion of regional science and technology has become increasingly important as a driving force to activate regional community, which gives great help not only to construct multi-polar and decentralized nation land but also to advance quality of life for the regional people, and serves to improve our nation's science and technology standard functions which they hold. Japan STA is pursuing the following policies in order to support R&D activities of regional communities and then to promote science and technology there.

- Joint-Research Project for Regional-Intensive

For the purpose of concentrating research potentials in regions, exploring research areas of the global level peculiar to regions and strengthening the research base resulting in the creation of new industries, joint research will facilitate the formation of a regional network COE (center of excellence) from fiscal 1997.

- Regional Science Promoter program

Beginning in fiscal 1996, STA supports the research and development promotion organization established by local government through dispatching coordinators who

to take the lead in examining and fostering demand for new technology in the regions and conduct evaluative tests for practical application of such technology.

- Subsidies of construction in relation to living and regional science and technology facilities

From fiscal 1997, STA support the construction and improvement of research facilities by local governments the "experience centers of advanced science and technology", "earthquake and seismic observation facilities", "research facilities for promoting advanced particle radiation therapy" and "advanced and basic research facilities".

- Regional frontier research system

In those regions which have a high research potential in important basis research fields, fundamental research is being carried out by investigators from the region itself and by researchers from the institute of Physical and Chemical Research.

- Frontier Research on Earthquake Disaster Mitigation

The Earthquake Disaster Mitigation Center (EDM) established under the framework of the Institute of Physical and Chemical Research (RIKEN) after the Kobe Earthquake promotes "Frontier Research on Earthquake Disaster Mitigation for Urban Regions" by utilizing a flexible research system.

- Research and development of coastal environment and utilization

JAMSTEC, in cooperation with local governments, conducts research to help solve coastal environment problems considering the needs and characteristics of the region.

- Arrangements of information system using pilots

From fiscal 1996, STA will make arrangements of an information system using pilots which aims at using the data obtained by an earth-observation satellite for practice of regional administration under the cooperation between the National Space Development Agency of Japan (NASDA) and regions.

- Meeting for promotion of science and technology in regions

For strengthening collaboration between the state and regions and promoting smooth development of science and technology administration, STA holds liaison conferences of officials in charge of science and technology administration of the state and regions and forums and other meetings concerning science and technology policy.

Under the STA, Japan Science and Technology Corporation (JST) is a very important corporation, JST was found on October 1, 1996 as the implementing organization of science and technology policy in Japan. Technology transfer is one of its major activities, through which JST promotes commercialization of excellent research results from universities, national laboratories, and others to facilitate emergence of new industries and aims at realization of "science and technology closely linked with people's life" for improvement of regional society and everybody's life. Technology transfer includes many important programs such as contract development, technology transfer facilitation program, original research exploitation project, patenting support service, regional science promoter for evolution research and new tech-venture oriented research and development.

4) MONBUSHO [22]

To review the model research cooperation between industry and universities and to further promote the cooperation, the "Advisory Panel to consider the model research cooperation between industry and universities" was called in February 1996. The Panel discussed specific measures and submitted its final report to the Monbusho. On the basis of the report, the Monbusho improved various systems.

In response to various social expectations and needs for universities, and on the basis of the Basic Plan for Science and Technology, the number of cooperative research conducted by university faculty members for industry has been increasing. There is rising expectations for practical application of universities research results. Technology transfer from universities to industry have been conducted by way of personnel exchange. However, it is now important to establish a new technology transfer system through, for example, patents.

- Promotion of patenting research results

Promotion of patenting research results includes change people's attitude, development of educational activities to raise related parties' interests in obtaining patents, provide and incentive to obtain patents and a support system. The "formation of intellectual properties such as patents" is considered as a "criterion for evaluation" in the "model evaluation method of scientific research". It is necessary to provide an individual researcher with a public support system for obtaining patents.

University's prompt response to the needs for technology. It is necessary to make universities research results easier to use for industry. For example, the introduction

of a "technology transfer research" contract and the establishment of a "supporting committee for technology transfer" on campus are under consideration.

Improvement of the Invention committee operation. To operate the Invention committee more efficient and more effective, it is necessary to revise the operation system such as dividing the committee into small departments

- Promoting of transfer and utilization of patents

This to find what technology the market and industry need and to evaluate its applicability and market value.

Necessity of training coordinator for technology transfer. It is important to train experts in technology transfer, so-called "judges of technology", who can find evaluate new technology among university's research with professional eyes.

Technology transfer to smaller enterprises, which is to promote technology transfer to smaller enterprises and venture business, which are highly motivated to create new businesses.

Return to universities and/or researchers. Enterprises return a part of the profit they make by using patents to related universities and/or researchers as, for example, royalty fees.

As for the patents granted to the national government. The government gives subsidy to each university's cooperative research based upon the contribution of its royalties received to the special account budget for national educational institutions.

- Promotion of establishment of technology transfer organizations

Functions of the model organization for technology transfer including finding and evaluating research results, applying and obtaining patents, granting enterprises to use patents, administering royalties and helping start business.

The organization is expected to produce such a good cycle as follows. Universities research results are transferred to industry at a reasonable price, which reimburses the universities and researchers for research expenses and which, in turn, helps promote further research. The organization will be independent from universities education and research organization. And the form of organization could be a non-profit organization, a corporation and an incorporated educational institution. It is very

important for such technology transfer organization to cooperate with the Science and Technology Promotion Corporation that has good experience of transferring technology.

Operation of technology transfer organizations. Operating organization is expected to require a fair amount of money and time until the transferred patents produce profits. Thus, operation needs to be carries out gingerly.

Cooperation with local communities. In order to effectively utilize universities research results in local communities, it is important to actively cooperate with local municipalities.

Necessity of public support. To consider providing policy measures as well as preparing a legal system to diffuse such organizations nationally. To make good use of business associated with technology transfer carried by the Science and Technology Promotion Corporation, and to establish a new type of cooperative research laboratories, such as Campus Incubations, which have liaison function.

4. Evolvement of China's regional policy

China's regional policy had been evolved from the important document "Decision on Science and Technology System Reform" in 1985 to the "Provision on Promoting Scientific and Technological Achievement Transfer" in 1999. After 15 years of breakthrough and innovation, a large amount of efforts had been made on promoting research and development, on technological achievement marketalization and business startup. [23]

In October 1982, Communist Party of China put forward the general guideline for the development of science and technology, "Economic construction must rely on science and technology, science and technology development must oriented to economic construction", which guide the direction for motivating science and technology personnel to devote into economic activities. In "Decision on Science and Technology System Reform" issued in 1985, the concept of "Startup investment" was firstly put forward, which provided the policy guarantee for the development of China's high-tech startup investment.

In September 1985, with the support of State Science and Technology Commission of China and the People's Bank of China, the State Council approved the first startup

investment corporation—China New Technology Startup Investment Corporation which is a nationwide financial institution specialized in startup investment.

In 1986, in order to promote the dissemination of science and technology achievements to the country side, encourage the development of SMEs and vitalize the local economy, the State Science and Technology Commission of China launched the Spark Program. This program supports and promotes the dissemination of applied technology, fostering a large number of technological personnel in the countryside, and promoted the rapid development of Small and Medium Enterprises. The Spark program is the first program approved by the Chinese government to promote the development of rural economy by relying science and technology and is an important component of plans for the national economic and scientific and technological development. The main contents of Spark Program is to support a large number of technical projects that use rural resource, need small amount of investment, have quick benefits and are advanced and appropriate in technology. Establish spark technology intensive zone and develop spark regional mainstay industries.

In 1988, approved by the State Council, the State Science and Technology Commission of China implemented the Torch Program, which aimed to promote the commercialization, industrialization and internationalization of the high-tech achievement of China. In order to collect more fund source, the State Science and Technology Commission also established the Torch Foundation, to support the development of high-tech enterprises. Most of the Torch Program projects are concentrated in the High and New Tech Zone, oriented to the new technological enterprises in the High and New Tech Zone. Most of these enterprises were venture enterprises, the Torch Program provided fund partly replaced the venture capital, which venture enterprises urgently needs. The Torch Program Foundation is the typical startup foundation, the implementation of the Torch Program promoted the combination of science, technology and finance, promoted the establishment of startup investment mechanism.

Another important program is the National Science and Technology Achievements Spreading Program. The purpose of the program is to mobilize and organize scientific and technological workers and all the force of society to apply advanced, mature and appropriate scientific and technological achievements to the development of national economy, to the vast rural areas and industrial and mining enterprises. The main contents of the Program are to create environment and conditions favorable for the continuous development of extension of scientific and technological achievements.

Screening and release the project list for the "Guideline of Program", and implementation of projects of Annual program, and establish extension and demonstration bases and research centers.

In 1988, China launched a new program-High Technology Research and Development Program (863 Program), which aimed to promote the research of basic science. 863 Program provide the research fund for high level of science and technology research. Due to it did not aim at enterprises, only aim at the research institutes, so the level of industrialization is comparatively low.

In 1988, the State Council approved Beijing to establish the experimental zone take Zhongguancun as the center, and approved the "Provision On the New Technology Industrial Development Experimental Zone of Beijing", the preferential policies in this provision create a sound development environment for the enterprises in experimental zone. Thereafter, a large number of scientific and technological personnel came experimental zone to start up their firms.

In 1991, the State Council issued the "Provision on Policy Issues for High and New Technology Industry Development Zone ", in which the venture investment fund was encouraged to be built in the development zone. Some high-tech zone can build venture investment corporation. These means that the startup investment had attract the high attention of the country.

In 1995, the State Council issued the "Decision on Accelerate Science and Technology Progress", this document advocated to develop science and technology venture capital, build up science and technology venture investment mechanism. And in 1996, the State Council issued "Decision on Deepening Science and Technology System Reform in the Period of Ninth Five-Year-Plan", this decision also stressed to accelerate the transfer of technological achievement.

In 1999, the State Council approved the "Provision on Promoting the Transfer of Science and Technology Achievement" which was jointly formulated by the Ministry of Science and Technology, the Ministry of Education, the Ministry of Personnel, the Ministry of Finance, the People's Bank of China, State Tax Bureau and the State Industrial and Commercial Administrative. This Provision aimed at guiding the research institute, high learning and science and technology personnel to take part in the technology achievement transfer.

5. Regional science and technology promotion policy of China

Science and technology policy of China was carried out in accordance with the "Law of Science and Technology Advancement of China", which was approved by the Standing Committee of National People's Congress. With respect to regional government, the Advancement Law states explicitly that local and regional governments have a responsibility to promote science and technology advancement. In Science and Technology Advancement Law, the responsibility of regional government was stimulated in Article 8 as "All level of local government should take effective measures to promote the science and technology advancement". And in Article 16: "All level of local government should encourage and support the development of science and technology organization, provide socialized science and technology service for economy development". [24]

In a highly central planned economy before the end of 1970's, China's regional science and technology policy were in fact determined by the central government, and regional science and technology policies are of minor importance for regional development. The reform in the economic and science and technology systems since 1980s has increasingly given local government more autonomous decision power in regional development, and thus stimulated the activity of local government in making efforts towards regional innovation. Many regional governments began to pay more attention to the importance of science and technology for regional development. A slogan "developing vigorously a province or city by application of science and technology", which was followed by a movement, has been popularized in most regions, it also has result in the budget increase of local government in science and technology, especially in mid-developed and less-developed regions.

In order to promote the regional economy development and technology innovation, Chinese government also issued many policies and regulations. In March of 1991, "Provision of Policies Issues on the National High-tech Zone" was approved by the State Council, which aimed accelerate the development of high-tech zone and local economy. In this document, preferential policies for the national high-tech zone were stipulated, these policies had greatly stimulated the development of high-tech zone.

In January 1996, the State Science and Technology Commission issued "The Provision of Cognizance on National High-tech Innovation Center". In this document, the qualification and preferential policies for the national high-tech innovation center were stipulated. In July 1999, Ministry of Science and Technology, State Economy and Trade Commission issued "Provisions on Promoting the Development of Private

Science and Technology Enterprises", to create fine compete environment for private science and technology enterprises, and help these enterprises to improve their innovation capability.

The development of local innovation policy is pushed by the need to develop new and high tech industries in China. It is widely believed that the development of new high-tech industries is the key for the Chinese economy. The success of the U.S. Silicon Valley and Route 128, and the following growth wave of high tech parks in western Europe and Japan has encouraged Chinese enthusiasm and effort in establishing high tech parks as the most effective way of promoting high tech innovations. An important pioneer high tech park was established at "Zhongguancun" of Beijing, in 1988, it is a typical "Chinese Silicon Valley", and it represents the first model of Chinese high tech park, which is closely related to national innovation policy.

Following the Zhongguancun Park, many high-tech parks have been established or are planned in various regions of the country. In principle most parks were established to best use the existing S&T resource. This means that the relevant endogenous processes are to be strengthened rather from attracting exogenous resources. If attraction policies do become relevant, it is likely that they will be oriented towards large multinational investors. Shanghai's Caohejing high-tech park is a good example, based on microelectronics zones near to important universities and R&D institutes, the park has actively attracted foreign investment and technology.

Shengzhen Science and Industry park in Guangdong province is another kind of model. Being the first Special Economic Zone of China, Shengzhen has the highest autonomous decision power and the most favorable environment for development. As science and technology resource is very limited, Shengzhen park was established to mainly attract exogenous resources and promote technology transfer from abroad and north or east of China. The academy of science of China has been actively involved in planning, building and administrating the park. For most of the regions characterized by lacking S&T resources, this model seems to offer a readily available instrument for local innovation policies.

6. Some regional innovation promotion policies of China

1) National technological innovation conference

From August 23-26 1999, the National Conference on Technological Innovation was hold. On this conference, A very important document "The decision of the Central Committee of the Chinese Communist Party and the State Council on the

Strengthening Technology Innovation, Developing High-tech and Industrializing High-tech findings " was issued by the Central Committee of the Chinese Communist Party and the State Council. This decision, included 15 items in four areas, called for more effort to transfer most scientific resource into market-oriented projects, deepen economic, scientific and educational reforms and improve scientific legislation, aimed at boosting China's technological innovation and industrialization.

This decision pointed out that new and high technologies are vital to safeguard the state sovereignty and the country's economic security in the future. The decision stressed that it is imperative to push forward actual structural reforms, activate existing scientific and technological resource, intensify market-oriented research and development, and vigorously promote the use of hi-tech and applicable technologies so as to effectively turn science achievements into competitive products. It outlines how the state is to take measures to ensure enterprises play a major role in technological innovation. Enterprises will be encouraged to move to the forefront of technological development and actively invest in technological upgrading to promote their competitiveness in the marketplace. The decision suggested that co-operation between enterprises and universities or research institutes should be strengthened. Through such co-operative projects, enterprises are able to obtain the technological talents and resources necessary for their survival and growth in the market competition, while universities or research institutes are given the opportunities and capital to develop and perfect technology.

Constructing national level high-tech development zones, promoting the development of private science and technology oriented businesses and technological intermediate agencies are also listed as major tasks of the country's technological innovation, giving more incentives to the serving agencies are also important contents of the new policies. The policies gave details about guidelines and measures regarding infrastructure construction, investment in scientific research, venture capital and other issues crucial to sharpening China's technological competitiveness.

Reform is an imperative task for China, which will help the country pool its technological talents and resources and launch research program with commercial orientations. China will speed up its technology innovation in all its industries, particularly in the agricultural, manufacturing and service sector.
China will create a sound climate to foster high-tech industries and provide solid guarantees to help researchers convert technological breakthroughs and new inventions into commercial products.

2) Proposals on Promoting the Development of Non-government Science and Technology Incentive Enterprises (NSTIE)[25]

Establishing NSTIE to serve economic construction is a significant creative task for scientific and technical personnel. Such enterprises have the basic features of "rising their own funds, freely grouping their personnel, making their own decisions, being responsible for their own profits and losses, and pursuing self-regulation and development." Their major task is to apply scientific and technological achievements to industry. They also engage in technology development, technology transfer, technology consulting, as well as providing technology services. The Party and government have given approval to the development of NSTIE, which have won the support of the general public as well. They are an important component of China's scientific and technological progress, and are the most vibrant area of development among small and medium-sized enterprises. In the new situation of promoting the two fundamental transformations and the strategy of rejuvenating China through science and education, in order to guide and support non-state-run science and technology-intensive enterprises in their efforts to perfect their enterprise system, raise their management levels, and boost their innovative ability so that they can make greater contributions to China's economic and social development, the following suggestions are made:

(1) Create an environment where NSTIE can enjoy fair competition

Making great efforts to develop NSTIE is a major step for accelerating the industrial application of scientific and technological achievements. We should, in accordance with relevant government regulations, encourage more scientists and technician to establish more NSTIE, and attract people who had studied overseas to come back to set up such enterprises using advanced technology and management. Serve as coordinators between relevant government departments, thus facilitating the approval and registration process. All enterprises service centers, engineering technology centers, productivity promotion centers should consider it an important task to nurture NSTIE, and actively provide various related services.

The state has established an innovation fund for small and medium-sized science and technology intensive enterprises to support the technological innovation endeavors of such enterprises (including NSTIE enterprises). Similar funds established by local governments should also be made available to NSTIE, providing financial support when research findings are put into industrial production. NSTIE should be encouraged to apply for government scientific and technological projects, particularly

projects featuring the commercialization and industrialization of high and new technology achievements, while guaranteeing fair participation and competition for non-state run enterprises. NSTIE which undertake the projects shall be rendered the same government support. State owned scientific and technological institutes and institutions of higher learning must make their experimental facility available to NSTIE non-gratuitous basis.

Impartiality should be upheld toward NSTIE when implementing the state's industrial policies, technological policies and policies intended to help scientific and technological innovation, to encourage them to make full use of their advantages in technological innovation and form new areas of economic growth. Efforts should be made to address the problems and difficulties of most small and medium-sized NSTIE in acquiring loan guarantees. Credit guarantee institutions for small and medium-sized enterprises must also serve NSTIE, spread credit risks and provide support to those enterprises in obtain loans for scientific and technological innovation projects. State policies intended to encourage enterprises to export their products should be conscientiously implemented and NSTIE should be allowed to play their important role in the export of high and new technological products and service. The government protects the legitimate right and interests of NSTIE when it comes to preferential taxation policies. The NSTIE should be allowed to raise funds on the international capital market through the issuing of stocks and bonds. They should have the right to refuse to pay any illegitimate fees levied upon them in violation of state policies.

(2) Guide NSTIE in upgrading their capabilities in scientific and technological innovation

Upgrading the capabilities of scientific and technological innovation will guarantee the healthy development of NSTIE. Guidance should be provided to large NSTIE in the establishment of technological innovation departments, expansion of scientific and technological input, recruitment of talented people including university graduates, and raising their ability for technological innovation and the industrial application of scientific and technological achievement. The government should promote bilateral or multilateral technological cooperation between NSTIE and scientific and technological institutions in accordance with the principle of sharing benefits as well as risks. They can supplement each other in personnel and technology. Those with the necessary conditions can apply the state for the post-doctorate personnel. The departments concerned should provide support when NSTIE and scientific and

technological institutions jointly establish pilot plants, industrial experiment bases, engineering technology centers or open laboratories.

The government encourages the NSTIEs to become actively involved in the reform of small and medium-sized enterprises through leasing, mergers, acquisitions, and conversion of high and new technologies to make fixed assets more efficient, and enlarge the scale of the transfer of scientific and technological achievements into practical productive forces. When a NSTIE acquires a state-run industrial enterprises, the relevant policies provided in the "Supplementary Notice of the State Council Regarding the Trial Regulations on Mergers, Acquisitions, and Bankruptcy of State-owned Enterprises in Certain Cities" shall be applied. Large NSTIE which are near bankruptcy because of bad management can be entrusted to NSTIE for operation upon reaching agreement to maintain and increase the value of their state capital.

(3) Rationalize the relations of proprietorship of NSTIE and perfect the enterprises system.

The problem of unclear relations of proprietorship of NSTIEs must be solved. The government must properly solve disputes over proprietorship between NSTIE and state-owned enterprises or institutions left over from the past. The guiding principle is to encourage the conversion of scientific and technological achievements into productive forces, to encourage scientists and technicians to setup enterprises, and protect the rights of the state-owned property. It must be make sure that individual property owners exercise their legitimate rights in decision making, management, and rewards and compensation. Once the relations of proprietorship are clear, the government should give support to large NSTIE which will turned into corporations in accordance with the "Corporate Law", and gradually establish modern enterprises system. The government should allow the small and medium NSTIE to explore and eventually perfect new organizational forms such as the cooperative shareholding system, and make the gradual transition towards a modern enterprises system. Upon approval by the relevant departments, small state-owned scientific and technological enterprises can be restructured as NSTIE adopting the shareholding system or cooperative shareholding system. Small state-owned scientific and technological institutions can be leased and managed by people on the basis of voluntaries, equality and benefits for both sides. If scientists and technicians from an enterprise collectively apply for leasing, they are entitled to have the first choice under the same conditions.

Guidance should be given to the NSTIE so that they will attach importance to and reinforce internal management, gradually perfecting the legal person management

system. A scientific and efficient system of decision-making, management that gives incentives to managers and holds them accountable at the same time. The government should train and employ professional management personnel and make the transition to standardized and modern management. The management philosophy that propagates short term gains should be expunged, and base an enterprise's development on correct market forecasts, sustainable technological innovation, and scientific management and operation.

(4) Provide guidance and service to the development of NSTIE
The government should establish a training system for managers of NSTIE so that they can keep abreast of the latest state policies and other applicable knowledge and keep the enterprises on the right track of development. the government should continue to publicize the position and functions of NSTIE in China's reform and opening program and modernization drive. The public should be given a better understanding of NSTIE, and they should pay attention to and give their support to those enterprises to create an orderly and fair environment for their development.

Under the leadership of local government, and in accordance with the spirit of this document, all departments concerned, particularly science and technology commissions, and economic and trade commissions at all levels should work out their plans and specific policies and measures to promote the rapid and healthy growth of NSTIE. They must provide better guidance and service, and serve as good coordinators.

All scientific and technological management departments should further transform their functions and perfect institutions that give guidance and services to NSTIE. They must strengthen basic management work, such as in the fields of research and statistics, and raise the standards of their professionalism and efficiency. All economic and trade commissions must incorporate the development of NSTIE into their general plans for guiding the reform and development of small and medium-sized enterprises and provide directions and support for NSTIE.

PART 4. MAIN PROGRAMS AND INSTITUTIONS OF JAPAN AND CHINA FOR INNOVATION

Programs and institutions are the important components of regional innovation systems, through which the government can organize effective innovation activities. How to effectively carry out these important programs and institutions, fully play the role of them, and gradually perfect them in the practice is one of the important aspect for the regional innovation. Some distinct characters of the program and institutions can be used for the reference for both Japan and China.

1. The Technopolis Project in Japan [26]

The word "Technopolis" is a Japanese creation, it means a high-technology industrial complex. The basic idea behind Technopolis is to realize "rural serenity in the city and urban activity in the country". The Technopolis Plan is a new strategy for the development of relatively backward regions, aiming at the creation of attractive towns in which industry, academics and residential space are closely interrelated. The main responsibility for carrying out Technopolis development plans rests with the localities concerned, which can be expected to make optimum use of regional characteristics. In this case, "industry" means high-tech industrial complex including electronics, bio-industry and new materials industries; "academics" means colleges offering course in technology, or other institute or laboratories providing regional business with scientific and technological fundamentals, and "residential space" means pleasant town which can attract managers, engineers, researchers and their families. The Technopolis Plan gives us an advance view of the 21st century.

The Ministry of International Trade and Industry (MITI) first announced the Technopolis concept in 1980. The background of this is that local areas strongly desired to expand their employment opportunities and become more vigorous by attracting high-tech industries. With the upgrading of the industrial structure and continuing technological innovation, high-tech industries are growing very rapidly and expected to be the leading industries of the future. These kind of industries need infrastructures, including research functions and information, in addition to hard ones such as airports and expressways. Hi-tech industries are becoming increasingly localized. These industries do not need large-scale plants or investments, and their products with a high price of per unit. Accordingly, hi-tech industries can be easily rooted in local areas. Finally, the sense of nationhood is changing, with more and

more people desiring to go back to local cities in the search for a comfortable life and regional culture. [27]

When the Technopolis project was first advocated, it aimed at the construction of several new model towns throughout Japan, each of which would have a population of about 50,000 and an area of about 2,000 hectares. The announcement triggered a strong response throughout Japan. 38 municipalities made requests for construction, and 19 areas were selected as leading candidates. Through careful surveys and discussions, the original concept was modified into a plan to make the most of existing facilities and potentials, maintaining the independence of each area. In March 1983, the Law for Accelerating Regional Development based upon High-technology Industrial Complexes, the so-called "Technopolis Law", was enacted, and the Technopolis project begun in earnest.

The Technopolis concept has five major features. First one is the integration of industry, academics and habitation. The most remarkable feature of the Technopolis concept as compared with conventional development policies is that it is not a mere policy for the attraction of industries to regional areas. In a Technopolis, there has to be an academic zone consisting of universities, research institutes, and other educational facilities. The second one is there is a close relationship with the mother city. The Technopolis concept aims at achieving regional development by making most of each area's existing land, culture and other accumulations of heritage. For this purpose, the "industry", "academic" and "habitation" zones are located in the suburbs of a local city, which is referred to as the "Mother City". The third one is formation of industrial complex through inducement and self-development. Under the Technopolis Plan, industrial complexes are formed not only by introducing new high technology industries, but also by self-development on the part of existing local enterprises. The fourth one is research and development (R&D) of the "transfer" and "frontier" types. Two types of R&D go on in a Technopolis. One is the "transfer" type, whose main role is to transfer the achievements of electronic and mechatronics technologies to existing industries. The other is the "frontier" type, which produce such creative R&D as may be attractive to the world market. Judging from the present status of R&D, the transfer type R&D is considering more important to the Technopolis than the frontier type for the time being. The fifth is the importance of each area's individuality. While the Technopolis Plan is a project of a national significance, it must be realized by each area using its own creative ideas, methods and efforts and making the most of all the potential it has.

The procedures for developing a Technopolis is as follow. First, a prefectural government should designate an area satisfying the following requirements specified in the development guidelines based on the provision set forth in the Technopolis Law. (1) Security of integration in respect to the natural, economic and social conditions. (2) Participation of high-tech enterprises with potentiality or high-tech oriented enterprises. (3) Industrial sites, industrial water and residential area should easily be available. (4) Adjacent city with population of approx. 150,000 or more. (5) Participation of high tech university engaging in education and research. (6) Easy to access high speed transportation.

Next the government authorizes the plan, after examination that it confirms to the development guidelines. The local government concerned puts the plan into action. The government assists localities by providing tax incentives, financial and so on. However, this assistance is not on a large scale. And the development program was approved for 14 regions in 1984, 4 regions in 1985, 2 regions in 1986, 3 regions in 1987, 2 regions in 1988, and 1 regions in 1989, that is the construction of technopolis is under way in a total of 26 regions in Japan.

The Technopolis concept attaches great importance to the autonomy and self-motivation of the region, and is expected to trigger development of the potential the region has. In each Technopolis region, intense effort has been made, with this expected, following the development plan, and with the Technopolis development organization and other local industries and universities and the governmental organization concerned as the leader, these efforts is gradually producing results. The results are, (1) The Technopolis Development Organizations succeed in creating a fund and begun to perform an active industry support function. (2) Intercourse and joint research projects between industry, university and governmental organizations became accepted by the local community concerned as usual matters. The industry-college-government intercourse is done in various forms such as social gathering, study meetings, technology interchange plazas and joint researches. There were many instance of development of new products or new engineering techniques by local enterprises. (3) Facilities were improved to enhance the research and development function, personnel training function and information providing function, and (4). Improvements were made in factory sites and other industrial infrastructures and in urban infrastructures. The Technopolis project can be considered to be making overall steady progress.

Some problems need to cope with. Firstly, a further improvement in cooperation and intercourse between newcomer enterprises and native ones and among colleges, public testing laboratories and native enterprises is hoped for. Sophistication of local industry through technological development and propagation is the main subject of the technopolis concept. For that purpose, construction of "Tech-Network" in Technopolis region will be effective in promoting intercourse between industries, colleges and government organizations concerned. Secondly, the fact is that, although the locals concerned have large expectations from the Technopolis foundation, local needs are not necessarily met. Enrichment of the scale of the foundation and contents and scale of the project is hoped for in the future. MITI has appropriated 1,680 million yen for fund creation of the Technopolis foundation in the 1987 amended budget, and has decided to continue positive use of the industrial relocation subsidy to support the projects of the Technopolis Development Organizations. Thirdly, enhancement of soft industrial support functions such as a research and development function, talent fostering function and information providing function is hoped for.

In order to promote the construction further, MITI also had taken some measures, one of the measures is the Techno-Network plan. In technopolis regions, there is a problem in that trade, technical tie-ups and joint research are insufficient between high-technology newcomer enterprises and native enterprises and cooperation through joint research, technical guidance and the like is also insufficient between native enterprises, colleges, and governmental organizations, so that technology propagation effects are not yet obtained adequately. To cope with this situation, the construction of network through trade, technical tie-up, joint research, technical guidance and the like is effectively in promoting intercourse within and outside the technopolis region.

In order to promote the Technopolis construction, MITI took some measures to promote construction of an intercourse network within and outside the Technopolis. The main measures include (1) form of intercourse, (2) talent fostering and securing, (3) technology sophistication, (4) marketing and (5) information providing.

The MITI also took some new location-related measures to support Technopolis construction. One of them is the research core and Technomart (Technology market), the research core (base facilities for research and development and industrialization), provided for as the research and development base of a region in Item 1 on specific Facilities of the Provisional Act on Promotion of Specific Facilities through Utilization of Private Entrepreneur's Capabilities, is being implemented in various places. The research core plan, which aims at well-balanced land development

through sophistication of regional industrial structure and providing of opportunities for brain work, helps Technopolis construction in itself. The local persons concerned are expected to make a further effort at this. The Japan Technomart Foundation, a new technology information exchange system, is advancing in establishment of its branch office. In the Technopolis regions, the number of its branches is steadily increasing, In addition, establishment of branches is under consideration in other Technopolis regions. For Technopolis construction, buildup of the function of providing information, especially technical information, is essential.

2. Japan Regional Development Corporation (JRDC) [28]

In August 1, 1974, Japan Regional Development Corporation (JRDC) was established on the base of Coal Mining Area Development Corporation, which was founded in July 20, 1962. The objective of JRDC is to contribute to the appropriate nationwide distribution of population and industry by carrying out the necessary activities for encouraging people and industry to relocate to local areas from metropolitan areas, promoting regional development, and promoting the development of coal mining areas.

The first principle feature of the corporation is its involvement in projects organized national policy and screened from a abroad, nationwide perspective, projects which require advanced technologies difficult to be implemented by the private sector or local governments, and projects that are large-scale and require extended length of time for implementation. The second feature is that its industrial parks and new town projects are comprehensive and multilateral in planning, with thorough attention paid to local socioeconomic infrastructure and other conditions. And the third is that JRDC responds to local government proposal for development projects and collaborates with such government in such projects. By reason of these features, the JRDC contributes to public benefit and community welfare through it activities.

Japanese manufacturing has been supported by basic technology industries that produce parts, molds, test equipment, etc. Amid the rapid change of the economic environment in recent years, these industries are striving to energize themselves through advancing their technologies and launching into new fields. For the purpose of assisting the activation of these industries, comprehensively and systematically, a law named "Law on Temporary Measures for Activation of Specific Regional Industrial Agglomerations" (generally know as "Law of Activation Regional Industrial Agglomerations") was enacted, in March 1997. Based on this law, in the promotion area for activating the group-sitting of the basic technology industry. Its

objective is to alleviate the burden of initial investments for exploiting opportunities in new directions

In the promotional areas (including the tri-metropolitan areas) of activating the colocation of basic technology such as manufactures of parts, molds, test equipment, etc., as well as software and design development. For such enterprises, the JRDC plan to construct and lease factories and operation sites, will facilitates prototyping, new product development, small scale manufacturing, etc.

In the promotional areas (other than the tri-metropolitan areas) for activating the group-siting of the basic technology industries, this project seeks to develop, lease or transfer land for operations of activating the group-siting of industries. This is a vehicle for locating enterprises defined as the basic technology industries such as the manufacturing of parts, molds and test equipment, as well as software and design development. When enterprises of the basic technology industries desire to launch into business operations, this project aims to alleviate the burden of their initial investments and thus, to activate the colocation of local industries, by giving them a choice of either a conventional land transfer or a term leasehold for business use land. Additionally, along with the development of the land, public facilities such as roads, parks, water supply and sewage as well as watercourses will be provided.

Concerning the Industrial Relocation Promotion Projects. In the course of high economic growth period, Japan expanded its economy and society dramatically with industrialization. This trend also caused extreme concentration of population due to the shift of people from rural communities to major urban areas. Recently, the natural environment and living conditions that rural communities provide have caused an inflow of the people seeking permanent residence in such area. On the other hand, the income disparities between major cities and regional communities remain still wide. Employment opportunities in the regions are far from adequate both in quality and quantity. JRDC has been faced with the overpopulation and depopulation problems, the regional income disparities, and the needs latent particular, in the younger people living in regional communities, as well as with the needs for create basis for industrial growth in rural areas.

Concerning regional core city development. In the situation of centralization of population and various social functions in the Tokyo Metropolitan area, the "Law for comprehensive Development of Regional Core Cities and Relocation of Industrial Facilities" was enacted in 1992 in order to create attractive residential environments

equipped with advanced urban functions to promote well balanced industrial functions nationwide. Under the "Regional Core Cities Law", JRDC has undertaken two types of projects: firstly Specified Urban Redevelopment Project on defunct railroad depots and former plants sites located in built-up areas of regional core cities in order to upgrade urban functions. Secondly Industrial Facilities Relocation of industrial functions such as business offices and sales offices to regional core cities, Adopting methods to build attractive urban environments with industrial function. JRDC support comprehensive development of regional core city areas.

Regional City Development Project. The regional city development (new town development project) is implemented for balanced land development and regional growth and on request from local governments to develop new regional cores of local economy and culture. The objective of development is to create attractive new towns that offer comfortable loving conditions and natural setting while preserving regional characteristics, and are equipped with advanced and integrated urban functions for development of towns oriented to science and education, social welfare and culture, high technology, or resort and health functions or of new city centers, according to the local policy and principle on regional development. Since project startup in 1974, regional city development projects have been implemented in 17 locations, covering some 5,370 ha. of area. Because land area a single project range between 150 to 610 ha., these projects require long-term commitment.

3. The cooperative research center of university and industry [29]

The scheme for cooperative research projects between national universities and the private sector dates back to May 1983 when Monbusho (the Ministry of Education, Science and Culture) issued a formal notification to all national universities and other national institutions of higher education.

The purpose of the cooperative research center of university and industry is the following:

(1) To provide a research facility or laboratory space for university-industry cooperative research projects or contract research to be conducted in the national university concerned.

(2) To implement within the center various type of technical training programs targeted at technicians and engineers employed in the private sector, or otherwise assist private companies and other external organizations (including local governments, non-profit institutions, etc) in providing technical training for their employees.

(3) To provide technical advice or consulting services for private companies and other external organizations on questions related to research and development.
(4) To hold special lecture meetings, workshops, symposium and such other activities as appropriate.

To promote the cooperative between the university and private company, the cooperative researcher center project has started 1987. And in this year, three cooperative centers were established in Kumamoto University, Kobe University and Toyama University. Since then the forty-three cooperative centers have been already established in the national university till the year of 1995.

In most of the cooperative research center, the center employs a professor as a part time director as well as one or several full time associate professor and part time visiting professors. The form of research cooperation between the center and industry is varied. It may consist of joint research, commissioned research, acceptance of commissioned researchers, receipt and use of research donations and so on. In order to dispatch a researcher to a university for a cooperative research project, the employing company must pay an annual fee of 412,000Yen to the host university to cover the basic costs for the individual's research stay.

The cooperating company or organization may be asked to bear other direct costs such as "remuneration for cooperating researchers", "travel expenses", "cost of expendables", procurement of equipment and "utility costs". When a private company contributes more than two million toward the direct costs of a cooperative research project, it is possible for the national university to also pay part of the direct research costs out of government-allocated funds.

Patent right arising from cooperative research projects between a national university and a private company (or the external organization) are, in principle, jointly share by the government (or the individual investigator belonging to the university, depending on the circumstances) and the partner company. When an invention is made independently by an individual university researcher patent may become the property of the individual inventor alone, is a agreeable to the other parties involved. All inventions made in the course of a cooperative research project, as well as any patent applications therefor, must be reported to immediately to the "invention committee" of the host university for formal determination of ownership.

Now, legal and regulatory barriers that discourage academia-industry cooperation in Japan are gradually removed. For instance, professors are now allowed to consult for industry, although they are not given any release time to do so, and despite some controversy when it comes to implementation, professors can now own their own business. Discussions are underway to consider changing the faculty tenure system to accelerate the science and technology achievement transfer. Of particular note is the growing interest in possible ways to reduce the control that the central government exercise in managing the universities' financial matters.

Plans are in progress to combine the Ministry of Education, Science, Sports, and Culture (Monbusho) with the Science and Technology Agency (STA) to form a Ministry of Education, Science and Technology in 2001. This merger is expected to have implications for the academia-industry relationship.

4. Technology Licensing Officies (TLOs) [30]

In May 1998, "University Technology Transfer Promotion Law" was passed, which purpose is to encourage the technology transfer from national universities to industry by providing assistance to university, the concept of the Technology Licensing Office (TLOs) was established by this legislation as a joint effort of MITI and Monbusho. MITI is the funding agency (20 million yen/year/TLO) and Monbusho is the approving agency. The TLO authorizes the university to establish offices to patent and license university inventions that do not belong to the central government. Till now, there are 14 universities and research institutes had built TLOs.

In August, 1998, "The Law for Promoting University-industry Technology Transfer", came into effect, the law encourages TLOs to serve as a bridge and facilitate technology transfer from universities to private companies. TLOs are expected to make good use of university research, by meeting the needs of society and returning licensing income to the universities. This will promote innovative scientific research in Japanese universities.

In Tsukuba, the Institute of Tsukuba Liaison Co., Ltd. was approved as an official TLO by Monbusho and MITI in April, 1999. Other authorized TLOs have been established in cooperation with the University of Tohoku, the University of Tokyo, Nihon University, Wasada University, the University of Kyoto and Ritsumeikan University.

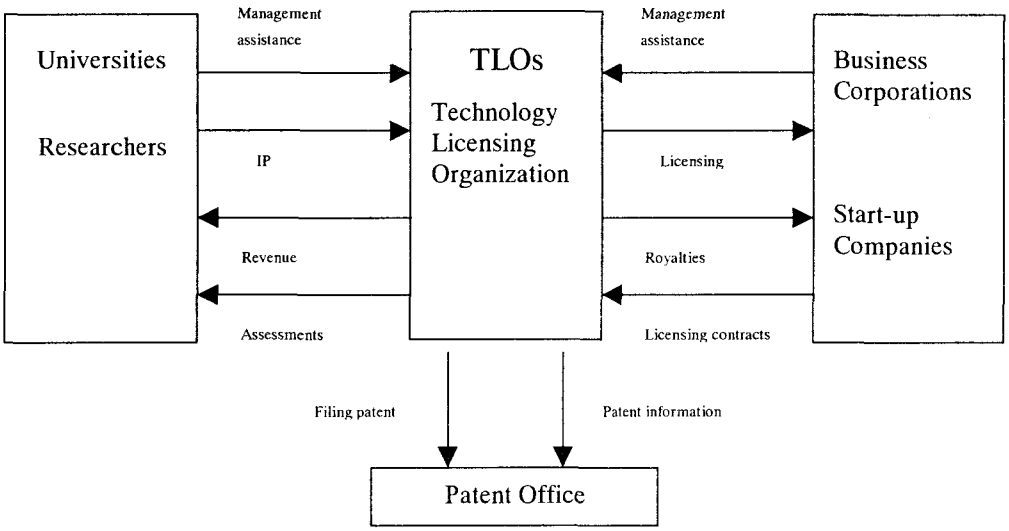


Fig.4-1 Technology licensing organization

Through TLOs, universities can contribute to society, universities can set up more new businesses and develop existing industries in order to revitalize the Japanese economy. The results of university research can make this possible and more cooperation between universities and companies can help to solve many global problems, such as problems of the environment and the population growth rate.

Through TLOs, universities can fulfill their responsibilities to society. TLOs will make use of the results of university research to stimulate the development of the private sector, so university researchers are expected to transfer their research results to TLOs. The process of transferring patented technologies from universities to industry will be transparent and efficient, and researchers and their universities will receive licensing income as a result. TLOs will handle the patenting of research ideas and deal with various financial, administrative and legal affairs on behalf of university researchers.

5. Incubator and regional industrial technology center [31]

As a part of the main infrastructure of an S&T park and also as important facilities and functions for bring about innovation. Incubator is a facility (including the which provides only a fixed asset such as a rental office or a rental research room) that

provides rental offices, rental research rooms and shared services at a low fee, consultation service for management and business planning and marketing. And also financial support, for persons who are trying to establish a business, corporations that have recently become established, and also small- and medium-sized corporations that are attempting to advance into new fields.

As for the trend concerning the establishment of incubators, because both innovation center and science park has the incubators, so the total number of incubators is the sum of the number of science park and innovation centers. The incubator starts to spread from 1988, up to 1993, a total of 45incubators were established, and since fiscal 1994, a total of 20 incubators have been under planning. Due to the difficulty of judging the functions and the economic effectiveness of incubators in inter-regional economic development because many of the incubators in Japan have not long been established and there are no effectively operating examples of the actual establishment of new corporations, it is difficult to manage incubators, and there is a lack of entrepreneurs and difficulty of obtaining scientific and technical material. These functions are currently being studied at many parks that intend to establish incubators in the future.

Regarding service provided by incubators that were established till the end of 1993, apart from rental research rooms and rental offices, there were only four items, technical consultants, eating houses and restaurants, conference rooms, and database, provided by 50% or more of incubators. Consultation services concerning patents, financing and marketing were provided by small proportion of them.

Regarding the methods used to recruit tenant entrepreneurs for incubators. The most common method of recruitment was by personal introduction, a large amount of them use distribution of recruitment posters, some of them use marketing and explanatory meeting.

In order to promote regional science and technology research and development, many regional industrial technology center were established. There are two kinds, one kind of them is the Public Research Institutes (PRI), and the other kind is National Research Institutes (NRI). PRI usually established by local government and works on local people and companies, while NRI is owned by the central government and work on national subjects

Generally speaking, innovations in the regional economy are mainly related to: (1) an innovative company as the main actor; (2) several related supporting organizations such as PRI, national research institutes, universities, special financing organizations and so on; (3) policy and implementing organization for promoting innovations. In this context, usually universities have not so intimate communication with small & medium companies than large companies in Japan. Therefore small & medium companies will choose the support from PRI than university in the innovation.

The main aim of the public research institutes for local industry is to: (1) Continually support the rising up of the standard of living of people through industrial; (2) development in terms of promoting innovations in the region; (3) Improving living and working conditions and environment; (4) Improving innovative abilities in the region and communicate more effectively innovative needs and resource; (5) Promote the advancement of local technologies in the region.

It is true that the environment in which new technologies are introduced is also of key importance to its diffusion and effective use. Furthermore effective policies developing institutions of industrial communications and information network, instrumental in forming and feeding the skills and knowledge base, are highly significant determinants of diffusion of innovation, or to fill its function as a "multiplier" or technological advancement in the region, such institutions affect co-ordination in many different ways.

Accompanying with advancing highly, diversification and internationalization of technology, innovation mechanism is also changing so as to correspond to them. High technology requests small & medium company to master or develop related software technology besides hardware. The R&D pattern of technology is diversifying from a linear type to spiral type to network type, by shortening of the product of life cycle. As a kind of diversified net work policy, Technopolis are flourishing, and are very useful for developing new inter-industrial business in Japan.

6. Regional Science Promoter (RSP) program

Recently, Japanese policymakers have introduced the concept of Regional Science Promoter (RSP) Program. In this program, an individual is designated as the New Technology Coordinator (NTC) whose role is to coordinate the fulfillment of the S&T needs of the prefecture. The NTC aims to upgrade the technologies of SMEs and to give incentives to R&D type startup enterprises. To help accomplish these goals, the NTC provides a relatively comprehensive "Technology Support System" that is based

on the defined technology and manufacturing strengths of the prefecture. Thus, Technology Support System provides consultation in technical-Chemistry, robotics, metals and advanced materials. Management- analysis of company needs engineering, and plant and equipment investment. Currently, TSS consultation is being considered for expansion to include assistance in human capital development, e.g. marketing, accounting, business planning and personnel training.

The purpose of RSP is to improve the coordination functions which promote research and development (R&D) activities, it is considered indispensable for constructing science and technology based in regions. The Regional Science Promoter Program, when local governments intend to prepare centers of research coordination functions provided in the foundations and other entities which have been established for activating activities of science and technology, will work to support new technology coordinators and their activities in such a view point as the nationwide formation of the infrastructure to support science and technology.

As a results of the coordination activities, functions such as picking-out excellent research talents, storage of information on research resources, formation of research information networks and construction of researchers' personnel-exchange networks are expected to be provided for R&D promotion central organizations.

This program provides support for coordination activities for the maximum of 4 years in the regions designated by the Science and Technology Agency (STA). In the 5^{th} year, by the time when this program has been completed, the coordination functions of R&D promotion centers formed in the regions will be taken over by the relevant local governments, in the expectation that activities in the regions such as the promotion of science and technology, activation of regional economy, improvement of quality of life and the increase of intellectual property will be developed further.

Regarding the division of roles between the state and regions, the state (Science and Technology Agency) intends to construct a wide range of cooperative relationships with regions involved in planning and implementing various measures including those for the improvement of research environment and promotion of pioneering research for regions to construct science and technology bases peculiar to them. In this RSP program, STA aims at expanding the coordination functions of R&D promoter footholds that are to be constructed by the local governments. Under the guidance of STA, Japan Science and Technology Corporation will support the new-technology coordinator who is the key person of regional R&D promoter footholds and his

activities. And the Japan Association of Regional Research Exchange is also requested to play a part of roles in the designing and operating this program as a whole, including planning to hold new-technology coordinator conference.

For promoting regional R&D activities from the standpoint of constructing science and technology bases, the local governments play leading roles for designating the central organization functions including third sectors as the center of coordination and to provide sufficient coordination functions in the central organization.

As regards the central organization (center of RSP), under the guidance of the relevant local government, the central organization will promote the preparation and formation of coordination functions which these organizations shall have, in collaboration with the activities of the new-technology coordinator with the environment and position easily to conduct activities and support his activities.

The activity of new-technology coordinator include definition of areas to be search for; survey on regional needs and research seeds; combination of regional technological needs and research; planning of research projects, formation of research agreement, public disclosure and other activities peculiar to the region.

7. Collaboration of Regional Entities for the Advancement of Technological Excellence (CREATE Program)

Japan has dedicated itself to building and strengthening the various regions within the country. A key part of the overall strength of a nation is the strength of the individual regions that make up the country. For they think a critical part of this vision to help and strengthen the foundation for science and technology in each region. In this program, the Japan Science and Technology Corporation (JST) work closely with each region's strengths and their science and technology vision. A key part of their effort is to facilitate a smooth and natural cooperation among the various centers of strength in the region, such as research oriented companies, universities, public laboratories, national laboratories and others. The JST also work hard to ensure that leading professionals in the region can participate in this effort. Through this activity the JST hope to promote meaningful joint research, exiting new technologies, leading edge companies, and significant new industries. The ultimate goal is to create a Network-Structured Center of Excellence in each region that builds on local strengths, and which contribute to the total strength of the nation.

Based on important research fields identified by the country, this program endeavors to promote joint research on the regional level by bringing together regional organizations from the research sector, such as research-oriented companies, public laboratories, national laboratories, universities and others.

JST works with regional governments to establish a managerial body in a Central Project Organization such as a foundation that has the objective of promoting science and technology in the region. This managerial body is responsible for such things as promoting the program, coordinating various people and organization, and other such activities.

To conduct smooth program operations, the managerial body has the responsibility of appointing a Project Director, as well as establishing the Research Exchange Promotion Council, the Joint Research Promotion Committee, and other such research promotion functions. Further more, to promote joint research, the managerial body can establish a central research facility as needed in public laboratories, or other appropriate locations. The managerial body can also hire researchers, do out-source research by contracting to companies, universities and the like, as well as other activities that facilitate and promote research.

Each regional program will last for a period of five years. The Science and Technology Agency (STA) will conduct a mid-term review of each project in beginning of the third year to determine if new research directions are needed. The final research results will also be reviewed when the project is concluded after five years.

The funding from each region for the project will be about $3 million per year, but the exact amount will depend on such factors as the content of each region's project, their management system, and progress in the research.

Project funding can be used for operating costs for the Research Exchange Promotion Council and the Joint Research Promotion Committee, for research costs (equipment, materials, travel, etc.), for outsourced contract research cost, for personnel costs (Project Director, Research Director, Technology Facilitators, and researchers), and for other appropriate costs as need.

Two key parts for the success of the program are the support of research and the transfer of research results to industry. To accomplish these important objectives, a

flexible system with the components outlined below is implemented within the Central Project Organization. This system can contribute to the improvement of the regional industrial infrastructure by facilitating the transfer of results from the joint research program to regional companies where commercialization can be doe, as well as facilitating the use of those results to create new companies.

The position of Technology Facilitator will be established in the Central Project Organization. In addition, a flexible technology transfer system will be established that provides a link between market needs and the stockpile of intellectual property that is derived from university, national laboratories and joint research. The Technology Facilitator and the supporting system will introduce the results from joint research to research-oriented companies, as well as provide feedback from the marketplace to the researchers.

An important part of the program is to provide the wide variety of professionals that are needed for each of the various stages of the R&D, technology transfer, commercialization, and company creation. To foster joint research, the conversion of research results into new companies, and other such activities, a Skill Bank will be established by registering lawyers, accountants, marketing firms, consulting firms, and others into the system. The Skill Bank can be used as needed by the Project Director, Research Director, Technology Facilitator, research partners and others. The actual construction and long-term use of the Skill Bank depends on the particular situation and needs of each of the region.

In this program, the responsibilities of the regional government is as the followings. Support of joint research. The regional government is expected to provide research funds for research done at public laboratories and to provide space at joint research facilities that have been developed by the regional government. Support of the central project organization. The regional government is expected to provide a part of the salaries for the Project Director and his/her staff, as well as office space as needed. The support of regional network structured COE. The regional government is expected to provide support to strengthen and expand the research promotion activities of the Central Project Organization and to continue with the building and management of a regional Network-Structured COE.

Till now, there are 13 prefectures had launched such projects, they are the Ibaraki, Osaka, Hiroshima, Fukuoka, Hokkaido, Yamagata, Miyagi, Kanagawa, Iwate, Gifu, Aichi-Nagoya, Kumamoto. The program objective covered from the New

Technologies for Water Restoration, to Genetic Engineering and Sensing Technology for Advanced Bio-materials, and New Technologies for Environment-Friendly Cities.

8. Japan Industrial Location Center (JILC) and Japan Association of New Business Incubation Organization (JANBO)[32,33]

The Japan Industrial Location Center (JILC) is a comprehensive research institute, and was established by MITI in 1961 with the aim of facilitating industrial location and promoting regional development. The objective of JILC is to seek the efficient and stable expansion of industry by helping companies to shift to and become settled in areas that are appropriate for their type of industry. And to realize regional development that is in harmony with regional characteristics by drawing up and coordinating development plans and measures for each region.

To achieve these objectives, the JILC undertakes such work as conducting research and surveys, offering consultation and mediation, and holding symposiums and seminars.

JILC pursing the following themes to determine how people's lives and industry should be in the new era.

(1) Theoretical and corroborative research connected with regional development policies, and industrial location policies and plans in Japan and overseas.
(2) Construction of a database covering regional development and industrial location in Japan and overseas.
(3) Basic and applied research connected with the drawing up of regional development policies, and industrial location policies in Japan
(4) Training for people engaged in the drawing up or implementation of regional development policies, and industrial location policies and plans
(5) International exchange in the theoretical and policy aspects of regional development and industrial location. Research into themes arising from new viewpoints is being conducted a network of talented people from a wide range of fields, including technicians, scholars and cultural experts formed into project Japan and overseas.

The JILC also provides consultation and conducts research regarding industrial location problems and regional development plans both in Japan and overseas and also collects and makes available information related to these areas. It also holds seminars aimed at facilitating the overseas expansion by Japanese companies and the entry into Japanese markets by overseas companies, provide development technical

cooperation to developing countries, holds training seminar for people connected with regional development and industrial location, dispatches study missions overseas to examine industrial location in other countries, and publish the center's journal.

Besides these, JILC still support the Technopolis construction. The Technopolis have been constructed in 26 locations throughout Japan, and at the heart of these projects are the Technopolis development organizations. These organization act as guarantee for payment of debt when companies which carry out high-tech development at a Technopolis take out a loan. In response to desire for the creation of are-guarantee system to facilitate this operation, the Japan JILC established the Technopolis Guarantee Fund in July 1986, and through this, is supporting Technopolis construction by acting as guarantee Fund in July 1986, and through this, supporting Technopolis construction by acting as Guarantee for the development organizations.

JILC also provide registered member system. The purpose of the JILC's supporting member system is to facilitate future regional development through the promotion of close ties among the center, local public organizations, industrial associations and companies. And the center is confident that the effective use of this system by members will contribute significantly to their future growth. The JILC provides supporting members' benefit with provision of the center's publication, industrial site mediation and consultation and regional development planning for basic research on regional development, regional development planning and diagnosis, research on the siting of energy facilities and so on.

2) JANBO

By taking action and implementation policies based on the Technopolis Law and the Brains-of-Industry Location Law, diverse research has been conducted and entire industries have emerged. A variety of supporting organizations for local industries have been set up to provide technological know-how, human resources, helpful information, and many other kinds of assistance, improving the foundation from which can move on to the creation of new business.

The Law for Facilitating the Creation of New Business was enacted to utilize the many years worth of these assets as a nursery bed to create new business, enabling us to improve the support system with the establishment of "regional platform". The regional platform is a comprehensive support system to provide one-stop service at each step, from research and development through to the establishment of business, by networking industry-assisting organization and support-providers with

entrepreneurs. The platforms, located in each of the prefectures and designated cities, are foundations for creating business in those areas. The core support institutions, new-business supporting organizations, local governments and authorities, public research institutes, and coordinators that comprise the regional platforms throughout Japan organized the JANBO to promote new business creation in local communities.

9. Development of high-tech zones of China

1) Development of high-tech zone [34]

High and new tech industrial development zone (high-tech zone) was developed under the background of reform and policy of opening to the outside. Since 1980s, Chinese government and some local authorities have the establishment of high-tech zone in several designated regions. A group of new high-tech enterprises gather in high-tech zone to be engaged in industrial activities of research and development, commercial management and sales service. Operating in the way of marketing economy and enjoying favorable policies in finance, price, foreign trade and personnel, these enterprises possess the independent rights to raise money, combination, operation, and development and restrain themselves.

In June of 1984, Chinese central government indicated in relevant documents that high-tech zone should be established in several designated regions for the development of new high-tech industries. In July of 1985, a series of favorable policies started to be implemented in the first high-tech zone, Shenzhen Science and Industry Park, which was co-established by China Science Academy and Shenzhen city. In May of 1988, the State Council of China ratified to set up a new tech development-testing zone in Beijing (it is generally called as "Zhongguancun Street"). In the Beijing high-tech zone, eighteen special regulations stipulated in "provisional regulations" were implemented. At that time, Chinese high-tech zone finished their brewing stage and started their operation stage with the relevant regulations.

Beijing high-tech zone implemented 18 items of special regulations, which played an exemplary role in China. The state council approved that taking the creation of high and new technology industrial zone and high and new technology innovation centers as the important parts of national Torch Program. Under the promotion of Torch Program, similar regulations stipulated in many provinces and cities, a group of high-tech zones were established in many parts of the country. In March of 1991, the State Council of China issued the nationwide policy documents of high-tech zone for the first time in order to guide and standardize the development of high-tech zone all over the country. Meanwhile, the central government approved 26 national high-tech zoned

distributed over the country. The central government also strengthened the macro-management of high-tech zone, and Chinese high-tech zone had reached a certain stage of initial scale.

The development of high-tech zone all over the country have been gradually improved since the requirements of new high-tech products were increased in the market along with the vigorous development of the Chinese economy. From 1991 to 1992, nearly 100 cities asked the central government to ratify them to set up national high-tech zone. In order to judge and make decisions, a joint investigation group formed by several high-level authorities learned on the spot information of certain provinces, cities and their development zones. After analysis and demonstration, the State Council of the China approved the setting up of another 25 high-tech zone as the national level high-tech zone. From then on Chinese high-tech zone entered the stage of stable growth.

In June of 1997, on the basis of quick development of high-tech zone, the State Council approved to build a national agriculture high-tech industrial development exemplary zone in Yanglin, Shanxi province. To promote the development of agriculture high-tech industry, and to solve the agriculture development problem in dry and semi-dry region and the total number of national high-tech zone had reached 53. The number of local high-tech zone approved by province government was 57. In Oct. 1998, 5 high-tech zone, including Beijing, Suzhou, Hefei, Xian and Yantai high-tech zone were approved to be "The Asia-Pacific Economy Cooperation Organization Science and Technology Industrial Zone".

Most of the high-tech zones were built in the large and medium sized cities with intensive intellectual and some coastal cities with fine condition for opening to the outside, in which the high-tech industry can be quickly formed. From the viewpoint of the distribution of high-tech zone, there are about half of the high-tech zone were located in the central cities or in capital cities, about one fourth of high-tech zone were located in industrial cities, and another one fourth of high-tech zone were located in coastal cities.

2) Management of China's high-tech zone

As regards the structure of high-tech zone, most of them are consist of five parts: policy implementation zone, integrating construction zone, high-tech innovation service center, university science and technology park, and the technology market. Generally, the policy implementation zone was set in built area with intensive

universities, research institutes and enterprises, for all of them can take the advantage of country's preferential policies. The integrating construction zone usually in the periphery of city, in context with the development planning of the city, to build the infrastructure in this zone, to provide enough space and fine service for the new high-tech enterprises and corresponding institutions. While the high-tech innovation service center (incubator) is unique institution in high-tech zone, for transfer the science and technology achievement. The innovation center was established both in policy implementation zone or integrating construction zone. While the university zones are usually established near the university.

The main missions of high-tech zone given by the government were to attract Chinese scientific and technological personnel to enter the economy activity. To encourage technical innovation activities, to accelerate the growth of new high-tech industries. To push forwards the transformation of traditional industry. To deepen the reform of science, technology, the economy and society, and to liberate and develop the scientific productive forces of China.

In order to complete these missions, high-tech zone progressively achieve the following functions in their process of development. (1) Act as the base to develop new high-technology industry, (2) act as the radioactive source to expand new high-technology to traditional industry, (3) to be a window to open to the world, (4) act as a testing area for deepening reform, (5) demonstrate the possibility of combining closely science, technology and the economy, (6) be a new community embodying the modern socialistic civilization, and (7) act as school to foster new high-technology industry personnel.

In order to fulfil above objectives, China determined the new high tech fields to support and to develop emphatically, after the demonstration of technical, economic, and other concerned specialists. These fields generally represent the dominant trend of contemporary tech development and have the comparative high value of development and good market prospect. Meanwhile, these fields can adapt the present technical and economic development of China. The chosen high tech fields for development in China include six major fields. They are new materials, new energy, energy-saving and environment protection, biological technology, electronics and information, integrative machinery and electronic technology, other new high tech fields. Several most representative technical sub-fields have also been chosen for each technical field. These fields and their sub-fields are the guidance for Chinese new high tech innovation and development.

China's high-tech zone were established and developed in a special history and reality environment. They have grown not only on the basis of Chinese economy, science, technology, policy and social culture, but also in an international environment of globalization, decentralization and integration as well as high-tech competition. When China established its high-tech zone, taking its own essential economic and social factors and present international environment as the basis, it supports and promotes the development of high-tech zone all over the country through "three major pillars", namely new high-technology, infrastructure, and support policies.

Using the experience of Western country science parks for reference and integrating into the domestic situation, Chinese high-tech zone formed the following innovatory characteristics:

The management of enterprises operates in China's newly established market economic system. The construction of high-tech Development Zones is practiced using an overall plan and large regional exploitation. The legal position of development zones is examined and approved by government. The commercialization, industrialization and internationalization of new high-tech research achievements are guided by the regional "Torch Program". Government provides policy support for the construction and exploitation of Development Zones.

Regardless of their scale and ownership of the enterprises, they can all take the same rights to manage the enterprises independently. The Chinese government does not intervene operation activities, and only conducts macro-management. The principles of management are promoting the innovation of the enterprises, deepening the experiment of reform and open marketed, pushing the cooperation between domestic and international high tech enterprises and providing policy support and comprehensive service.

3) Present situation of high-tech zone

Since the establishment, China's high-tech zone had achieved rapid development, and gradually became the most important base for the development of China's high-tech industries. From 1991 to 1998, the total income of 52 national high-tech zone (excluding Yang Ling High-tech zone) increased from 8.73 billion Yuan to 483.9 billion Yuan, increased by 55.4 times, average growth rate during this period is 77.5%. Industrial gross production increased from 7.12 billion Yuan to 433.36 billion Yuan, increased 60.9 by times, average growth rate is 79.8%. Total tax increased from

1.19 billion Yuan to 47.7 billion Yuan, increased 40.1 times, average annual growth rate is 69.4%. The exports value increased from 180 million US dollars to 8.53 billion US dollars, increased by 47.4 times, average annual growth rate is 73.5%.

High-tech zone has also created a large amount of employment opportunities, in 1998 the employees in high-tech zone has reached 1.83 million. The average output value per person in 1998 is 240,000 Yuan, it is 4 time than the 51,000 Yuan in 1991, and it is much higher than the average productivity in China's industrial enterprises.

High-tech zone had fostered a large amount of high-tech enterprises with their own intellectual property right in the field of electronic information, modern communication, biomedicine and new material. These enterprises included the Legend Co., Stone Co., Founder Co., Shenzhen Huawei Co., Changsha Yuanda Co., Qingdao Haire Co., and Sichan Changhong Co., some pillar industries with superiority and special features had formed. Simultaneously, a large amount of small and medium sized high-tech enterprises with strong technology innovation capacity gained quick development in the high-tech zone. The number of high-tech enterprises whose total income exceed 100 million Yuan had increased from 7 of 1991 to 678 of 1998, the number of enterprises which exceed billion Yuan had increased from 0 to 68, among them there are 9 enterprises whose income exceed 5 billion Yuan.

High-tech zone had been played a more and more important role in the local economy. The industrial growth value accounted for a rather large of proportion in the that of the city in which the high-tech zone is located. For example, the proportion is: Suzhou 47%, Mianyang 36%, Zhongshan 22%, Harebin 21%, Changchun 16%, Beijing 16%, and Xian 15%.

The rapid growth of high-tech zone had created a solid basis for the three-tiers of strategic planning of China's high-tech industry development. The first tier is at present, 80-100 high-tech zone (including national and local) were established and get their initial well development. The second tier is about 10 of the high-tech development belts were formed, including the industry belt in Jiangsu Province along Changjiang River, Qilu industry belt in Shandong Province, Zhujiang Delta industry belt in Guangdong Province, etc.

4) Major problems and the policy trend

With the support of central and local government, high-tech zone had gained great achievement, accounted for a more and more large proportion of local economy. But there are some problems existing in high-tech zone:

- There is great unbalance in the high-tech zone development. Some local government can not fully recognize the importance of high-tech industry, no powerful measures were taken to promote the development of high-tech industry. It has influenced the development of whole country's high-tech zone.
- There is no obvious industrial characteristic in some high-tech zones, high-tech products were duplicate. The reason for this on one hand is that market management system is not well developed, and the same products can co-exist for a long time. On the other hand, affected by the old system, research projects were duplicate themselves, so the high-tech products relying on the high-tech science and technology achievement transfer will sure be duplicate. Thirdly, the industrial development in most of high-tech zones had not yet formed their pillar industry, which can cover the whole country, the Small and Medium-sized enterprises are in their inception.
- Science and technology enterprises incubator and other service providing institutions were well developed. But they are all in the separate running situation, capital investment, crediting guarantee and the investment of innovation incubating fund is in the stage of inception. The construction of capital market lack for policy support, and small and medium science and technology oriented enterprises is in the shortage of fund.

The policy measures of the Chinese government in the future to solve or mitigate these problems include the following.

- Establishing the venture investment system and encouraging the investment in high-tech zone from many channels, guiding the large and middle-sized enterprises enter into high-tech zone, join the construction of high-tech zone.
- Improving the market system of high-tech zone and realizing the connection with the international market. Creating a sound environment to inspire qualified personnel increase the innovation vigor of high-tech zone. Strengthening the legislation of high-tech zone and create a transparent legal system.
- Standardizing and unifying the support policies of high-tech zone to ensure the fair competition. Enlarging international cooperation in high-tech zone.

The construction of Chinese high-tech zone is an important strategic step towards the next century in economics development. It provides the opportunity for industrial

circles scientific and technological circles all over the world to play their abilities in the funds and talents.

10. Business incubator

1) Development of incubator

Business incubator (some times it was called high and new technology innovation center in China) is new kinds of social and economic organization. It provides the entrepreneurs with fine innovation environment and conditions, helps them to transfer the science and technology achievements into products as soon as possible and enter the market place. And helps the Small and Medium Enterprises (SME) rapidly grow up, and fosters the successful enterprises and entrepreneurs.

China's business incubator was formed and developed supported by the former State Science and Technology Commission (Today's Ministry of Science and Technology) and the local government. In June 1987, the first business incubator was established, which is the WuHan Donghu innovation center. Thereafter, the high and new tech incubator developed very quickly and gradually plays a very important role in the process of high and new technology industrialization and local economy development entered a rapid development period.

By the end of 1999, there were about 110 incubators (includes 37 national level of innovation centers). According to the statistic data, the incubators can provide enterprise with about 884,000 square meters of working place and about 240 million RMB Yuan of incubator fund, there are 4,340 enterprises under incubated, and 1,379 enterprises had been incubated and enter the market. There were about 7,000 science and technology achievements had been transferred. These enterprises employed more than 70,000 people, and the total income reached 6.1 billions Yuan RMB. [35]

The rapid growth of innovation centers or business incubators has brought much positive influence on China's scientific, economic and social development in that they help Chinese people break away the old mode of thought, inject new vitality into china's economy, grant a bigger role to intermediary agencies in innovative activities, create a congenial climate for enterprises and hammer out the innovative mechanism inside enterprises.

The rapid growth of incubator in China attributed to the following measures and policies: strategic emphasis on the development of small and medium-sized enterprises, participation of all sectors concerned especially government's effort,

emphasis on fine environment and management of service and emphasis on self-improvement of incubators.

With regard to measures for further development, China will deepen reform, accelerate speed in construction and development of incubators, and seek diversity and more subjects in development of universities and research institutes.

2) Category of incubators

After more than ten years of development, various kinds of science and technology oriented enterprises incubators had been formed in China. According to their characteristics, these incubators can be categorized as the following.

- Comprehensive science and technology enterprises incubators

This kind of incubator services for all of the high-tech zone, providing working places, facilities, service, training and consulting. Organizing innovation investment activities, promoting the effective combination of "Technology-Capital- Products" and "Institutes-Enterprises-Market", fostering and developing high-tech enterprises and entrepreneurs with flexible mechanism, strong innovation ability and fine development prospects.

- Specialized technology incubators

On the base of comprehensive science and technology enterprise incubators, some of the innovation centers gradually transferred into some kind of incubator servicing for some special technology domain. Integrating resource and energy in a special areas with their own advantages, which in favor of the development of incubated-enterprise for the marketalization and internationalization. Since 1996, some incubators that specialized in the enterprises for medicine and new material had been built in Beijing, specialized incubators for biological medicine had been built in Shanghai, special incubators for software had been built in Tianjin and Xian, and the specialized incubators for agriculture high and new technology had been built in Yangling, Shanxi province.

- University science and technology park

Relying on the intellectual resource, information resource, research and development condition of university, taking the advantage of preferential policy and perfect conditions in university, the university science and technology park promotes the commercialization of research achievements yielded by the university. Continuously convey the high-tech enterprise and high-tech products to the high-tech zone and the

society. And the university science and technology park had become another kind of effective way to promote the university's science and technology achievement transfer and enterprises incubating. By the end of 1998, under the co-support of Ministry of Science and Technology and Ministry of Education, there are more than 30 university's science park had been developed. Among these parks, the Software Park in Northeast University, Science Park in Peking University, the Science and Technology Park in Tsinghua University and the Science and Technology Park in Shanghai University had gained quick development. For example, since the foundation, the Science and Technology Park in Peking University and the Science and Technology Park in Qinghua University had greatly promoted the transfer of scientific and technological achievement. More than 100 high-tech enterprises had been incubated.

- Overseas scholar innovation park

Since carrying out the reform and open up policy, China had sent a large amount of young scholars to learn abroad. Till now, there are more than 300 thousands of people had been sent out to learn abroad, among them, more than 100 thousands of them had returned to China and work for the country. The overseas scholar innovation park was built based on the preferential policy, environment and conditions, to attract the overseas scholar coming back China to establish their enterprises. By the end of 1998, with the support of Ministry of Science and Technology, Ministry of Education, Ministry of Personnel of China, 25 overseas scholar innovation parks had been built in Suzhou, Beijing and Shanghai.

- International enterprises incubators

International enterprise incubator is the another kind of incubator which developed from comprehensive science and technology enterprise incubator. It provide the infrastructure and service environment with international level, through high quality of service, and broad working network and information with overseas, on one hand, to introduce the foreign Small and Medium Enterprises, research and development institutes and science and technology achievements, and help them to cooperate with China's enterprises to exploit the market. On the other hand, it provides service to the research and development institute of China's small and medium scientific and technological enterprises and large enterprise to enter international market. Recently, with the help of UNDP specialist, the Ministry of Science and Technology had approved the city of Beijing, Shanghai, Chongqing, Chengdu, Wuhan, Suzhou and Xian to build international enterprises incubators as the pilot incubators.

3) Experience and development direction of incubator

The experience of China's incubator shows that, high and new tech incubator had greatly promoted the transfer of science and technology, and greatly enhanced the capacity of high tech enterprises and high tech zone. There are some important factors supports the success of incubator:

- Local government had played an important role in the development of incubator. Local government greatly promoted the development of incubator through formulating preferential policies and increasing the investment. At present, the major capital of building incubator is come from the local government fund.

- The incubator had created a fine environment and condition for the science and technology achievement transfer and the enterprises development. At the mean time, the incubator provides incubating service such as the preferential policy, facilities, fund raising, personnel training, consulting and information network to decrease the risk of enterprises close down.

- Scientific and technological achievements transfer mechanism with the enterprise as the main body has been established, the technology and market were combined tightly, and enterprises were encouraged to develop technology and products with fine market prospect.

- Incubator has built close relationship with the market, technology, capital and talent, provided effective measures for solving the problem of disparity of economy and science and technology. Built up technological innovation mechanism with enterprise as the main body.

Following directions can be considered for further development of the China's incubator.

- Further playing the role of incubator in national economy growth and science and technology development.
- Building and developing the incubator social support system.
- Promoting the internationalization of incubator.

11. University Science and Technology Park

1) Development of university science and technology park

The emerging and development of university science and technology parks was the result of the system reform of science, technology and education of China, and it is the urgent demand of high-tech industry development. The objective of establishing university science and technology park is to take the advantages of high learning institutions, to promote the transfer of science and technology achievements, and strengthen the linkage between high learning institution and economy circle. [36]

In 1989, the first university park, Science and Technology Industrial Park of Northeast University was built in Northeast University, Sheng Yang city, Liaoning province. After ten years of development, the Science and Technology Park of Northeast University had get great success. In 1994, the gross production value of the Science and Technology Park of Northeast University was 150 million-Yuan, the profit was 17 million Yuan, exports was 700,000 US dollars, two major industries – computer software and industry automatization had been formed in the park.

Following the building up of Science and Technology Park in China's Northeast University, many other parks were built in many other universities like Harbin Industry University, Shanghai Industry University, Southeast University, Nanjing University, Chengdu Electronic University etc. Till now there are about 40 University Science and Technology Parks had been built in China, and many others are in the planing for building. University Park construction had gained great achievement. For example the Science and Technology industrial park in Tsinghua University has planned construction area more than 500,000 square meters, and more than 100,000 square meters of building had been built and put into use, providing sound environment for the development of high-tech enterprises. In 1998, the enterprise's total income in Peking University Science and Technology Park has exceeded 2 billions Yuan, the profit exceeded 100 million Yuan, created more than 4,000 employment chance.

2) Innovation mechanism

University Park combines the high-tech research and development, high-tech industry, technology trade and financial service together. The supporting objective of University Park is the transfer of science and technology achievement of local university and research institutes.

University Park's financial support to incubated enterprises includes share release right, share investment, loan or other proper manners.

University Park's management support to incubated enterprises includes that the Park takes part in the important decision-making for the development of enterprises. The Park can control whole process of important link of enterprise production activity. The Park using special assessment indicators to judge the difficult of enterprises encounter in their running. On the base of judgement, the Park can take measures to solve the problem. And when enterprises encounter difficulty, the Park can take a kind of special management pattern to actively intervene and improve the operation of enterprises.

Intermediary counseling for the enterprises. These services include that (1) Enterprises management and counseling, (2) Human resource or talent development, (3) Counseling and supporting for luring the investment. (4) Financial counseling, (5) Information advice and service, (6) Patent counseling, (7) Law counseling, (8) Auditing counseling, (9) International cooperation counseling.

Mechanism of capital quit. The capital investment of University Park to seed project mainly is the stock-right investment, so the capital quit manner is mainly the stock-right transfer. The objective of capital quit include two aspects, one is to call back the capital as soon as possible, to ensure the fine cycle of investment procedure. The second one is that to get investment profit, and therefore attract the coming of new investors, and expand the total capital of University Park.

Talent fostering and incentive measures. One aspects of it is to foster comprehensive management talent, organize some young managers to go abroad to the advanced foreign University Park to learn their management experience.

3) Problems in the development of University Parks

Although some achievement had been reached, there are still many problems in the development of University Science and Technology Parks.

- The relationship between University Science and Technology Park and High-tech zone.

University Park is a part of zone, and it is to some extent the dependencies of technology, talent of high-tech zone, is important impetus to the high-tech zone development. University science and technology parks can provide mature high-tech enterprises and products to high-tech zone. While high-tech zone should strengthen

the contact with University Science and Technology Park, carry out the preferential policy of high-tech zone to Science and Technology Park, provide overall guidance, support and service for University Science and Technology Parks. But sometimes, the relation between high-tech zone and university science and Technology Park is not so smooth, the role of University Park is limited.

- The quality of University Science and Technology Park needs to be improved.

Although many University Science and Technology Park had been built, the quality of them is not so high. The building and development of University Science and Technology Park need favorable environment and condition, such as the scale of local industry cluster, the strong research capacity of university.

- Incubating service of university with the science and technology achievements transfer.

Science and technology achievements transfer is a kind of comprehensive system engineering. Successful transfer needs many factors such as capital, financial, sales and law. Some of the university has no ability to provide these services. So the science and technology achievement transfer function of university parks was quite limited.

The development of University Park in China is just at the starting stage, there are a lots of work to do. The overall management had not yet be in the proper orbit. The management of University Park should be brought into the management of national high-tech zone, for University Park can fully take the advantage of policy, supporting system and infrastructure of high-tech zone.

Like the Japan case, Ministry of Science and Technology and the Ministry of Education should jointly formulate policies for examining and approving the establishment of University Park. And give some special policies to University Park for the smoothly transfer of science and technology achievements.

Part 5: Small and Medium Enterprises

1. Small and Medium Enterprises of Japan

Small and Medium Enterprises (SMEs) of Japan are defined by the Small and Medium Enterprise Basic law which was promulgated in 1963 and amended in 1973. As the mining & manufacturing and other industries with 300 or less employees, of 100 million JY or less, wholesale with 100 or less employees, of 30 million JY or less, Retail and service with 50 or less employees, or 10 million JY or less.[37]

While the Small Scale Enterprise was defined as the manufacturing and other industries with 20 or less employees, and commerce and service with 5 or less employees. Objective of small and medium enterprises policies are stipulated in the introduction and Article 1 of the Small and Medium Enterprise Basic Law.

As symbolized in their significant share not only in the number of enterprises but also in the amount of shipments and the number of employees, Japanese SMEs have played a very important role in every area of the economy and society of Japan. When viewing their importance in Japan's economy, statistics revealed that out of total of 6.53 million business establishments SMEs (excluding primary industries) accounted for 6.47 million with 99.1% share.

Their number of employees amounted to 42.27 million people, which was 76.5% of a total of 54.16 million (excluding primary industries). Regarding the market share held by SMEs by industry in 1991, they occupied 51.4% of total shipment in the manufacturing industry, 61.4% of the total sales amount in wholesale trade and 76.8% in retail sales.[38]

With the significant share of SMEs in the Japanese economy, the above ratios have not been greatly changed for about 30 years since the enforcement of the Small and Medium Enterprises Basic Law. This could be regarded as a proof for the fact that SMEs have continued to perform well, demonstrating their unique flexibility and creativity, even at the time of recession experienced by Japanese economy.

The Small and Medium Enterprise Basic Law recognize that SME play an important role in the Japanese Economy and it is necessary to encourage SMEs for well balanced growth and development of the nation's economy. Its objectives are to

promote the growth and development of SMEs, and to enhance economic and social well-being of entrepreneurs and employees of SMEs.[39]

For accomplishing the above objectives, the law describes the need to improve productivity and business conditions of SMEs by the means of rectifying the economic and social disadvantages SME face and supporting their self-help (1) rectifying the economic and social disadvantages SMEs face, and (2) supporting their self-help.

As regarding the implementation of SME policies, it is impossible for the central government (Small and Medium Enterprise Agency having about 200 officials) to implement directly policies for each of the 6.47 million SMEs in Japan. Therefor, the Small and Medium Enterprise Agency is to secure to facilitate the implementation of policies for SMEs through planning, coordination and budget preparation. The various policies are mainly implemented by local administrations, special corporations and SME organizations. For example, eight local bureaus of international trade and industry and 47 prefectures administrative offices, subsidized by the central government give management guidance and technical assistants to local SMEs.

Moreover, the Japan Small Business Corporation and other special organizations like governmental financing institutions implement training or support to SMEs through subsidies from the central government. Furthermore, various SME related organizations take different types of measures for SMEs with the assistance of the central government.

2. Evolvement of Japan's SME policies in relation to the country's economic development [40]

During the period of reconstruction of Japan from 1945 to 1954, the emphasis is improvement of basic tools for SMEs policies from finance, organization upgrading and management diagnosis and guidance. In 1948, the Small and Medium Enterprise Agency was established.

During the period of first stage of high growth from 1955 to 1962, the dual structure (Gaps between SMEs and large enterprises) was rectified. The SME policies was systematized and response for the structure of Division of Labor among Subcontracting enterprises. From 1963 to 1972, which is the second stage of high growth period, this is a period of modernization of SME upgrading policy. In 1963, the "Small and Medium Enterprises Basic Law" was established, the policies for

rectifying disadvantages were intensified. Measures for small-scale enterprises and for enriching equity capital were put forwarded. During this period, the "SME Modernization Promotion Law" was issued and the Small and Medium Business Investment and Consultation Co. Ltd. was built.

During the period of stable growth of Japan From 1973 to 1984, much effort was made on the knowledge intensification and enriching intangible managerial resource. Institute for Small Business Management and Technology, Small Business Information Center, Japan Small and Medium Enterprise Corporation and the SME Regional Information Center in District were built.

From 1985 to 1999, this is the period of transition of Japan. During this period, some policies were formed for structural change and industrial agglomeration. The "Law for Promotion of Creative Activities of Small and Medium Enterprises" and "The Law for Intensifying Management in SMEs" were established. In 1999, "Small and Medium Enterprise Basic law" was amended. The policy concept of the New Basic Law is changed to developing and growing a wide range of independent SMEs for greater economic vitality from the previous of rectify the gap between LE & SMEs in terms of productivity.

3. Focus and new development of Japan's small business policy [41]

1) Focus of small business policy of Japan government

In order to help Japanese economy to overcome the instability in the financial system and the slump in business conditions and to regain its natural strengths, the Japanese government will implement a comprehensive range of policies. The policies will support new start-ups and job creation, counter the credit crunch faced by SMEs, strengthen the infrastructure for "formative" industries, raise regional economic vitality. And encourage SMEs to be innovative in business and respond to changes in the business environment, and develop the environment to lay the foundations for growth in the 21st century, concretely:

- support for new start-ups and job creation

The Japanese government will provide support for programs that coordinate activities for introducing SMEs to other firms, research organizations, specialists and other external management resources, organize nationwide training and seminars for people intending to start up a new business, and distribute information on job offers. The government will also work with the authorities concerned to expand opportunities for

disbursements to small and medium-sized venture businesses by designing R&D subsides and the like as "earmarks" subside, etc.

- strengthening of the infrastructure for "formative" industries

Programs for internships in a broad range of fields, developing technical manuals, providing advisory support, and attracting and developing of human resources will be established to ensure the survival and development of the techniques and skills fundamental to "formative" industries, such as the manufacturing, casting and micro-processing industries.

- Support for the business innovation at SMEs

The Small and Medium Enterprise Modernization Promotion Law and Temporary Law concerning Measures for Smooth Adaptation to Structural Changes in Economy by Advancement of Specific Small and Medium Enterprises to New Fields, etc. will be progressively integrated, the Law on Supporting Business Innovation of Small and Medium Enterprises enacted, and other supportive measures to promote original and inventive business innovation by SMEs will be adopted, such as a system of cheap loans, tax breaks, special exemption for credit insurance, and subsidies.

2) New developments in small business policy

There are many new developments in small business policy for the support of enterpreneurialism and venture business, policies to reactivate local economies.

(1) Creation of environments conducive to growth for the entrepreneurs, ventures and small business that will create new markets and jobs to reactivate local economies.

Review of basic principles underlying small business policy, MITI says that Small business must be seen as a source of dynamism in the national economy. They will review the range of small business policy and install support for entrepreneurs and ventures as a new pillar of small business policy.

- On enhancement of venture support

Improved training for venture business personnel. MITI will provide a deeper pool of knowledgeable venture capitalists who nurture new industries and others who have specialized skills for the support of venture business. MITI will also create an environment conducive to the utilization of these personnel as required by venture business.

Facilitation of direct finance. It is vital that a wide range of financial products be provided as appropriate for assessed risks in order to create smoother supplies of funding as warranted by the stage of a company's development. In particular, there are some ventures that have only limited means of fund-raising because of the excessive dependence on indirect finance, which is biased towards physical collateral. MITI will therefore create an environment conducive to the use of direct finance in order to provide these firms with a wider range of fund-raising options.

Enhancement of indirect finance. As stated above, MITI will expand the ranging of financing available to venture business from the current predominance of indirect finance out to include direct finance. In indirect finance, MITI will improve the convenience of government loan programs so as to facilitate fund-raising according to the company's stage of development.

Tax incentive. MITI will abolish the tax on retained funds in order to enhance the net worth of venture business and encourage greater investment in facilities, research and development. MITI will in addition reduce inheritance taxes and other burdens so as to facilitate the continuation of businesses. To assist venture companies in attracting personnel, and will enhance the stock option systems and make corresponding enhancements in the tax code.

Promotion of technology development and commercialization. R&D oriented ventures suffer from several impediments: the risks inherent in technology development, the difficulty of securing funding, and the limited personnel, information and other managerial resource available. The MITI will develop an integrated support system to assist companies throughout the entire process of technology development and on into commercialization.

- On enhancement of support for entrepreneurs

The MITI will create an environment that is more conducive to entrepreneurialism by making use of local platforms (general support systems from research and development through commercialization as defined under the New Business Creation Promotion Law) and, in light of the lack of collateral and credit among most prospective entrepreneurs and soon to be entrepreneurs, making greater use of union, voluntary groups, and other joint organizations. By doing so, the MITI will seek improvements in Japan's start-up rates and more job opportunities for all members of society, including women and the elderly. From the perspective of supporting start-

ups, the MITI will also promote the spread of franchises and other chain systems already used to a great extend in the distribution service industry.

(2) Support for business reform at the small business that provide energy and vitality for local economies, programs to revitalize local economies.

- Support for managerial reforms at smaller business and enhancement of competitive conditions.

Support for managerial reforms. The MITI will support efforts by individual small business to engage in aggressive business activities and unflagging managerial reform. Examples of areas to be supported include the development and supply of new products and services, the installation of new production methods and efficient order management systems, and the development and introduction of new methods of selling products.

Facilitation of access to managerial resource. The MITI will utilize market functions and private sector energy to provide support for small business endeavoring to enhance and reinforce their access to management expertise, technology, information and other "soft" managerial resource. The MITI will also support ties among small business with mutually complementary managerial resource.

Opportunities for market entrance, more appropriate transaction patterns. The MITI will abolish the commerce and industry union cartels by which the government intervenes directly in the markets so as to provide small business with opportunities for market access. The MITI will create an environment conducive to improvement in rules, system, and private trading practices that impede the business activities of small business or place excessive burdens on them.

Creation of safety nets against drastic changes in the business environment. The MITI will create appropriate safety nets to mitigate the impact of changes in the business environment, thereby enabling managers to adapt to changes and have second chances of achieving their goals. The MITI will provide necessary and sufficient additional funding for about 20 trillion guarantee facility of the Small Business Financial Stabilization Special Guarantee Fund that is scheduled to terminate at the end of fiscal 1999, thereby preparing for changes in and making appropriate enhancement to the small business financial environment in fiscal 2000.

- Support for programs to encourage new start-ups and ventures in local communities.

The MITI will develop programs for high-potential regions that provide appropriate mixes of "soft" supports (funding, personnel, technology) and "hard" supports (incubators etc.) so as to reinforce the local platforms administered under the New Business Creation Law passed in 1999. The overriding purposes in this will be to improve eases to start-up support programs, improve efficiency by consolidating programs, and encourage local-led efforts. The MITI will also create a nationwide network to supplement the efforts of local governments, and will create an environment that encourage competition among the programs offered by local governments.

- Reenergizing "main streets".

"Main streets" have an important role to play as the place where "people, goods and information" come together and interact in the local community. They are also the breeding ground for new goods and services. The MITI will endeavor to create demand, encourage investment, and create new industries from the synergy obtained by enhancements and links among the many "soft" and "hard" program available.

- Reenergizing local industrial concentrations.

The MITI will move steadily forward with programs to encourage the concentration of small business in the industrial concentrations, "company towns", and "industrial belts" that provide the basic technologies underpinning manufacturing.

- Reenergizing technology development with ties among local industrialists, scholars and government officials.

The MITI will create technology development programs led by public institutes and provide stronger support for research and development by industry/academia/government consortia so as to reenergize technology development in local communities through ties between industrialists, scholars, and government officials. The MITI will also develop ties among local platforms to facilitate the commercialization of research and development results.

4. Future directions of Japan's Small and Medium Enterprises Policy [42]

The Small and Medium Enterprises Policy Making Council put forward the recommendation for the development of small and medium enterprises of Japan, which gives the future direction of Japan's Small and Medium Enterprises policy.

1) Supporting bootstrap efforts for business innovation and start-ups

- Promoting business innovation

Traditional policies centered on facility modernization through the various industry cooperatives are proving less effective today. Instead, multifaceted support, including that to inter-industry networks, is needed to facilitate business innovation for the independent specialization that so many SMEs are working for.

From support for new equipment to support for coping with a diversity of management issues, e.g., research and development and human resources development. As for organizational intermediaries, from industry cooperative to the diverse range of voluntary groups and other network organizations that have sprung up to meet new needs, as well as individual SMEs. And the financing support system for structural upgrading. From the pursuit of economies of scale as in collective operations to support for individual SMEs in their business innovation.

- Support for ventures

Making effort to facilitate an environment conducive to the emergence of ventures commercializing original technological insights or developing new business forms and models, and to support these start-ups' bootstrap efforts. Including providing risk capital, while the capital market has to be improved, including reforming and revitalizing OTC markets and creating a better market for privately held shares. And the effort have to be made to broaden the pool of available capital, including making more use of limited liability investment partnerships and creating tax preference for private investors. And enhancing the ventures support infrastructure and promoting technological development and commercialization. Here the effort must be made to enhance the small Business Innovation Research (SBIR) program and to facilitate technology transfer.

- Promoting start-ups

The present Basic Law says nothing about start-ups. Yet it is essential that policy resources be allocated toward the creation of a climate conducive to new business start-ups. This is an important SME policy focus. Including facilitating the supply of start-up capital, improving the start-up infrastructure and fostering the entrepreneurial spirit and improving the entrepreneurial climate.

- Business innovation in the commercial and service sectors

It is important to support business innovation in the commercial and service sectors consistent with the special features that characterize these sectors. Looking especially at the small retail sector, and given the fact that small retail operations are typically part of larger integrated organizations, policies should be considered that encourage

restructuring within these organizations and the emergence of new organizational structures. It includes shifting the emphasis to support for competitive commercial districts. While study needs to be given to policies for restructuring commercial districts organizational strength as part of the effort to promote evolutionary change in commercial districts and investment in commercial districts. And the emphasis has to be on supporting independent initiatives by local communities, such as those to revive their city centers. It also includes support for individual retailers and support for innovation in the wholesale sector, including retail support for closer integration among manufacturing, distribution and retailing.

2) Creating a more competition-conducive climate

- Facilitating capital procurement and enhancing equity capital.

Public financing system should be strengthened, even as they remain inherently complementary to private-sector financing, to respond to the diverse capital requirements of start-ups and business innovation and to enhance their safety-net functions. At the same time, the climate needs to be improved to facilitate access to direct financing, including facilitating bond issues and other tools in line with the diversification of capital procurement means. Including public financing, there is a need to move away from collateral-secured lending and to put more emphasis on technology, commercial feasibility, and other non-financial factors in considering loan applications, as well as to devising more flexible systems in terms of interest rates, interest-payment grace period, and the like. There is also a need to move away from qualitative complementation systems and deal with systemic risk, as well as putting greater emphasis on safety-net aspects. There is a need to move from indirect financing to promoting the issuance of corporate bonds, including making greater use of credit guarantees, and to improving the data accumulation as it relates to risk assessment.

- Enhancing intangible management resources

The government should scale back its "guidance" role and shift to support for market mechanisms and private-sector initiatives so as to promote the enhancement and strengthening of intangible management resource such as managerial expertise, technology and the information needed for restructuring and start-ups. Include restructuring support policy implementation. For national, there is a need to place more emphasis on formulating basic policies, indicating a menu of options and conducting model programs and wide area programs. For prefecture, the prefectures should select from among the options on the national government menu and then

implement these policies on their own. At the same time, they should strengthen their core support organizations for one-stop service.

- Promoting linkages for cross-complementation of managerial resource

Sharing of SME management resources should be encouraged through such diverse organizational patterns as joint subsidiaries, trade association, networks, and other loose linkage among corporations on a voluntary basis. Seeking to offer the possibility for flexible restructuring, the cooperative structure should be promoted and made more flexible with the addition of a growth perspective.

- Enhancing human resources

As well as enhancing the labor markets, easing labor mobility, and effecting other improvements in the labor environment, enhancing human resources also requires a greater effort on personnel training and development. Include improving the labor market climate, strengthening human resource development.

- Leveling the playing field and ensuring the SMEs have a fair chance at contracts.

Commercial and industrial cooperative cartels and other administrative intervention in the market should be dramatically scaled back and eliminated. At the same time, consideration needs to be given to strengthened measures to ensure that trading is fair and orderly and that SMEs have a fair chance even after market deregulation. Includes fair trading, ensuring a fair chance at national government and other contracts.

3) Providing the necessary safety net

While corporate risk management is fundamental, it is important to promote responses to the sudden changes with emergency shelter policies in the event of abrupt changes in the business climate or other externalities and to implement systems giving people a second chance if their entrepreneurial dreams do not work out the first time.

- Short-term emergency shelter in the case of abrupt changes in the business climate. Financial support policies in case of credit crunch. Measures such as those to strengthen management foundations.

- Risk insurance systems (including mutual relief system for small-scale enterprises safety nets, mutual relief system for the bankruptcy prevention of SMEs, and overseas investment insurance for global operations).

- Improving the legal provisions relating to bankruptcy law (simplifying and streamlining corporate reorganization procedures to make them easier to use and to make it easier for people to get a second chance).

4) Policy implementation

- Enhanced policy assessment and improved advantages

Policy assessment methodologies will be devised and adopted with all due haste. The beneficiary-pay principle should be applied as appropriate (in the expectation that having the people who draw on the policies evaluate them and select the best ones will ultimately lead to better service). Measure will be bundled and procedures simplified.

- Strengthening SME associations

Making effort to promote healthy competition among SME associations and to raise the quality of support managers by budgeting by function. And consideration should be given to encouraging societies of commerce and industry to merge and consolidate and to take broader regional perspectives. The federations of Small Business Associations should become more specialized as network facilitators.

- Balanced decentralization (the role of local government organization)

Local governments should move away from just implementing local versions of policies implemented by the national government and should take the lead in choosing from the national government's policy menu to develop those measures that are best suited to local conditions.

5. Japan Finance Corporation for Small Business (JFS)[43]

Japan Finance Corporation for Small Business (JFS) is a government financial institution whose capital is wholly subscribed by the government and specialized in small business. Based on the government's small business policy, JFS provide funds to help the growth and development of small business while supplementing private financial institution.

The main source of JFS funds is not taxes. JFS procures funds through borrowing from the government and issuing government-underwritten and government-guaranteed bonds under the fiscal investment and loan program financed by postal saving, public pension funds and other source. These funds must absolutely be redeemed with interest and the JFS therefore charge interest for their loans even

though JFS is a non-profit governmental organization, and ask for cooperation in loan evaluation and credit analysis.

The small business sector, which accounts for approximately 99% of all companies and 78% of all employees, constitutes an important and indispensable part of the Japanese economy. In the run-up to the 21st century, great hopes are being placed on the ability of small business to revitalize the economy creating new industries, products and service. However, the ability of small business to raise funds is in general more limited than that of large firms, for example, they have difficulty raising funds from capital markets. Therefore, government financial institutions such as JFS have been established to supplement private financial institutions, and to promote the stable growth and development of small business.

As regards to the merits of obtaining funds from JFS, firstly, JFS provides long-term (up to 20 years), fix rate, low interest (equivalent to long-term prime rate or lower) stable financing which is difficult to obtain from private financial institutions. Secondly, even after lending, JFS provides small business in an individual customized manner, with effective and useful information which is based on analytical know-how, accumulated over the years and based on a customer database of 50,000 companies nationwide. Adopting a fair, impartial and long-term viewpoint JFS offers funds and information on how to make optimal use of the funds, in order to support the growth and development of small business.

JFS provides a variety of "funds for business" such as facility funds for entering new fields, dealing with environmental problems, overseas investment, and operating funds with preferable long-term conditions. Furthermore, JFS responds rapidly by providing emergency loans and loans for disaster recovery to small business suffering from the effects of changes in the economic and financial environment, or damages caused by natural disaster.

To obtain JFS loans, the eligibility depends on past business performance, forecasts on future business performance, business trends, the evaluation on the applicants business plan, etc. Financing is not necessarily denied to the companies only because applicants are temporarily operating at a loss is there is a prospect of future recovery in business performance. Since the long-term supply of funds is involved, collateral and guarantor are necessary. However, in the case of Special-purpose Loans such as Loans that Foster New Business with High Growth Potential for venture businesses,

etc., funds are provided even when collateral is partially insufficient in consideration of the future potential.

Funding by the JFS targets a wide range of business such as manufacturers, wholesalers, retailers and service industries. Eligible business should have capital equal or lower than 300 million or 300 or fewer employees in the case of manufacturers, capital equal or lower than 100 million or 100 or fewer employees in the case of wholesalers, capital equal or lower than 50 million or 50 or fewer employees in the case of retailers, capital equal or lower than 50 million or 100 or fewer employees in the case of service industries. Sole-proprietor business that have a need for "funds for business" are also eligible for funding.

JFS develops a variety of loan facilities to meet the needs of small business in accordance with Government small business policy. On the threshold of the 21st century, the Japanese economy faces structural changes caused by the development of the globalization of economic activities and the progress of deregulation. JFS actively supports companies that tackle these changes positively, and those that are striving to develop new businesses and business innovations with their unique technology and know-how. In November 1997, in response to government economic policy, "Small Business Consultation Desks" were opened in all JFS office nationwide. Also after fiscal 1998, JFS has been offering a variety of special emergency loans based on government economic policy. JFS is striving to provide an even higher level of support to small businesses facing difficulties in handling the rapid changes in the financial environment.

One of the obvious characteristics of JFS is the supporting and nurturing Small Business comprehensively and continuously, and providing effective and useful information through enough dialogue with clients. In the process of loan arrangements and other service, JFS conducts management analysis by making use of small business data and analytical know-how accumulated over the years as specialized financial organization for small business, and provide as much feedback as possible to its clients.

While engaging in discussions with managers and providing them with appropriate advice on management problems facing the applicant's company, in order to maximize the effectiveness of funds, JFS also strives to continuously provide effective and useful information for the development of small business in an individual, customized manner, even after the lending. In order to help small business

grow by solving their diverse problems one by one in a systematic way, JFS has built its own business support system, called "RIP System", based on a database containing information on a approximately 50,000 small business clients. In September 1998 JFS was the first financial organization in Japan to obtain ISO9001 certification on information services at all its offices.

Small Business that demonstrate entrepreneurial spirit, and show originality in new businesses and business innovation, play a very important role in the revitalization of the Japanese economy which is bracing for a major change.

However, since in general many of these business are in the early stages and their business potential is difficult to assess with insufficient collateral, they face difficulties in securing loans from private financial institution. JFS actively responds to this situation by using the analytical know-how accumulated over the years and the valuable experience obtained in solving the management problems of applicant small business. With a sure eye for small business, JFS assesses the feasibility of new business, and even in cases where collateral is not sufficient, taking into consideration the business potential, it provides funds by making loans with collateral exceptions, or by accepting non-collateral warrant-bearing bonds.

Even after providing funds, JFS headquarters and branches harmoniously assist business development, such as providing new business with advice and information for the solution of diverse management problems.

In February 2000, JFS established loans that foster new business with high growth potential to help small businesses undertaking new businesses with high growth potential such as: venture companies, one of the pillars of the government's new small business policy, within the framework of assisting venture companies.

The main feature of this special type of financing are that it makes exemptions for some collateral requirements, and when collateral is not sufficient even with these exemptions, JFS is able to provide funds to companies with insufficient collateral by accepting the company's newly issued warrant-bearing bonds.[44]

At the same time it established this program, JFS also set up an "Office for Fostering New Business" at headquarters to promote this program and strengthen support services for small businesses undertaking new ventures.

6. Small and Medium Enterprises of China

In China, the Small and Medium Enterprises also play a very important role, the number of Small and Medium Enterprises in 1998 was more than 10 millions, account for 99% of the total establishments of enterprises. The number of employees of SME amounted for around 75% of the total (excluding primary industries), and it accounted for more than 80% of new created employment chance.[45]

Generally speaking, in China the SMEs refer to the enterprises which excepting state-owned large enterprises, it compose of the Villages and Towns Enterprises (VTEs), foreign capital and joint-capital enterprises, and the non-governmental S&T oriented enterprises.

VTEs are the enterprises that established in the rural area of China after the reform and open up policy was carried out. Most of Villages and Towns enterprises are SMEs. The characters of them are the scale was comparatively small and technology level is low, but the number is huge.

Most of the independent foreign capital and joint-capital enterprises are SMEs, in 1996, the total number of foreign capital and joint-capital enterprises reached 43,412. Comparatively, the technology level and management level is much higher, and it is one of the main factors to bring forth the improvement of efficiency of SMEs.

Non-governmental S&T oriented enterprises are a new parts of SMEs, in 1996, the number of non-governmental S&T oriented enterprises is more than 100,000, with more than 2 millions employees. At present more than 70% of the enterprises in national and provincial high-tech zones are non-governmental S&T oriented enterprises.

Compared with Japan's SMEs development and policies, the development of China's SMEs are facing some problems. One of them is lack for special law for SMEs. For a long time, there was no law or regulation concerning the SMEs of China was formulated to support the development and protect the legal right and interest of SMEs.

The second one was that there was no systemic supporting policies for the development of SMEs. In China, the economic policies were formulated according to the type of ownership and industrial characters, rather than the different behavior

characters of the different enterprises. For the sake of history, many economic policies were much more favor to the large enterprises. Only a little of economic policy issues in favor of the SMEs. Even though there are some policies especially for the SMEs, the SMEs do not know how to make the full use of them.

Lacking of a comprehensive administrative agency for the SMEs. The overall management to the SMEs is much separated. Though recently the Bureau of SMEs in the State Economy and Trade Commission specialized in the overall management of SMEs in China has been built, but how to play the role of it is the most important.

The society support system for the SMEs had not been built up, most of the intermediary agency was in government sectors. Underdevelopment of society support system had seriously constrained the development of China's SMEs.

Another serious problem for the development of SMEs is the shortage of fund. The inherent character of little scales, weak strength and low credit degree of SMEs make it very difficult to get financial support. Under the new situation of China that national professional bank transfer to the commercial bank and strengthening financial risk prevention, it is more difficult for SMEs to directly enter financial market. On the other hand, financial support from government was also quite insufficient.

In China, one kind of very important SMEs is the non-government-run science and technology oriented SMEs (S&T oriented SMEs). The characteristics of S&T oriented SMEs include comparatively small investment requirement, fast start-up, flexible decision-making mechanism, low management cost, adaptability to market diversity, and especially the unmatchable superiority of innovation mechanism and innovation effectiveness. S&T oriented SMEs is not only an effective catalyst for the transformation of scientific research achievement and realization of technology innovation but also an important source for the national economy growth. It has shown in recent years that in terms of quantity and quality, S&T oriented SMEs has become an important component and new growth point of national economy. According to the statistic data, in recent years most of the economic indicators of S&T oriented SMEs increased at the speed of 30-60% annually. In 1998, the number of S&T oriented SMEs has exceed 70,000, employees more than 3.3 million, total income exceed 600 billion Yuan.

7. China's Small and Medium Enterprises Policy [46]

Based on the basic situation of China's SMEs, the policy implication for promoting the development of China's SMEs can be described as the following.

1) Perfecting the overall administrative agency for SMEs

One overall administrative agency is very important for the development of China's SMEs. In China, the administrative agency, especially the Small and Medium Bureau in the State Economy and Trade Commission, and fully play the role of it, overall coordinate the service and guidance of every level of government to the SMEs. The government should provide the following service to the SMEs: a) Collecting the market information, management technology information, production technology information and policy information, which the SMEs urgently need, b) Providing SMEs with the training of operating strategy, enterprises management, market development, accounting technique and law. c) Organizing experts volunteers to diagnose the problem of SMEs, and help them to find out any problems in operating and put forward the improving advice. d) Building up the linkage between enterprises and research institutes.

2) Strengthening the financial support to SMEs.

Although the government and bank had taken some measures for the financing issues for SMEs, but the financial difficulty of SMEs had not yet been settled. So the following measures can be taken. a) Supporting the development of small and medium financial institutes, encouraging them to develop the loaning business to the SMEs. b) Encourage every level of government to build up commercial-operated investment foundation. c) Standardizing the guarantee institutes for SMEs and improving their working efficiency. d) Trying to establish non-governmental venture investment. And to perfect the loan management system, in accordance with the characteristic of SMEs, perfect the loan evaluation and approve system, actively support the development of science and technology oriented SMEs, promote the technology advance of SMEs.

3) Establishing and perfecting the law and policies system for the development of SMEs.

For example the "Law on Development of SMEs" should be formulated on the basis of existing "Enterprises Law". Laws such as the law or provision on science and technology progress of SMEs, and the law or provision on employment of SMEs. This kind of law will play a very important role in the development of China's SMEs. On the other hand, abolish and revise the policy and regulation items, eliminate the

policy restriction to SMEs, to create a conducive social and economic environment for the start up of SMEs,

4) Select the special group of SMEs to be emphatically supported.

There are many types of SMEs in China, they play quite different roles in the economy development and society and economic development, so some of them must be given special priority to be supported. From the function and roles of the SMEs in China's economy, following three kinds of SMEs should be supported with emphasis. (1) high-tech oriented SMEs, this is very important at present situation, for almost all the industrial countries in the world support their high-tech SMEs as a basic policy. (2) The SMEs that were created by the unemployed peoples. Especially support this kind of SMEs can ensure the employees in which do not be unemployed again. (3) The SMEs which was created by community. For this kind of SMEs can provide more jobs and much important for the stable and convenient of social community.

5) Encourage the SMEs to build cooperating economic network relations with the large enterprises.

Forming the close cooperate relations with large enterprises is very important for SMEs, it can take the advantages both of the large enterprises and SME, and the SMEs can be the subcontractors of the large enterprises. Thus to avoid the duplicate of building and manufacturing of large enterprise and SMEs, to make them concentrate most of their resource to R&D and their predominance products. Encourage the SMEs and large enterprises to build cross-region economic cooperation relations, break the region limitation and realize the rational cross-region resource allocation.

6) Encourage and help the SMEs to build various kinds of association organization.

Through it the SMEs can form a united community, to prevent and resist the risk of market and finance. And avoid the over competition to protect the SMEs's interest. At the same time, through it the SMEs can exchange and share the information, technology and the experience, which is crucial for the development of SMEs.

7) Build up a social service system for the SMEs which can provide technology, management, law, policy and market information.

Through consultation, training, information providing and exchange, hold exhibitions to provide the service that the SMEs needed. And the science and technology circles, education circles and engineering circles all can provide their service for SMEs.

8. China's Small and Medium Enterprises Innovation Fund

For most SMEs, especially the S&T intensive SMEs in China, one of the biggest difficulty is the lack of fund, this makes many S&T oriented SMEs in their inception period of initiation can not rapidly commercialize many suitable science and technology achievements. And some other S&T oriented SMEs which eager to expand their industries miss the market chance because they can not get the bank loan due to lacking of tangible capital as mortgage. It is said that in whole the country, only 5-8% of the S&T oriented SMEs can get the bank loan, and most of these S&T oriented SMEs had been developed in a quite scale. Therefore combining the current situation of S&T oriented SMEs development and the capital market in China, the establishment of China's Small and Medium Enterprises Innovation Fund (CSIF) had been approved. The fund mainly subscribed by the government, as an important measure to promote the constant and stable development of China's economy.

1) The characters of CSIF [47]

The Fund is a government special fund, it was set up upon the approval of the State Council to support technology innovation. Through appropriation, low interest loan and investment etc, the Fund aimed at supporting and encouraging technology innovation activities of S&T oriented SMEs, facilitating transformation of scientific research achievement, fostering passel of S&T oriented SMEs with Chinese characteristics and expediting the industrialization of high and new technology industry. The Fund will play an active role in optimizing the industry and products structure, expanding domestic market demand, creating new jobs and promoting the healthy, stable and rapid development of national economy.

As a special government fund, the CSIF is different from the ordinary fund, either from commercial venture investment. It was managed and operated according to the rule of market economy to support S&T oriented SMEs with several kinds of ownership.

- The Fund was built by central government, it do not take the making profit as its purpose, but through supporting the development of S&T oriented SMEs, contribute to the national economic structure adjustment and growth, and creating new jobs as the return.
- The Fund is a kind of policy venture fund, through supporting the transfer of high-tech results, encourage and guide S&T oriented SMEs to take part in technology innovation, to promote the combining of economy and technology, accelerate the development of high-tech industry.

- The Fund is a kind of guiding fund, through providing fund to S&T oriented SMEs, to lure effectively investment from local governments, enterprises, venture capital firms and financial institution. Promote gradually the establishment of investment mechanism for high and new technology industrialization conforming to objective laws of market economy; further optimize technology investment resources and build up an environment conductive to innovation and development of S&T oriented SMEs.
- The use and management of CSIF must abide by the state laws concerned, administrative regulations, financial rules. The principle is: honest application, fair judgement, scientific management, first support to the excellent choice, public and transparent, and the special fund for special purpose.

2) Goal, supporting emphasis and the object of the Fund

The goal of the Fund in recent years is that through first batch of fund, about 1 billion RMB Yuan to support and guide the industrialization project of 1,000 S&T oriented SMEs. Within three years, increase industrial production more than 10 billion Yuan, provide 100 thousands of employment opportunities, and bring forth the development of corresponding industry. At the meantime, foster a large number of sciences and technology oriented enterprises groups.

The Fund mainly support the S&T oriented SMEs projects which is in their industrialization inceptive stage with high technology content, great market potential and high risk, which is urgently need government supports. While promoting S&T achievement transfer and foster S&T oriented SMEs, to promote the establishment of new investment mechanism, conforms the market economy principle and supporting the technology innovation of S&T oriented SMEs.

The technology field of the Fund emphatically support include electronic information, biomedicine, new material, resource and environment protection, new energy and high efficiency energy saving.

At the beginning of the Fund's establishment in 1999, the emphasis of the Fund focus on three aspects, the first one is to support a batch of innovative industrialization projects with strong competitiveness, to accelerate the forming of new economic growth points. The second is to actively promote the transfer of science and technology results. Encourage the combination of research institutes and enterprises, encourage the research institutes transformed into enterprises, and encourage the researchers to startup S&T oriented SMEs with their own research results, to improve

the sustained innovation capability of S&T oriented SMEs. The third one is to lure the investment to the technology innovation of S&T oriented SMEs, easing the difficulty for getting finance support, to bring along and promote the establishment of financing and investment system for S&T oriented SMEs which in accordance with market economy rule and serves for the technology innovation of S&T oriented SMEs.

According to the strategy of science and technology development and the industrial policy, in 1999 the Fund emphatically support the following projects:

- High and new technology products with own intellectual property right, high technology content and fine market prospects, such as software, communication technology, digital electronic products, bio-medicine, high efficient agriculture and environment protection.
- Science and technology results transfer, especially the industrialization of the achievements of "863" Program, and "Tackle Key" Program's.
- The joint project between industries, universities, and research institutes.
- The re-constructing project of traditional industry using high-tech especially the information technology and the development of information service.
- The high and new technology products that benefit for the developing of export markets.
- And some other projects.

3) Supporting manner

According to the different characteristic of S&T oriented SMEs and projects, the support of Fund can be divided into three different manners, include funding, low interest loan, and capital investment. The fund is mainly used to support the researchers who taking their own research results to startup S&T oriented small enterprises as the startup capital, and the subsidy to S&T oriented SMEs for innovative product research, development and test. The low interest loan is mainly used to S&T oriented SMEs's innovation projects which have had certain scale and technology level, taking the low interest to support and encourage them to use the commercial bank's loan, and expand their production and improve products competitiveness as soon as possible. The capital investment mainly used to the newly start up industrial projects that have high starting point, larger innovative content, high innovative level and large market demand, and to guide the direction of capital investment from enterprises and bank.

From the establishment of the Fund to January 2000, there were 3329 projects applied for fund support, the total amount of application is 4.5 billion RMB Yuan. Among

these projects, there were 1090 projects got fund support, average fund amount is 750,000 Yuan RMB per project.

Part 6. Case Study

Case I. Zhongguancun China

1. Overview and the innovation network in Zhongguancun area

Today in China, the name of Zhongguancun had become very familiar to many people, it was called the "Silicon Valley of China". In this region, there are 73 universities include the most famous Tsinghua University and Beijing University of China, there are 232 research and development institutes, and more than 4,000 high and new technology firms. So Zhongguancun is one of the most famous intelligence intensive, technology intensive region in China. [48]

Nowadays, a new batch of strong new high-tech conglomerates, represented by Legend Co., Founder Co., and Stone Co., has been gradually formed in Zhongguancun area. They closely follow international standards and start to be a strong force in international market through innovation in capital, technology, information and management. Now, enterprises whose gross industry output value exceed billions in Zhongguancun area numbered 40, with tax turnover exceed millions numbers 38, more than 10 enterprises had been named as municipal or national engineering technology centers, more than 18 enterprises have successfully gone public and ranked in the "national first 100 high-tech enterprises", 71 products with self-owned intellectual property right entered the top three in China market share.

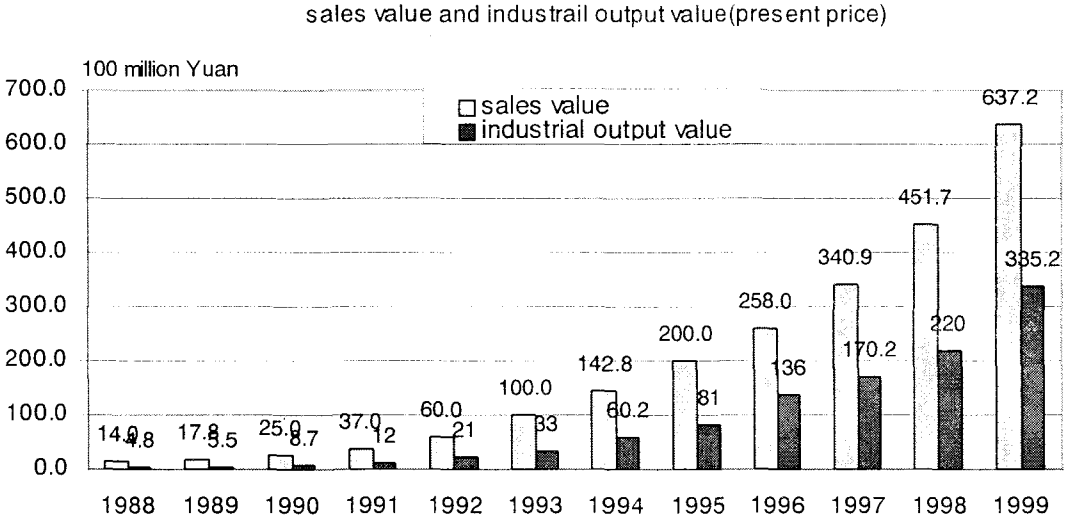


Fig.6-1 Sales and industrial output value of Zhongguancun

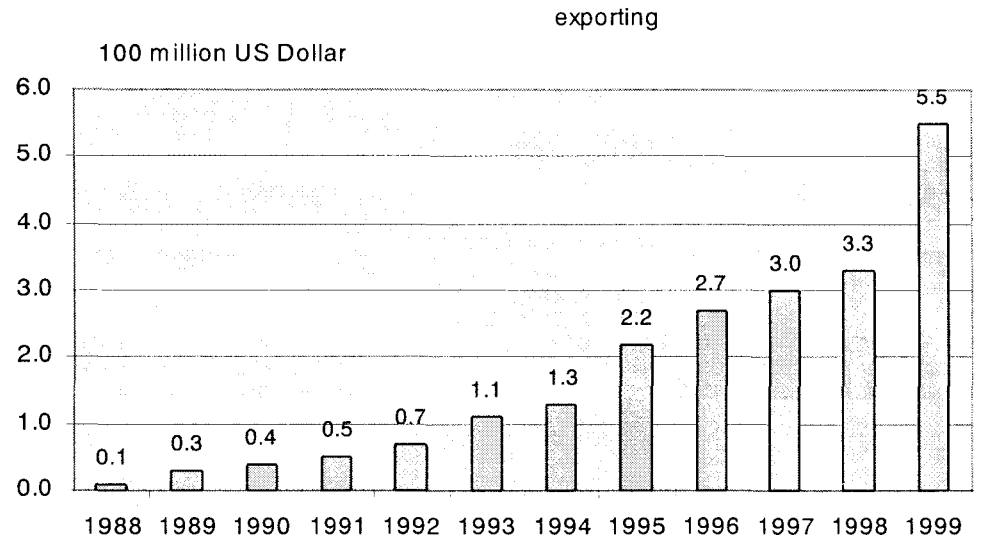


Fig.6-2 The Exporting value of Zhongguancun

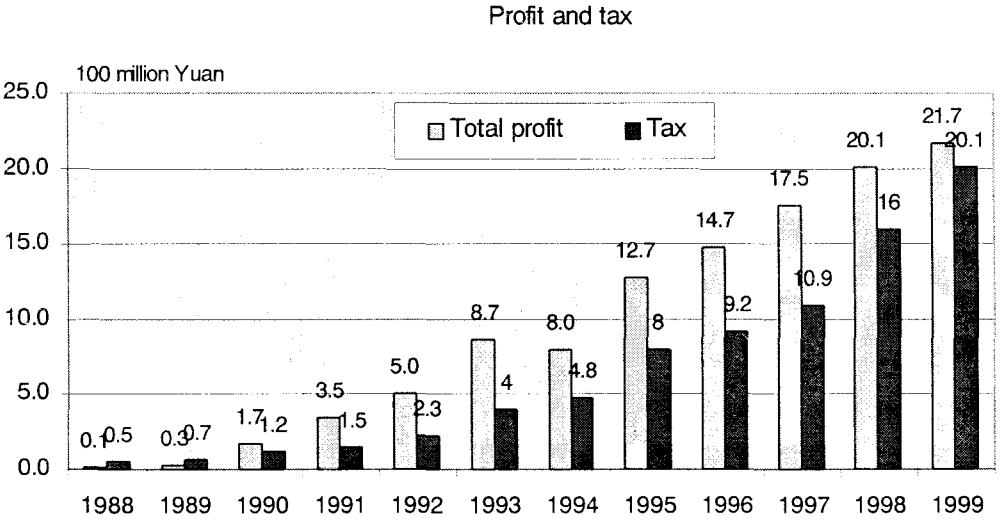


Fig.6-3 Profit and tax of Zhongguancun

Followed the development of the system reform of China's economy, science, technology and the education, in 1988, the first national high-tech development zone was built in Zhongguancun Beijing. After more than 10 years of development, it had become the new economic increasing point and the radioactive source, the high and new technology firms in this region reached more 4000. [49]

Behind the achievements, there is a vigorous innovation network supported the development, which was make up of the high and new technology firms, research institutions, universities, and the governments. Studying this innovation network, it can be analyzed from three perspectives, namely the participants, the resource and the activity of the network. Through network studying, it can be more clearly analyze the innovation activity in this region.

According to the different role in innovation activities, the participants in Zhongguancun regional innovation network can be divided into four groups: research institutes, universities, enterprises and government. Due to the different organization characteristics of these four groups of participants, their roles played in the network are different.

Research institutes refers to the national public scientific research and development institutes, such as the China Academy of Science, and the institutes that affiliated to the central or local governments, such as the Science Research Institute of Railway and the Research Institutes of Solar Energy Technology.

Universities refer to those that were directly related to appliance science and technology such as the Tsinghua University, Peking University, Beijing Science and Technology University etc. At the meantime it also includes the long, medium or short-term of training and education organizations related to science and technology human resource improving.

Enterprises include those of high tech firms in the region, which undertaken research and development, or the trade related to high technology. Government refers to the special regional government in Zhongguancun - Beijing experimental zone government.

The structure of Zhongguancun innovation network was formed from special historical and regional conditions. Under the traditional planning economic system, the deployment of science, technology, education and industry are separated. In establishment of science and technology institutes, the system of former Soviet Union was adopted, built up the science and technology research organization which independent from industries. So, under this system, a large amount of science and technology research institutes were built in the Zhongguancun area. But the industrial potential in this area is very weak. Since 1978, after the carrying out of reform and opening policies of China, a new technology enterprise cluster emerged taking high

and new technology achievement transfer as the main objective. Due to the emerging of this enterprise cluster, the "New Technology Industry Development Experimental Zone" was built. So the participants of Zhongguancun innovation system are comprised of the universities and research institutes which were established under the planning economy system and new technology enterprises and government that were established under the transferring economy.

The basis of Zhongguancun innovation network's exist is the intensive concentration of science and technology resource in this region and the intensive concentration of new technology enterprises. Here the science and technology resource include two parts, one is the "pure" technology resource, namely the technology had been embodied in equipment and corresponding intellectual property right, another is the skills embodied in the people, namely human resource.

2. Activity analysis of the innovation network participants in Zhongguancun area

1) Activity of research institutes

Activity refers to every participant's activity in Zhongguancun innovation network. The first one is the activity of research institutes. In Zhongguancun area, there are three kinds of research institutes, the first one is the institutes which belong to China Academy of Science (CAS), the second is the institutes which belong to local government sectors, and the third is local research and development institutes.

The responsibility of CAS is to conduct those important projects that concerning state interest and people's life, and some projects which cost much and with high risks, and basic research. In Zhongguancun area there are more that 40 institutes belong to CAS, these institutes are the main stream of research institutes in Zhongguancun area, they are a part of technology source of the high-tech industry in this area.

The second kind of institutes refers to the institutes that belong to government sectors but independent from enterprises. For example the Iron and Steel Research Institute in Zhongguancun area, which belong to the Ministry of Metallurgy, and the Railway Science Research Institute which belongs to the Ministry of Railway. These research institutes has close relations with their in charging Ministries, these institutes mainly focus on research, technology development and technology transfer concerning the necessary of industrial development. And usually these institutes can get more research fund from the in charging Ministries.

The third kind of institutes refers to the institutes that belong to the local government sectors. These institutes mainly focus their research activities on the technology development and transfer concerning local economy and social development. These institutes can get some research funds from the local government.

Restructure of research institutes in Zhongguancun area begun from 1982, in this year, the State Council of China put forward the basic guideline for the science and technology, which is "economic construction must rely on science and technology, while science and technology undertaking must oriented to economic construction". From then on, the reform of traditional governmental oriented science and technology system begun.

One of the reform measures is on one hand to keep elite researchers continue to perform basic and applying research. On the other hand, most of the scientific and technological personnel to transform from merely conducting science and technology research to not only conducting science and technology research, but also conducting science and technology achievement transfer and industrialization of high technology. Such restructure eased the dependence of research institutes on government, and strengthened the dependence on the market.

Research institute's research funds consist of government administrative appropriate funds, science and technology foundation, government support projects, bank loan, enterprises cooperation project investment, etc. Among these sources, the proportion of government appropriate funds decreased year by year.

The changes of research funds source component reflects that market dependence of the research institutes had been enforced. At the mean time, the overall economic system reform and science and technology system reform had demanded organization innovation and institutional innovation, market motivation had become the main source of impetus for research and development.

In order to adapt the new situation, the administrative system of the research institutes in Zhongguancun area had been reformed:

- Establishing new technology enterprises which take high and new technology commercialization as their main objective.

Most of research institutes in Zhongguancun area had built up their own enterprises, for example, in 1983 the CAS cooperated with Haidian District to originate science

and technology development company which is the earliest in CAS. From then on, a large number of companies were built in Zhongguancun area, some of them had become very famous companies in China now, for example the Legend Co. and the Founder Co., Ltd. Till now, there are more than 400 various technology enterprises belong to CAS in Zhongguancun area, with employment more than 20,000 peoples. According to the statistic data of 1996, the enterprises engaging electronic and communication account for about 35.2%, engaging instrument account for about 11.2%, engaging chemical products account for about 9.2%, new material 7.5%, mechanic 5.5%, the others like bio-technology, medicine which accounted for about 28%.

- Establishing professional administrative institution, to manage the science and technology development and achievement transfer.

The research institutes that belong to CAS and government sectors, separately manage the traditional research and production. For example, the CAS established "High-tech Enterprises Administrative Bureau", every government sectors establish industrial division to directly manage their enterprises, and the technology transfer had become the very important work for these management sectors.

2) The activity of university

There are 73 universities in Zhongguancun area, these universities played a very important role on the development of high-tech industry development in Zhongguancun area.

University is one of the important components to promote the science and technology research and development. As for the R&D investment, universities account for a considerable proportion. According to the statistic of R&D investment of 1996, enterprises account for 27.1%, government account for 50.1%, university 12.1% and others 10.4%.[50]

Different from public research institutes, universities paid much more attention on the basic research, and the research result mainly is the publication and paper, the technologies oriented to practical use is comparatively little, and most of these technologies are at the stage of laboratory stage, further development is required. Nowadays, the traditional conception of education as two centers of "education and research" had become the three centers "education, research and the development of high-technology and the industry". All these are due to the system reform of universities. The system on one hand will make the market dependence of university

gradually increased, on the other hand will have the university directly take part in the high-tech industrialization process.

The change of manner and proportion of science and technology investment reflected the increasing of market dependence of university's science and technology development. For example, in the middle of 1980s, the average science and technology investment of 10 universities including Tsinghua and Peking University, the governmental appropriate funds accounted for about 39.4%, while in the middle of 1990s, this number had decreased to 22.4%.

As for the university taking part in the development of high-tech industry,
Firstly is that university directly take part in the development process of high-tech industry. Through directly take part in starting up high-tech industry, to realize the industrialization of high technology (namely spill off). Universities can directly take part in the development process through providing technology resource, talent and land. The original enterprises of Zhongguancun were derived from university and research institutes, it can be said that the university like Tsinghua and Peking University are the incubators of these enterprises.

Transforming the content, measure and manner, providing the continuous education and training for the high-tech industry and even to the whole society. Due to the development of high technology, the time of science and technology from invention to practical use become shorter. So in order to adapt to the changing situation of science and technology, continuous education is a urgent demand for all of the staff. So, at present some of the universities and research institutes give various of training course to staff.

3) Activity of enterprises
The main body of innovation in Zhongguncun area is the high-tech enterprises. Some trade-oriented enterprises that engaged in technology trade also play an active role in the innovation network. Till 1998, there were 4438 enterprises in Zhongguancun area, include all the enterprises with various kinds of ownership.

Guided by the market, after the continuous development and improvement, a multi-direction high-tech industry development structure based on electronic information technology had been formed. At the mean time, an open network taking Beijing as the center to radiate the whole country and even overseas had been formed. At present, electronic information, optic-machinery-electric integration, new material, new

energy, environmental science and new medicine, life science and medical engineering account for the 35%, 24%, 21%, and 9% of the overall production respectively.

Since 1993, the number of manufacture enterprises in Zhongguancun area continuously increasing, in 1995, the industrial production value of Zhongguancun area accounted for more than 70% that of the Haidain District of Beijing. This reflected that the high-tech enterprises in Zhongguancun area played a very important role in promoting science and technology achievements transfer and in promoting the combination of science, technology and economy.

Proper innovation strategy is the key factor to improve the competitiveness of enterprises and to get the competitive predominance, so the innovation strategy is the core of enterprises operating strategy. Innovation strategy is determined by the technology capacity, product structure and the forecast to market of enterprises, and it was affected by national industrial policy and economic environment.

According to the research result of OECD, the innovation strategy of enterprises can be divided into technology development strategy, product and market strategy and production input strategy. The technology development strategy can be divided into developing new technology, further developing other related technology, utilizing high and new technology to improve existing technology.

Enterprises in Zhongguancun area had shown the following characters on the selecting of innovation strategy. 1) On the selecting of technology development strategy, the enterprises in Zhongguancun area took the products innovation, which based on technology improvement as the main measure, and the technology innovation as the complement. The technology innovation of enterprises can be realized through two kinds of pattern, namely technology innovation and product innovation. 2) On the selecting of product-market strategy, the enterprises in Zhongguancun area generally selected using existing products to develop new market. The reason of this is the innovation of enterprises was changed with its development, when a enterprises in its startup period, usually it will take the strategy which using new technology to develop new market, after they exploiting certain market by their new products, thus they can keep the competitive predominant in the market.

4) Activity of government

The development manner of science park can be categorized into two basic types, one is the enterprises independent development manner like the Silicon Valley of USA as the representative. The other kind is integrated planning and structuring manner with which the Tsukuba of Japan as the representative. Zhongguancun area belongs to the independent pattern under the policy guidance.

Among the participants of Zhongguancun innovation network, the government did not take part in the innovation activity directly, but it play an indispensable role in the development of innovation network. Here the government do not refer to the Beijing City government, but the Beijing Experimental District Office, the Office is a special level of office, which specially for the administration of high-tech industry in Zhongguancun area of Beijing.

The major function of this Office is: 1) Screening the qualification of high and new technology enterprises enterprise which apply to enter the high and new technology zone. 2) Administrative enrollment for the entered enterprises. 3) Levying tax on the enterprises in the zone. 4) Supervising the enterprises executing country's financial system. 5) Undertaking the statistic and other administrative works of the enterprises in the zone. Due to the special historical background, the overall environment for resource allocating through market system had not yet been established. Various of science and technology resource which need for developing high-technology, such as talent, capital, land, special material and information, still be separated in every sectors. The separation of ownership and the location of resource make the experimental government almost has no direct predominate right to the resource.

The experimental government provides comprehensive service for the enterprises. From the viewpoint of function, the regional policy and activity include that of national government, experimental government and new technology enterprises three levels. New technology enterprises is the main body of innovation activity, experimental government is the comprehensive administrative sectors which carry out industrial policies, and it is also the supporter and participant for promoting the combination of science, technology and economy.

The national and regional innovation policies include supporting entrepreneur, providing technology and reducing the obstacle of innovations. The experimental government of Zhongguancun area did a lot of work on providing technology information, helping new technology enterprises to acquire production license, import

license of raw material and all kinds of standard appraisal, and providing macro planning and guidance.

In order to solve the problem of insufficient industrial development space, the experimental government constructed 1.8 square km information industrial base in Shangdi. Besides these, experimental office also launch some corresponding research, for example the "Financial system reform and the high-technology development of Beijing experimental area" etc, "The affection financial system reform to high-tech enterprises and countermeasures", "The investigation on high-tech enterprises property right in Beijing experimental area". Some of the problems involved in high and new technology industry development had been studied in depth. All of these comprehensive service provided by the experimental government, had created indispensable conditions for the formation and development of Zhongguancun regional innovation network.

3. The relations between the participants of Zhongguancun regional innovation network

1) Formation and development of the innovation network

The formation of Zhongguancun innovation network experienced a complex process. Strictly speaking, before the reform and opening up policy was carried out in China, there was no regional innovation network in Zhongguncun area. Under the planning economy, science, technology, education and economy were under the plan and management of country. Although in Zhongguancun area the intellectual resource is abundant, the distribution of technology talent is quite unbalanced, science and technology research was separated with the industrial production, talent structure and working situation was not so good, there was no favorable environment for promoting the development of high-tech industry.

Before 1984, the technology capacity of Haidian District where the Zhongguancun area located was very weak. There were altogether about 100 small and medium sized factories, and they were no the technology intensive factories and the production value were very low, the science and technology personnel in enterprises is only about 30,000. University and research institutes had a little contribution on the income of industrial and agriculture sectors. On the other hand, due to no market concept, universities and research institutes can not rapidly industrialize the science and technology achievements. For the instance of CAS, in 1985, in the research project of the institutes in Zhongguancun area, there were only 10% of the projects were come from the enterprises. And the technology level of small and medium sized enterprises

in Zhongguancun area was very low, they had no ability to absorb new technology and new achievements.

So, during this period, in Zhongguancun area, there was only the one way relations between enterprises, universities, research institutes and government, there was no innovation network exist.

The gestation of Zhongguancun innovation network was begun with the formation and development of non-government-run high technology industry. After the implementation of reform and open up policies at the end of 1970's, some personnel in CAS begun to establish their own companies, and after some debate on this, Chinese government affirmed this direction, and thereafter, non-governmental high technology oriented enterprises begun their startup course. Till the end of 1986, there were altogether about 279 non-government-run science and technology oriented enterprises, among them, there were about 83 companies were high and new technology related. By the end of 1988, thanks to the support of the State Science and Technology Commission, Beijing Municipal government, China Academy of Science, and the Haidian District government, the number of high-tech enterprises in Zhongguancun area had reached to more than 400. At May 1988, the State Council issued "Provision on Beijing New Technology Industry Development Experimental Zone", and decided to established the Beijing new technology industry development experimental zone. This was the first national high-tech industrial development zone in China.

After the development of this period, the barrier between science, technology, education and industry which under the planning economy had been gradually lift in the Zhongguancun area. The relationship between enterprises, universities and research institutes in Zhongguancun area had been built through the establishment of high-tech enterprises.

Since the foundation of experimental government, Zhongguncun area had become the most vigorous area in Beijing or even in the whole country. Zhongguancun had become the biggest developing, producing and selling base of electronic information and corresponding products, and the center of sales network, which connect in home and abroad market. The sales value of Zhongguancun had account more than one third of the whole country.

2) The manner and content of the links in Zhongguancun area's innovation network

In the innovation network of Zhongguancun area, there exists the links between high and new technology enterprises with universities, research institutes, and the link between enterprises with enterprises, and the mutual compensating links between new technology enterprises and the traditional enterprises.

The role of university and research institute includes two aspects. One is to directly take part in the innovation activity, other one is to indirectly take part in the innovation activity through the manner of joint start up new enterprises or cooperating with enterprises, include the following.

Material resource links. Material links refers to that universities and research institutes provide new technology with materials investment like land and facilities. Universities and research institutes hold land which government allocated or bought in low price at early time. At the mean time, universities and research institutes can cooperate with the development dealer to construct commercial land or incubator facilities. Now, many companies in Zhongguancun area taking use of the land of university and research institutes to build their headquarters and some of the company built their headquarters just in the universities or in research institutes. The Zhongguancun Science Park, Tsinghua university Science Park and Peking University science park were all the example of this case.

Human resource links. First of all, on the human resource links, universities and research institutes sent many professional talents to the high-tech enterprises in Zhongguancun area. The personnel in experimental zone increased at the rate of 46.9% every year and most of these personnel, especially the professional personnel came from universities or research institutes in zhongguancun area. On the other hand, through the human resource training, research institutes, universities and new technology enterprises strengthened their cooperation. In 1995, the experimental government had organized various kinds of training course concerning administration and law more than 23,000 person-times through professional training and combined cultivation. The enterprises organized various kinds of training more than 95,785 person-times.

There were some typical joint training cases of enterprises, universities and research institutes, for example the Stone Group Co. and Peking University jointly sponsored the MBA course. The Legend Group Co., Ltd. and the China Peoples University jointly built the practical exercising base for the post graduated students, the Legend Group provide the practice position for the post graduated students of the University

to improve the practice ability of them, and recruit students from them. The New Auto Group Co. provided 1 million RMB Yuan as the scholarship foundation to several universities. The scholarship awardees can conduct the research in the New Auto Group and under the co-guidance of Group's expert and their own tutor.

Technology resource links. The links of technology resource include the direct investment of technology and cooperation taking the technology innovation as the content. Regarding to the direct investment, most of the technologies of which the new technology enterprises have were non-patent technology.

Technological cooperation. With the development of new technology enterprises and the market-oriented reform of university and research institute, the enterprises had been undertaking a comprehensive cooperation with universities and research institutes. The content and manner mainly include the project cooperation, cooperation with individuals, co-building economic entity, utilizing of personnel and facilities, information exchanging, technology training, etc.

The links between enterprises. The links between new enterprises on one hand are the economic links, on the other hand are the culture links. The economic links include the cooperative development between enterprises. For example the Legend Group Co. cooperated with Founder Group Co. to develop the vector font of Chinese character. The links also include the interaction, for example, many small companies act as the sale agent for the large companies like The Legend Group and the Stone Group. In addition, there were strong products information links among the enterprises of Zhongguancun area. Zhongguancun located in Beijing, it is very convenient to get the latest information of politic, economy, culture and technology. There are many channels for the product information exchange among them. The predominant one is the electronic fittings market and products information network. Regarding to the culture links, after more than 10 years of development, a special culture environment in Zhongguancun area, namely the "Zhongguancun culture" had been formed. The most important culture carrier is the internal publication of enterprises. The internal publication is one of the important tools to publish internal information, convey and display the view of enterprises and create enterprises notions. According to a investigation, most of the large companies in Zhongguancun area have their own internal publications. Therefore, the common psychology culture created one special cultural environment in the region, which greatly benefit the innovation.

Another kind of enterprise links is that of new technology enterprises and the traditional industry. In recent years, the function of experimental zone as high technology incubator and the source of radiation had been greatly improved, the new technology enterprises radiate technology taking the enterprise branch as the carrier, a large number of high-tech radioactive base and technology service network had been formed. On the other hand, due to the industrial model of "two end is in this area, and middle of it is in out side" made the new technology enterprises had many links with the traditional industry. With the joint development as the main manner of technology achievement transfer and technology cooperation, technology become share, the new technology enterprises continuously provide the whole society with new technology and products. A newly developed industrial cluster had been formed with high and new technology as the driving force. Many such projects had gotten significant benefit from this.

4. Innovation capacity of Zhongguancun regional innovation network

As mentioned above, in the innovation network of Zhongguancun area, new technology enterprises, research institutes and universities take part in the innovation activity, the innovation capacity of Zhongguancun area was embodied in these three components.

The new technology enterprises in Zhongguancun area are the main body of innovation activity, and they are the major representatives for the innovation capacity. The evaluation factors for enterprise innovation capacity include several aspects of, on one hand, it should evaluate the technological decision-making capacity, R&D capacity, production capacity, market development capacity, financial capacity and organizing capacity of the enterprises that are directly related with technology innovation activity. Meanwhile, it should also evaluate the capacity of getting advanced technology and information, and therefore combine internal knowledge to create new technology and information, realizing technology innovation and dissemination. This kind of capacity is the more depth capacity than the technology innovation, it can be called the "the technology capacity of enterprises".

According to statistical data, the production value rate, R&D investment rate, proportion of science and technology personnel rate, proportion of advanced facilities and the number of R&D institutes is much higher than the average level of whole country's large and medium industrial enterprises. But the "Project capital investment intensity" is lower than that of state owned large and small enterprises, it also reflects that it is more difficult for small and medium new technology enterprises to get fund

than the state owned large and medium enterprises. The proportion of patent applying of small and medium enterprises is also lower than that of state owned large and medium enterprises. Main reason for this is that the updating of technology and products in Zhongguancun area is quite high, the second reason is that major technologies that the enterprises in Zhongguancun area have are non-patent technology. Through above comparing, it is clear that the innovation capacity of enterprises in Zhongguancun is higher than that of the average level of whole country.

Review the overall innovation capacity of the new technology enterprises in Zhongguancun area, some concludes can be reached. The first one is that the new technology enterprises, especially the small and medium enterprises have strong innovation incentive. In the intensive competition, enterprises greatly increase R&D investment, about 80% of the enterprises built their comparatively independent research and development sector or institutes, to keep the continuous innovation capability. Among these enterprises, the small and medium enterprise research and development activity is more active, the R&D investment of them accounted for more than 60% of total R&D investment. The technology investment of 40 elite companies accounted for about 42% of the total investment, now these companies had become the nucleus for the technology development.

The second is that the enterprises kept steady intensive technology investment and the proportion of investment tend to be more reasonable. Since the establishment of Zhongguancun high-tech park, the investment increased by 62% annually, it is the fastest among the growth indicators. In 1995, the overall R&D investment accounted for about 8% of the total income, and 25.8% of GDP. From the view of proportion of R&D to innovation investment, it becomes more reasonable for the development of Zhongguancun area.

Other characters of enterprises in Zhongguancun area were that there were steady research projects, the effect of science and technology achievement transfer and application was distinct. The technology accumulation of enterprises increased, and the technological facilities level was high.

Research institute and university are also the major innovation power, limited by their organization characteristics, the innovation activity of research institute and university is mainly conducting research and development. But all of research results need further commercialization, so the innovation activity of research institute and university is not completed.

Here we take the CAS as the case of research institutes to analyze the innovation activity. In Zhongguancun area, there were 23 research institutes of CAS, 17 national laboratories, they accounted for 32.5% of total institutes of CAS. From 1988 to 1992, the annually average research projects of CAS were 8379. For every year, there were 2443 projects were finished, the average research investment in each year is 500 million RMB Yuan. The major research projects of CAS were the research and development projects. From 1988 to 1992, about 93% of the projects and 90.8% of research personnel and 88% of the research fund were put in research and development. From 1986 to 1994, all the institutes of CAS registered 10,668 science and technology achievements, about 1185 items every year. (All of these refer to the advanced achievement in the country).

In Zhongguancun area, there are altogether 73 universities and colleges, among them, there are about 10 universities are the most famous universities in China, all these universities have more than 1,000 or 2,000 personnel who engaged in research and development. For example the Tsinghua University, more than 6,000 personnel engaged in research and development. Regarding to the science and technology funds, more than 10 universities the funds exceed 10 or 20 thousands Yuan RMB. In the case of Tsinghua University, the science and technology fund investment more than 200 million Yuan RMB. The fund from enterprises increased quickly, the proportion of this part larger. This also reflects that universities depend more on the market.

Comparison of the R&D activity of new technology enterprises, universities and research institutes shows that, as regards the aspect of science and technology personnel, CAS is obviously better than the new technology enterprises, as for the fund investment, new technology enterprises obviously stronger than the research institutes and university.

Regarding to the links of research institutes, universities and enterprises in Zhongguancun area, the majority is the direct resource investment, while the technology cooperation and information links are in the second position. Survey showed that, the information source of new technology enterprises innovation activities, about 63.3% of which was come from internal R&D, 32.8% come from the high level of administrative personnel. This reflects that the information for technology innovation mainly comes from internal, while the technology information get from universities and research institutes only account for a very little proportion.

Generally speaking, in Zhongguancun area, on one hand the new technology enterprise cluster with strong innovation incentives makes this area has strong innovation capacity. On the other hand, in this regional innovation network, the links necessary for the innovation is still weak, need to be strengthened.

Case II. Shenzhen City, China

1. Overview of the development of high-tech industry in Shenzhen City

The development of high-tech industry in Shenzhen City was started from the end of 1980s. In 1991, the government of Shenzhen City put forward the development strategy of "Taking the S&T progress as the impetus, vigorously developing the high and new technology industry", thereafter, a series of policies and programs were issued to promote the development of high-tech industry. After 10 years of development, five major high-tech industries including electronic information, biotechnology, new material, integration of electronic and machinery, and laser technology had been formed. Among these industries, the electronic information industry had become the backbone industry of Shenzhen City. In 1998, the total productions value of electronic industry has reached 60.2 billion Yuan, accounted for 91.9% of City's total high-tech industrial production value, and 32.6% of City's total industrial production value. Bio-technology and new material industries are the newly forming high-tech backbone industries, in 1998, the production value of bio-technology and new material high-tech industry respectively was 0.96 billion Yuan and 1.69 billion Yuan, the average annual growth rate 1992 to 1998 was 52.63% and 38.19% respectively.[51]

With the rapid development, the high-tech industry of Shenzhen City continuously radiated the Zhujiang Delta area, to bring along the development of high-tech industry in the vicinity. A large portion of high-tech industries in the vicinity cities was brought along by Shenzhen City's high-tech industry, and they provided the supporting service for the high-tech industry of Shenzhen City. Shenzhen City had become the center of the high-tech industry development of the city cluster in the Zhujiang Delta area.

Analyzing Shenzhen City's regional innovation network, enterprises are the carrier of economy activities, so enterprise's development directly determines the development of industry. In the circle of high-tech industry, there are a large number of enterprises that were developed from little ones. Among these enterprises, 129 of them were

ratified by the government of Shenzhen City, more than 300 enterprises with high-tech projects and more than 400 enterprises were ratified by the S&T sector of Shenzhen City's government. All of these enterprises underlay the development of Shenzhen City's high-tech industry.

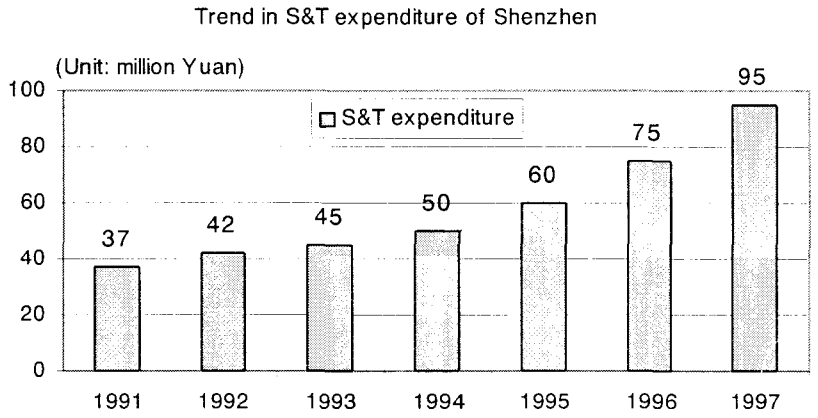


Fig.6-4 Trend in S&T expenditure of Shenzhen

The development of Shenzhen City's high-tech industry was begun with the HongKong moving part of its electronic industry to Shenzhen City in the early 1980s. For many years, foreign capital has been the important promoting force for the development of Shenzhen City's high-tech industry development. At the end of 1980s, some science and technology personnel in the field of micro-electronic technology begun to startup enterprises, thus the first batch of high-tech enterprises emerged. It marked the beginning of high-tech industry development in Zhujiang Delta area. With the increasing of foreign investment and the impulse of government, the high-tech industry has seen its quick development since the early days of 1990s. The foreign capital enterprises had become the main force in the development of high-tech industry in Shenzhen City. For many years, about 64% of the high-tech enterprises were joint venture. All of these joint ventures involved in almost all the 7 fields of high-tech industries in Shenzhen City. Before 1997, the production value of these enterprises accounted for more than 70% of that of whole City.

In recent years, the manner of foreign capital entering the Shenzhen City's high-tech industry became more flexible. For example, the U.S. investors shared the stock of Kexing Biotechnology Company, the U.S. venture capital entered Kingdian Company. The entering of foreign capital into high-tech enterprises with national intellectual property right shows that the foreign investors are quite confident in developing high-tech industry in Shenzhen City. Along with the development, these

joint ventured high-tech enterprises brought along the growth of national high-tech industry, as well as the development of subcontract enterprises in vicinity area.

In recent years, with the improvement of high-tech industry environment in Shenzhen City, more and more foreign high-tech companies, especially the multinationals were attracted to invest in Shenzhen City and to establish their new factories, high-tech industry had gradually become the hotspot of foreign investment. At present, many famous multinationals like IBM, HITACHI, Philips, Dopont, HP, Xerox, Samsung, Sanyo, DEC and many others had invested in the high-tech industry of Shenzhen City. These international companies now had become the important parts of Shenzhen City's high-tech industry.

Foreign capital entered into Shenzhen's high-tech industry, brought along the increasing of high-tech product export, optimizing the export product structure. Because foreign capital invested high-tech enterprises was the mainstream of high-tech product export. For many years, the export of these enterprises accounted for more than 70% of the total export of Shenzhen City.

2. The environment establishment for innovation in Shenzhen City

One of the important factors of Shenzhen City's fast development of high-tech industry was the sound environment created by local government.

1) Government service environment.

The government actively play the role of guidance, created a sound service environment, which benefit the development of high-tech industry, created sound condition for the forming of policy environment, industrial environment. First one is to constitute and perfect the industrial policy and S&T law, policy and regulations. From 1990s on, a series of policies and regulations that encourage and support the development of high-tech industry had been issued, greatly promoted the formation of science and technology policy and law system with the intellectual property right protection as the core of. In Feb. 1998, Shenzhen City's government issued "Provision for Further Support the Development of High-tech Industry". A series of preferential policies were released to boost new high-tech backbone industry, and to accelerate the development of biotechnology and new material industries. On the other hand, vigorously promote the system reform, actively guide the enterprises to become the main body of science and technology activities. The third one is to actively promote the investment on the science and technology of whole society. While increasing the investment on science and technology, government encouraged enterprises to increase their investment on science and technology, and to gradually

form a multi-level, multi-channel societal investment system with government as the supervisor, enterprises as the main body and bank as the backup force. The fourth is to promote the reform of personnel management system, the Shenzhen government built up open personnel market and to boost the new employment mechanism for fairly competition. The fifth is to play the bridge role of government, strengthen the cooperation between enterprise circle and science and technology circle, making the university and research institutes to be the strong support of Shenzhen's high-tech industry. Through the establishment of technology intermediary market system, to provide the communication opportunity for enterprises and universities and research institutes.

2) Policy and regulation environment

In recent years, Shenzhen City government energetically promoted and carried out the establishment and perfection of a series of policy and regulation, in which take the creation, utilizing and protection of intellectual property right as the core. Created a sound policy and regulation environment for the development of high-tech industry.

Formulating preferential policies, adjusting investment direction, increasing technology development investment, attracting S&T personnel from home and abroad, especially those have their own achievements. In Aug. 1991, Shenzhen City government issued "Decision on Promoting Economic Rapid Development Relying on Science and Technology Progress", it put forward that in the middle or end of 90s, the development level of Shenzhen City will be in the front of China. In subsequently formed "The Industrial Policy of Shenzhen City Special Economic Zone", the computer and software, communication, bio-technology and the engineering were determined to be the prior industries. In June 1993, Shenzhen City government issued "The Management Provision of Non-governmental S&T Oriented Enterprises in Shenzhen Special Economy Zone", the non-governmental S&T oriented enterprises were introduced into the City's S&T industry. In Feb. 1998, in order to promote Shenzhen City's high-tech industry development, Shenzhen City government issued "Provision on Further Supporting the Development of High-tech Industry".

Establishing evaluating system for the intangible assets, perfecting law and regulation on technology becoming the stock, awarding technology developers, promoting the transfer of science and technology achievements. In order to adapt the new development, in Mar. 1994, Shenzhen City government issued the "The Provision of Evaluation Management on Intangible Assets of Shenzhen City Special Economy Zone", which filled the blank of intangible assets evaluation law system, make the

intangible assets evaluation get into the proper orbit. Technology becoming the stock is one of the important manners of science and technology achievements industrialization, the high-tech enterprises in Shenzhen City began to fumble the theory and feasible approach of technology becoming the stock in practice in the early days of 1990s. And to carry out the technology becoming the stock in the development of enterprises. On the basis of many years of fumbling and practice, Shenzhen City government issued the "The Management Method of Technology Becoming the stock of Shenzhen City Special Economy Zone", the implementation greatly promoted the technology achievements transfer.

Protecting technology secret of enterprises according to the law, preventing the losing of technology achievements, building up legal environment for the proper flow of talent. In 1990s, technology-losing problem raised by talent flowage begun to puzzle the science and technology firms in Shenzhen City. In order to protect the legal interest of technology secret owner, protect the enthusiasm of enterprises to invest in science and technology activities, and to promote technology progress in firms, "The Ordinance of Enterprises Technology Secret Protection of Shenzhen City Special Economy Zone" was approved by the People's Congress of Shenzhen City. This ordinance was the first one in China.

Building up high efficient intellectual law enforcement system, and forming an integrated policy and regulation system. Establishing a high efficient and perfect intellectual property right protection law enforcing system is the key issue which ensure the implementation of corresponding policies, and it is the indispensable link in a perfect intellectual property system. So on the basis of existing patent management office which responsible for patent bother and torts, a special steering group on intellectual property right protection was built up in 1995, which in charge of the management, coordination and intellectual property protection undertakings.

3) Technology innovation and technology development environment
Shenzhen City has created fine technology innovation and technology development environment from three aspects. One of them is the scientific and technological resource collocated with enterprises oriented and market oriented, to make the enterprises be the main body of technology activity and economic activity. Shenzhen City took the establishment of technology development as the objective, fully play the adjustment role of market, integrated the separated scientific and technological resource and economic resource on the overall objective of enterprises operating, and make them closely combined in the enterprise operating, to form a new production

factor. And dynamically optimize the allocation of science and technology resource. Initially form the technology innovation system, which consist of the basic research (inland university and research institutes), applying research (partly in inland universities and research institutes, partly in Shenzhen City, and partly abroad), technology development (partly in inland of China, partly in Shenzhen City, and partly abroad), and the technology achievements commercialization and industrialization (in Shenzhen City). The second is to create the environment for the regional research and development center, roundly improve the overall technology innovation capability. Actively create the conditions for attracting domestic large firms to build research and development institutes in Shenzhen City. For example, many famous high-tech large firms like the Legend Co., the Founder Co., and the Great Wall Co. built their own research and development institutes in Shenzhen City, they all become the important components of the technology development system in Shenzhen City. The third one is taking the market as the guidance, enterprises as the main body, to construct the new framework of technology development system. For many years, Shenzhen City took the establishment of technology development system as the important work of scientific and technological undertakings, and focus on the strengthening of the technology development of enterprises. The policy on resource allocation and personnel introduction inclined to the enterprises. At the same time, the government fully play the guidance role, every year about 80% of the science and technology fund was allocated to enterprises, and more than 90% of the scientific and technological personnel were concentrated in the enterprises, to ensure the development of enterprises.

4) The supporting environment of high-tech industry

The industrial supporting environment is the most distinct development environment of Shenzhen City. At the beginning of 1980s, a large number of enterprises that produce consumptive electronic products came Shenzhen City to build their factories. At the beginning of 1990s, with the dramatically decreasing of margin profit of these firms that producing traditional products, many firms moved to the backland. Some firms that do not move out of Shenzhen City have to improve the their technology level of product, to provide the supporting products and service for the high-tech enterprises from home and abroad. On the other hand, Shenzhen City's government actively created condition to build up a series of professional markets to underpin the development of supporting industry. At the same time, the enterprises those produce supporting products for high-tech industry in vicinity cities also get fast development. After the development of these years, the Zhujiang Delta area has formed the

integrated high-tech supporting industries with a considerable scale. Within this area, the electronic information supporting industry had become one of the largest in Asia.

The advantages had become the important conditions for promoting the development of high-tech industry in Shenzhen City and attracting foreign high-tech firms. At present more than 30 famous international high-tech firms came Shenzhen City to establish their high-tech industry. The supporting advantages are also the very important factors for China's Torch Program, "863" Program and Tackle Key Program entering into Shenzhen City.

5) Investment environment

At present, a multi-manner, multi-channel of effective investment environment had been formed with the government as the guidance, enterprises as the main body, banks as the back up force, and others as the complement. This environment had become the strong support for the development of high-tech industry in Shenzhen City.

Government increased the science and technology investment. The science and technology investment of government has the guiding and demonstrating role to the whole society. In recent years, government increased the science and technology fund annually. In 1995, the City's government fund is 60 million Yuan, accounted for 1% of financial expenditure. In 1996 and 1997, the fund reached 75 million and 95 million Yuan respectively. Besides these, in 1997 an additional science and technology foundation was established to support national "863" project – bioreactors research. In 1998, the science and technology fund had reached 150 million Yuan.

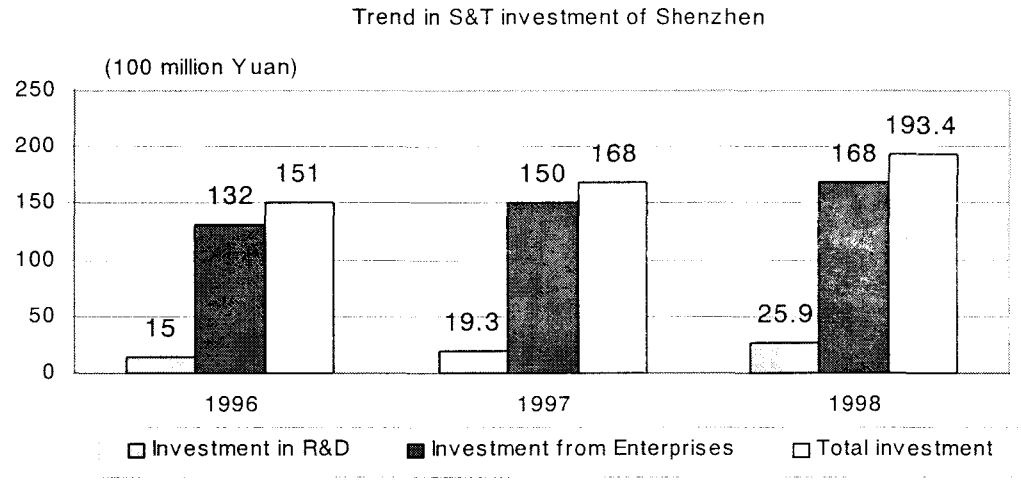


Fig.6-5 Trend in S&T investment of Shenzhen

Energetically guide and encourage enterprises to increase the investment on science and technology. In recent years, Shenzhen City took the guiding and encouraging enterprises to increasing S&T investment as a very important task. On one hand formulating a series of preferential policies and indicators to encourage enterprises increasing science and technology investment. On the other hand, through the guiding and demonstrating of government science and technology investment, to guide and encourage enterprises to increase the science and technology investment. Under the guidance of government, the enthusiasm of enterprises investing in science and technology had been obviously improved, enterprises gradually become the main body of science and technology investment. In 1997, the total investment of science and technology was 16.8 billion Yuan, in which the enterprise's investment accounted for 15.0 billion Yuan, the amount used for R&D was 1.93 billion Yuan. In 1998, the total amount for high-tech research, development and production was 19.4 billion Yuan, increased by 14.7% than that of 1997, the amount used for high-tech product research and development was 2.59 billion Yuan, increased by 34.1% than that of 1997.

Building up science and technology financing system with bank as the supporter. Energetically promoting the bank to increase the investment in science and technology. In recent years, the loan for supporting high-tech enterprises obviously increased. In 1991 the overall science and technology loan was 0.6 billion Yuan, while in 1997, it was 1.6 billion Yuan. The Shenzhen Branch of People's Bank of China also organized corresponding bank in Shenzhen City to take 50 million Yuan as a science and technology special loan each year to support the development of high-tech industry. At present, this fund had increased to 400 million Yuan, it support 10 projects each year, had gained distinct achievements.

Establishing science and technology investment system of whole society. Utilizing the stock market, to pave a new way for financing high-tech industry. From 1993, the government had arranged high-tech enterprises to collect developing fund through coming to the stock market with the priority. This has made more than seven high-tech enterprises like Huayuan Co. Zhongxing Co. access the stock market, through which collect more than 1.8 billion Yuan. Besides these, there were another 17 firms come into the stock market through holding stake, through which expanding the capital resource, and greatly promoted the development of high-tech industry in Shenzhen City.

Building up venture capital market system. At the beginning of 1990s, Shenzhen City began to study the venture capital. In 1995, the high-tech industry investment service Ltd. was founded in Shenzhen City, which aimed to solve the problem of high-tech enterprises and projects that can not get the bank loan due to lack of mortgage. This was a remarkable step of Shenzhen City before the establishment of venture capital market system. Till now, this company had provided the financing assurance for more than 302 projects of 130 high-tech enterprises and no-governmental science and technology enterprises, the accumulated value was 1.46 billion Yuan. Since 1996, the Shenzhen City roundly promoted the practice of high-tech venture capital investment market system establishment. At present, the Shenzhen City Zhongke Financing and Investment Consult Ltd. had begun to operate.

6) System innovation environment

At present, Shenzhen City has preliminarily formed market economy framework, built up relatively matured production resource market, talent market and technology transaction market, created a fine external condition for the system innovation of high-tech enterprises. It is a rather favorable condition for high-tech enterprises take part in competition in which the resource was rationally allocated, competition comparatively in proper order. Government and economic organization operated in efficiency, and the enterprises independently running, the government implement active supporting policy but does not intervenes the running of enterprises. In recent years, the system innovation was energetically encouraged in high-tech enterprises.

7) Talent environment

For many years, Shenzhen City engaged in creating a favorable talent development environment, talent mechanism which favorable to the market economy has been established, and new mechanism which in the field of hiring, the introduction, training and using of talents had been formed. On the other hand, Shenzhen City vigorously created fine conditions for the high-tech talents provided several of opportunities for them. In 1997, the Personnel Bureau of Shenzhen City set up a "Talent Market", faced to the whole country, played the role of government to promote the personnel flow. In only two years, the participants amounted to about 2.6 million person-times. In 1997, the Department of Organization of Shenzhen City set up "Senior Manager Evaluation and Recommend Center", to discover, examine and recommend enterprises manager for various kinds of enterprises. All of these efforts created fine condition for the talent's growth up and playing role.

8) Infrastructure and life environment

Shenzhen City's government energetically built up and perfected the infrastructure and information conditions in Shenzhen City, tried to provide a fine environment for the high-tech enterprises. At the mean time, Shenzhen City's government strengthened the service function, strengthened the cooperation with the sectors of telecommunication, administrative, bank, and taxation, to deploy the information network construction, to serve for the high-tech enterprises.

3. The creative measures of Shenzhen City to promote regional innovation

1) Improving the service function of government, creatively play the role of government

Since 1990s, the Shenzhen City's government adapted the development of high-tech industry, continuously improved government service function, to make the overall coordination of government promoting the industry development.

From the beginning of 1990s, the Shenzhen City changed the strategy of development, the new strategy of economy development must rely on progress of science and technology. The City's government put forward and energetically carried out the strategy of "Revitalizing the City through Science, Technology and Education". The City's government took the development of high-tech and high-tech industry as the emphasis of economic development strategy, and took measures to implement this strategy. At the same time, major leaders of Shenzhen City had strong awareness of high-tech industry development. Some problem arisen during important high-tech project and industry development can be quickly put forward to the decision-making level and be solved. A high efficient decision-making mechanism and system had been formed on high-tech industry development.

Another aspect of government function improvement is the rapid reaction mechanism, which had been built to serve the high-tech enterprises. For example, in Oct. 1997, shortly after the Asia Financial Crisis broken out, Shenzhen City's government made a "Decision on Supporting the Development of Bio-engineering Industry and New Material Industry of Shenzhen City's Government", to promote the development of bio-engineering and new material industry. Thereafter, in Feb. 1998, "Provision On Further Develop High and New Technology Industry of Shenzhen City" was released, this document played an effective role in keeping away the Asia Financial Crisis. In 1998, the growth rate of Shenzhen City high-tech industry was 38%. The export value of high-tech products reached 4.4 billion US dollars, grew 19.18% than the previous year. Beside these, the Shenzhen City's government energetically reformed and simplified the government examination and approving system, perfected the service

manner, promptly settled many difficulties and problems in the development of high-tech enterprises. For example, in recent years many foreign companies set up their branch companies in Shenzhen City, many problems like land requisition, talent employment, and the entering and leaving country of high-tech equipment.

The third aspect is to build up a rapid expert decision-making system with policy-oriented, and fostering the adapting capability of high-tech industry to future development. Through plan constituting, investment guidance or policy supports, to guide the industry development direction, making high-tech industry have the ability to adapt the changing environment. For example, through the rapid expansion during 1991-1996, the high-tech industry of Shenzhen City starved for improving the development quality. Based on the survey in depth, Shenzhen City's government put forward the internationalization strategy for high-tech industry in 1996, lured in foreign high-tech corporations and make it localization in Shenzhen City. At the mean time, pushed some national high-tech products entered the international markets, promoted the running of high-tech enterprises internationalization, to form a large number of international high-tech enterprises. Implementation of this strategy greatly promoted the high-tech enterprise's sustainable development and international competitiveness improving.

2) Building up a technology development system with market being the guidance and enterprises being the main body, promoting the integrated development of science, technology and economy.

In recent years, through the system reform, Shenzhen City had built up the technology development system with market being the guidance, enterprises being the main body, while inland universities and research institutes being the supporter, and the foreign research and development institutes being the complement.

Building up and perfecting the technology development system with market being the guidance, enterprises being the main body. For many years, Shenzhen City promoted the construction of technology development in many aspects. On one hand is fully play the guidance role of the government, and inclined the science and technology resource to enterprises. Supporting the independent development and re-innovation of the introduced technology. Promoting the combination of science, technology and economy. Recently action was taken to organize the Engineering Technology Development Center relying on enterprises, and make the Engineering Technology Development Center to be the frontier combination of science, technology and

economy. Till now, 12 Engineering Development Center had been built based on large enterprises. On the other hand, energetically promoting the cooperation of enterprises with inland universities and research institutes. At present, enterprises in Shenzhen City had built up close cooperation relations with more than 200 universities and research institutes. Recently, the cooperation level had been improved, and the research activities were extended to inland area, and the research institutes were built in inland area of China. Till now, there are about 40 such research institutes were built by the enterprises of Shenzhen City, thousands of science and technology researchers worked in them. Besides these, in order to adapt the development trend of present technology globalization and enterprise R&D internationalization, Shenzhen City's high-tech enterprises extended their research network to the developed country. At present, the high-tech enterprises of Shenzhen City had set several of research institutes in the Silicon Valley of USA. In the end of 1997, Shenzhen Taifeng Company purchased a Korea research institute. These research and development institutes had become the important complement of the research and development system of Shenzhen City.

Strengthening the technology development main body position of high-tech enterprises, and improving the ability of self-development. Enterprises directly face the market, is the most basic and important cell in economical activities, it has the best qualification to combine science, technology factors and economy factors. For many years, Shenzhen City's government strengthened the main body position of enterprises, gave many preferential policies to the enterprises on resource allocating, talent introducing etc. At the mean time, government fully played the guidance role, in each year about 80% of the science and technology fund was allocated to the enterprises. At present, among the total 521 research and development institutes in Shenzhen City, 477 were established by enterprises, accounted for about 91.7%. Among research personnel, there were about 90% of them concentrated in enterprises. The high-tech enterprises had become the investment main body for research and development. In 1997, 81.68% research and development funds was provided by enterprises.

Shenzhen is a quite new city, only 20 years ago, it was only a small fishing village, but now it had become one of the most important center cities in China. Among many factors that contribute to the success of Shenzhen, two of them were distinct. One is that Shenzhen is the first Special Economic Development Zone of China, many preferential policies were issued to support the development of it, through which, a sound environment conducive for innovation had been formed. The second one is the

successful introducing strategy, on one hand it introduce capital and companies from overseas, on the other hand it introduce talent and technology from the universities and research institutes of inland China to form its own advantages. But at the mean time, it own technology innovation capacity needed to be strengthened.

Case III. Ota City, Japan

1. Present conditions and challenges

1) Characteristics of industry in Ota City

Ota City, one of the 23 cities (wards) of the Tokyo Metropolis, is the shouthernmost district of Tokyo with a population of 650,000. Ota is important logistically as a support base for Japanese industry, which containing the largest domestic airport, harbor facilities and crisis-crossed by major highways and train lines. A remarkable feature of Ota City is the degree of development in the machinery and metal industries, which stretches back more than 60 years.[52]

Table 6-1 The number of factory, employee and shipment of Tokyo's 23 ward (city)

	Number of factories	Number of employees	Shipment (10,000JY)
Total	25,535	417,422	1,145,835,779
Ota	**3,014**	**50,812**	**130,586,305**
Chiyoda	674	27,835	147,389,141
Chuo	663	14,975	59,100,806
Minato	623	13,593	43,187,741
Shinjuku	1,129	26,528	81,878,731
Bunkyo	960	17,238	61,148,601
Taito	1,209	12,127	23,880,535
Sumida	2,230	26,780	60,842,771
Koto	1,362	21,786	62,188,182
Shinagawa	1,081	20,293	55,444,092
Meguro	468	7,406	16,318,626
Setagaya	481	6,715	13,722,359
Shibuya	316	5,913	17,269,150
Nakano	238	3,005	5,958,917
Suginami	303	7,624	22,939,665
Toshima	513	8,377	18,973,770
Kita	815	17,120	55,599,958
Arakawa	1,404	15,252	25,530,623
Itabashi	1,679	34,413	90,706,841
Nerima	476	6,999	12,040,568
Adachi	2,046	27,026	48,724,122
Katsushika	1,979	24,296	47,761,817
Edogawa	1,872	21,369	44,642,458

Source: http:/www.o-net.or.jp/ota/suji/sangyo1.htm

In terms of number of factories, number of employees, and amount of manufactured products shipped, Ota industry is in a class by it self even in Tokyo. There are 6,787 factories in Ota City, and over large number of small manufactures. Almost all of them are classified as small and medium-sized enterprises. Classified by size, 3,304 (48.7%) of these factories have 1-3 employees, while 2,207 (32.5%) have 4-9 Employees.[53]

Fully functionality can only be attained with business tie-ups between SMEs each having specialized technology forming a "full set" network. The world of SME industry in Ota City is an excellent example of the collaborative network, which is particularly advantageous in fabricating prototypes of product under development, as well as for processing of a high degree of difficulty.

With innovation and the accumulation of technical know-how, Ota industry is ready to take on the kind of sophisticated, demanding jobs that come from Japan's industrial giants. In many cases, local companies in various fields are engaged in ongoing trial/test production on behalf of leading companies.

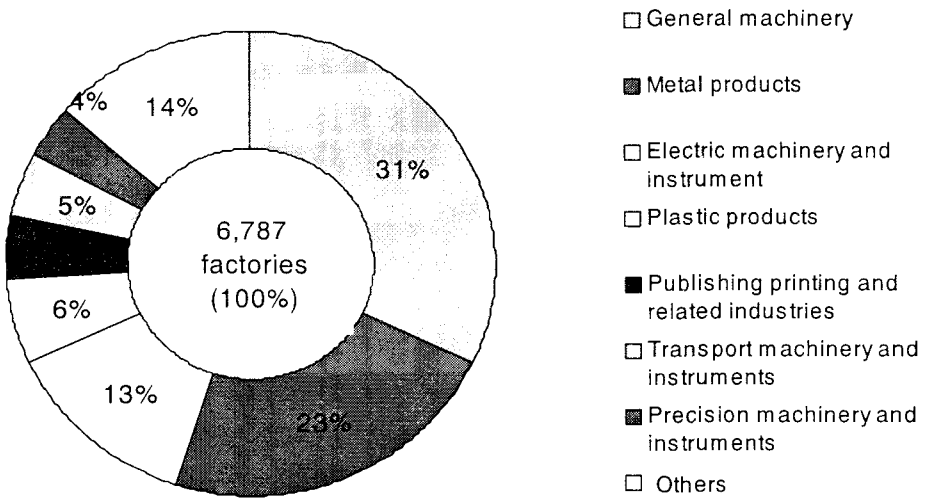


Fig.6-6 Proportion of the number of factories

Another feature of Ota industry is the so-called integration of full set processes. Taking metal products as an example, almost all of the necessary parts and processes are supplied separately by specialized independent firms. Materials supply, cutting, pressing, forging, and stamping, plating, surface treatment, painting and other related processes might each be carried out by a different factory. A similar integration is evident with electrical/electric machinery as well. This full range of industrial service is an asset to Ota that is available to firms that come to Ota.

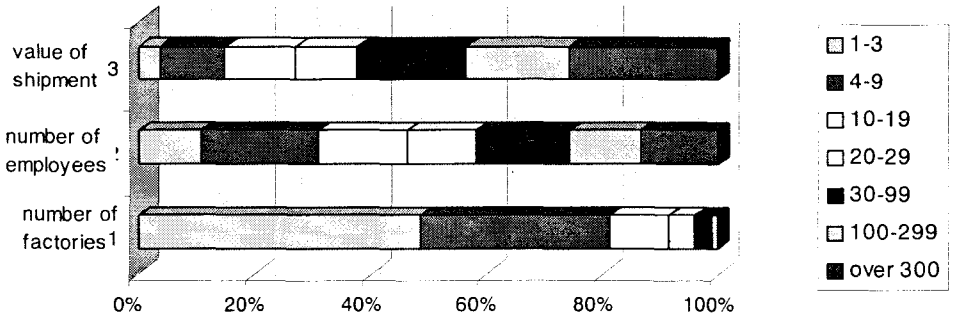


Fig.6-7 Proportion of the number of factories, employees and amount of shipment by scale of employees

In order to promote small and medium sized manufacturers possessing highly advanced technology in Ota, the Ota City Industrial Promotion Organization[54] was established, and it is a public funded corporation. The Ota City industrial Promotion Organization provides a venue for the exchange of information between companies in search of ways of adapt in their business and manufacturing strategies.

Plaza Industry Ota (PiO)[55] is also a public funded facility created to strengthen and support business. PiO facilities include a large exhibition hall (1,600 sq m), small exhibition hall, large convention hall and international conference room together with a business information corner and numerous meeting rooms. To provide a full range of services more efficiently, the latest laboratory equipment and office machinery are in place. Some of the principal areas of activity that have been enlarged and improved are as follows.

- Studies of area industry and companies. Information and consultation services on trade and investment to local and foreign business.
- Organization of seminars and workshops for business exchanges with foreign companies.
- Reception of foreign business delegations and organization of Japanese trade and business missions abroad
- Arrangement of large and small international business exhibitions as well as participation overseas.

2) Problems following the bursting of the bubble economy

The collapse of the bubble economy in Japan has brought about a retreat from development orientation and has highlighted the need for structural conversion of

industry. To clarify this problem, the Ota City need to come to a new understanding of what the structural problems were prior to the bubble economy and what has been postponed due to the paralysis caused by the bubble economy.

As stated above, small and medium-sized enterprises form the foundation for industry in Ota City. Many small business are excellent in the how to of industrial arts but are slow in spotting market needs and trends. These small companies have taken the lead from parent enterprises, if the parent enterprises ordered more goods, the small supplier, encouraged to expand production, acquired more equipment. Until the bubble burst, this was the right way to act to ensure enough work. But that all changed completely after bursting of bubble. Changing consumers need a growing awareness of environmental issues have led to a reconsideration of throwaway lifestyles and have pointed out the need for fundamental improvement in how production is carried out. This has been an undercurrent since before the bubble economy, but the delay in responding to such structural changes had made the current situation even more severe. This, along with the fact that it is harder to procure funds in the post bubble era, has brought about a great transformation on the production supply side. Model changes and the development of new products are in a lull, parts are being standardized, and large companies are turning to producing their own components rather than outsourcing the network to smaller companies.

Some managers of small and medium-sized companies who foresaw these developments are conceiving and implementing new strategies of becoming creative manufactures that come up with original products and that further hone the processing technology and skills that are their specialty. Such managers watch market trends with a clear purpose of production and with the desire to get away from subcontracting.

3) Assisting the activation of "People Who Make Things"
As previously mentioned, the smaller enterprises of Ota City are in a very difficult position. These are the small companies that are the reservoirs of the fundamental technologies upon which the machine industry is based.

Mastery of these fundamental technologies requires a long process of nurture and development, which cannot be reproduced overnight. Such human resources must be steeped in the various disciplines. Success attained deserves society's great respect but as the taste for physical labor diminishes, the motive force is dissipating.

Nearly half of the factories in Ota City have 3 or less employees, meaning many have no successor. Factories set up in the 60's and 70's are now ripe for handing over to the next generation, but there is often no one to inherit the skills. Erosion of the fundamental skills of industry threatens to undermine it base and lower the overall pyramid of manufacturing with a concomitant knock-on effect in other sectors.

For these reasons, the Law for Special Measures to Activate Accumulation in Specified Industries was enacted in June 1998, for the accumulation, support and development of fundamental technologies in small and medium sized enterprises.

Various measures have been developed throughout the area to activate the "People Whom Make Things" and as they are essential in maintaining Japan's competitive edge, Ota City feels that on no account must this high degree technical concentration be lost.

2.The path industry has taken in Ota City

1) The dawn of modern industry

Although today Ota City outclasses any other ward in Tokyo in number of factories, number of employees, and amount of shipped manufactured products, contrary to what one might expect, it got off a later start than neighboring regions in the dawn of modern industry.

Until the end of Meiji era in 1912, the industries most characteristics of what is now Ota City were laver preparation, which goes back to the Edo period, and straw plaiting, which likewise traces its roots to the wheat-straw handicrafts of the Edo period.

Modern factories can hardly coexist with laver cultivation, for which water quality is an issue, and there seem to have been difficult problems until the residents were reconciled to factories being built in the district. One example was the opposition of the villagers of Haneda (site of the present-day airport), to have the Yokohama Sugar Refining build its facilities there at the turn of the twentieth century. Also, the Tokyo government considers straw plaiting a important asset for obtaining foreign capital. This plaiting business depended on unskilled labor and low wages, about as low as a farmer might earn in the slack season. So sadly, it disappeared before the wave of modern industrialization.

In the valley of the Meguro River in neighboring Shinagawa to the north, a number of modern factories were built in the early Meiji era, helped along by the Meiji government's policy of building a prosperous country with a strong military and industry. Next, in 1906, Yokohama Sugar Refining, which earlier met opposition from the villagers of Haneda, built a factory in Kawasaki on the right bank of the Tama River, marking the start of the industrialization of the Kawasaki area.

But according to available records, modern industry did not come to what is today the Ota district until October 1908, when permission was granted for the construction of the Tokyo Gas manufactory in Omori. But this facility was not immediately built; it was not completed until about the First World War in the early Taisho era.

In the following years, pioneers of modern industry in the Ota district built their factories here, completing a link in the Tokyo-Yokohama industrial belt. Japan Storage Battery in Iriarai and the typewriter manufacturer Kurosawa Shoten in Kamata in 1913. Japan Special Steel in Omori in 1915, the general machinery, automobile, instrumentation, and heavy industry company Tokyo Gas and Electric Industries in Iriyamazu in 1917. The diesel engine manufacturer Niigata Steel Engineering in Kamata in 1918.

Shortly after what is now the Ota district was included in the region covered under the City Planning Law enacted in 1919, the old city of Tokyo was reduced to rubble in the great earthquake of 1923, and following the designation of Omori and part of Iriai as an industrial zone in 1925, more and more factories were built within the district. At the same time, this trend was helped along when factory land became available through programs for the readjustment of arable land.

Industry within the district took a leap forward with the outbreak of the 15-year with China in 1931. The City of Tokyo statistical tables for the following year 1932-when Omori Ward and Kamata Ward were created, later to be combined into Ota City (the new ward "Ota" was named after the "O" of Omori and the "ta" of Kamata), and for 1937, when the war expanded and the country was plunged into the Sino-Japanese War, show that during this short five year period the number of factories increased 2.08 fold, the number of employees 4.24-fold, and the production volume 5.51 fold.

The Omori Ward council noted this effort in its February 1944 "Resolution concerning Nomi River improvement and emergency measures", which gave the

Omori and Kamata of the time its "commendation as an arsenal district for remarkable increase and expansion of factories for military production".

The price for this reputation as "the nation's arsenal" was great indeed, for during the Second World War nearly all of the factories in the district were destroyed over the course of 19 bombing raids. A hint of tragic destruction is given by the fact that the population in the old Kamata Ward, which had the most factories, plunged from 198,067 residents at the beginning of 1945 to 47,907 on September 1 of the same year, according to a census taken just after the end of the war.

The burnt-out factories now had the task of reconstruction, indifferent to appearances and making full use of whatever machines and materials escaped the flame of war. Production had to be converted to meeting civilian demand. Factories that used to make tanks were now making wash basins and package racks to be pulled by bicycles, and turning, if not swords into plow-shares, tank armor into hoes. In the midst of this, the Korean conflict broke out in June 1950, creating a "special procurement demand" for military gear for the UN army in Korea. Following this "special procurement demand", the American military began to order finished weapons in 1952. This was known as "new special procurement demand". This forced industry to meet strict requirement for technology and quality control and eventually led to the industry in Ota City today, which is known worldwide.

2) Factory pollution and industrial relocation

While Ota City was becoming the top industrial ward within Tokyo under the biggest long-term economic booms since the Jinmu and Iwato, starting in about 1965, the problem of factory pollution became a major concern for the residents of the entire ward. Promulgation of the Basic Pollution Measures Law of 1967 and the Tokyo pollution prevention ordinance of 1969, along with the three laws on factory dispersal, has made it difficult to set up factories or expand equipment within the city. In addition, it is difficult to secure a young work force, and some companies have expanded or moved outside the city. And without moving the whole company or factory, some companies have begun to plan to move only their production division to an outlying region, while keeping their research and development or prototype fabrication division in the city.

Factory pollution is a serious problem for the small enterprises that account for most of the factories in the city, a problem that a single enterprise can do little about. In the face of this situation, in 1964 Tokyo and Ota City recognized the need for a policy of

separating residential and industrial areas by moving polluting factories to land reclaimed from the sea. This is the origin of the industrial parks on the islands of Showajima, Keihinjima and Jonanjima.

But such a policy makes it impossible to create neighborhood where people can live near where they work, an arrangement that supports the activities of small factories. This reconsideration led to the construction of Omori South factory apartments, in which residences and factories are in three-dimensional juxtaposition.

3) Concentration of mechanical and metal processing industry and national Technopolis Ota

According to industry statistics for 1970, the seven machinery and metal industries- steel, nonferrous, metals, metal products, general machinery, electrical machinery, transport machinery, and precision machinery- make up 80% of the total. This is all the more remarkable when compared with the average of about 50% for Tokyo as a whole.

As large companies proceeded to move out of the city beginning in about 1965, smaller factories, mainly in the mass-production machinery and metal industries, grew and remained in the city. The exodus of parent companies or primary subcontractors has put smaller factories under pressure to convert to other industries, and on top of this, the "Oil Shock" of 1973 reduced the amount of work, and the smaller factories suffered to meet parent company demands for cost cutting. In this process, smaller factories reconsidered their dependence on a single company and adopted a risk spreading system of specializing in specified fields of processing work, accepting work orders from multiple companies. This also made it possible to branch out into fields of little competition by specialization, and to take advantage of the high degree of concentration and produce sophisticated finished components or finished products of high added value through business tie-ups and compensation among specialized companies.

Starting in about 1975 the industries in Ota City, which had overcome two oil shocks through rationalization and specialization in technical fields in which they have an advantage, made further advance in the fusion of mechanical and electrical control technology known as mechatronics and starting in about 1985 they took a step further and introduced numeric-control automatic processing and NC machine tools, creating a production system of small lots, short deadlines, and high precision.

It has been said "if you airdrop the design drawings for anything into Ota City, the next day you will have a great finished product". The concentration of factories in Ota City has attracted worldwide attention as a unique area of concentrated full-set high grade processing technology and has come to be called a "National Technopolis"

4) The bursting of the bubble economy and the first step toward tomorrow
The production of prototype products in development and of initial-lot products prior to mass production has been the specialty of national technopolis Ota, which has hard hit by the period of economic upheaval in 1989 that is referred to as the bursting of the bubble, following which orders for prototype products fell. This was an particularly heavy blow for mold manufacturing industries, but industry in the city was united in coping with the situation.

Administration and industry took the first step towards the 21st century under the slogan set forth in the Ota "Ota City Industry Vision" of March 1995 (where O = open mind, taking the world as the field of action, T = technofront, the front line for a city of concentrated technology for the 21st century, A = amenity Stock, building a pleasant urban setting suitable for fostering new industries).

3. Policies and Outlook

1) Provision of an industrial environment
Creating a town where the siting environment is one of harmony between residential and industrial use. With respect to where factories should be located, there is the traditional urban planning concept that the industrial environment should be separated from the living environment. But in Ota City, where the actual situation of small factories encourages proximity between one's residence and one's workplace, the view is that there should be harmony between residential and factory land use, as exemplified in the factory concentration activities known as the Omori Minami Factory Apartment (Omori Machining Center). There are ten factories on the first floor, with publicly run apartments on the second through eighth floors, in a vertical arrangement of residences and factories adjacent to each other. Various efforts have been made in the structure of the building to prevent the transmission of noise and vibration from the machine factories, creating separate spaces so that the living quarters and the factories seem to be completely apart from each other. This sophisticated use of the land lessens the land burden, and factory employees are given preference in being allowed to live in the building, thus ensuring that one's residence is conveniently close to home. In the ten years since the factories and the residences. This is one of the activities for improvements for small and medium-sized enterprises,

and "factory joint use activities" for small enterprises are being applied, with substantial financing assistance.[56]

Since then, two activities have been carried out in Ota City on factory apartments to which such financing has been applied. Both involve a move to Jonanjima, which is reclaimed land along the coast.

Construction of factories for short term rent. Land prices as of 1985, per square meter of land, were about 350,000 yen even in built-up areas in the city, which was within the economic reach of small businesses for subdivision type factories. But in 1987 and 1988 land prices shot up to a peak of about 920,000 yen, and although they have been settle down recently, in 1995 they were still at the level of about 540,000 yen. This is hardly economically feasible for small enterprises, which find it difficult to develop their business with a purchased factory. In response to the demand for a better industrial environment for smaller business, Ota City planned and built rental factory apartment house.

Activities to provide an environment of residential industrial harmony. An urgent task to be tackled is to transform the area into one where industry and daily life coexist, by providing the proper environment, whether through purchase or rental, for fostering harmony between the two. This requires consideration not just of development of isolated bases but of neighborhood facilities. Ota City is working on "activity to provide an environment of residential industrial harmony", taking the site at 2-12 Hon Haneda as a model case for providing an environment of residential siting. This is a total neighborhood redevelopment plan for residential, commercial, and industrial coexistence along the three directions of (1) providing a model for "creating and industrial environment" as in the "Ota City Industry Vision" report of 1995. (2) Providing opportunities and facilities for taking full advantage of the technical and managerial resources of the nearby concentration of industry, and (3) promoting the "construction of techno-condominium" as in the "Ota City Industry Vision".

Through these measures, Ota City has sought to create support infrastructure as intended by the Law for Special Measures to Activate Accumulation in Specified Industries.

Dealing with deregulation. Another activity concerning land use policy was to call upon the national and Tokyo metropolitan governments for revision in regulations. Ota City has been engaged in moves to call for a loosening of the regulations under

the Industrial Restrictions Law and relaxation of type 2 special industrial district restrictions. These moves have had some success, but national policy on the industrial land use environment around large cities is still very restrictive. The Industrial Restrictions Law was enacted in 1959 to limit the concentration of population that it assumes factories cause. This unnerved industrialists near large cities, making them apprehensive about the continued siting of their factories in urban areas where pollution and high land costs are a problem.

Any industrial measures can be liked building a castle in the air unless industry has strong roots in a region and has such soil. In this sense it can be said that industrial land use policy is fundamental. But in the face of today's period of structural conversion, such land use measures alone are hardly enough for a fresh outlook on the future. The small and medium sized enterprises of the region need a base camp to store up energy to break out of their shell and taking wing, and there is a demand for new industrial support facilities for this purpose.

One function to be provided at such a base in (1) the convention function of a forum for exchanges in order to appeal to people in a wide range, break through fixed ideas by getting in touch with each other. And foster creativity by a turnabout of concepts. (2) it must also have the function of a trade center where products are bought and sold, being a technical center where people can polish up technical skills and support research and development, (3) providing also the function of a base for receiving various information and disseminating one's own information. Thus it is essential to have an industrial center that conforms to the industrial characteristics of the region and serves as the core for providing total support functions. Plans were decided upon for the Ota City Industrial Plaza to replace the Ota Trade Center that opened in 1960 and for the Tokyo Metropolitan Southern District Small and Medium-sized Business Center, which follows the concept of a Tokyo regional center, and the opening was held in February 1996.

2) Activating industry

The organization of the measures listed in the Ota City implementation plan are shown in the figure of last page with respect to the basic theme of ensuring industrial vitality, it include diverse software strategies in this way, among which we describe a number of activities that help to set the future direction.

Formulating an industrial policy. A report is prepared based on the arguments of industrialists in the city in conformity to the themes every year, and it is submitted

through the Ota City Industrial Promotion Measures Committee. This has played a big role in coming up with the specific of policies.

Based on the "Ota City Industrial Promotion Law" enacted in October 1995, various plans are being developed for realizing the "Ota City Industrial Strategy" advocated by the report of the "Ota City Industrial Vision Committee".

Nation wide, 18 municipalities participated in the planning for the Industrial Town Network Promotion Council, which was established in November 1996. Its purpose is to "promote the solution of problems through exchange concerning local industrial policy, promote ties between citizens, researchers, and businessman and network of enterprises between regions and contribute to the development of the regional economy".

A municipal Liaison Council for Small to Medium Sized Enterprises has been established to deal with the common tasks of the Chamber of Commerce and the 10 self-governing councils within the high concentration of small to medium sized enterprises. In 1998, the 2nd Inter-City Summit for Small to Medium Sized Enterprises was held in Ota City and was highly acclaimed by the participants.

Comprehensive consultation. Comprehensive consultation is provided through a single liaison, with the roles divided between the city of Tokyo and Ota City. Consultation that is particularly relevant to small- medium sized companies is provided, such as consultation in financing, receiving and placing orders, and foreign transactions. Appropriate advice is provided while ascertaining the actual nature of the company. In particular, to widen the range of production transactions in consultation about receiving and placing orders, parties are held to exchange information about orders in a widening domestic network, with participation by many people outside the city. And interest from abroad in the industry in Ota City is growing year by year.

Managerial and technical assistance. New-product and new technology contests promote the development ability of small-medium sized companies in the city, and prize-winning products can be exhibited in such trade fairs as Technopia Tokyo, leading to the development of a nationwide market.

Joint exhibiting is also done at overseas trade fairs targeted to the fast-growing Asian market, and many trade talks take place at these fairs. Since even existing basic

technology has not taken root in many regions of Asia, much less high tech, many inquires are received to Ota City exhibitors. Even is one proceeds from the stage of assembly industry to the level of being able to be manufactured from parts, it is no matter to learn the fundamental technology that supports these industries.

Finding talented people is essential for the continued existence and development of an industry. Activities in this direction include the recognition of "factories of excellence" that fit in harmonious with their surrounding and are a pleasant place for workers, as well as publication of a company guidebook to aid in recruiting workers.

Information services. Collecting and providing industrial information is a highly ramified undertaking, and in addition to the long-standing activities of surveying trends in the industrial business climate, publishing Technoplaze, providing a database network for industrial information (in the manufacturing industries), and running the Ota City information booth at Haneda Airport, since the move of the industrial plaza, the Ota City have begun industrial information service consultation such as design consultation, as well as operation of a new information corner. The information corner provides such full services as database information retrieval access to the Internet, and other PIO functions. The Ota City also have set up a personal computer-based catalog production system that allows small-medium sized companies, for a low fee, to prepare guides about their company and create their own product catalogs.

Promotion of exchanges. Exchange between different industries have been organized, at the behest of the city, into six groups, and group contact meetings are actively held. They have produced the results one would hope for from exchanges between different industries, such as the development of new products.

Planning exhibits are held to take full advantage of the PIO exhibition function in creating and industrial community. Exhibits and events that were not possible at the Ota Trade Center have become possible through greatly expanded facilities, and are being held on a grand scale.

Provision of a performance system. The Ota City Industrial Promotion Organization was set up on October 1, 1995 as a foundation to promote industry in Ota City. The industrial economy division, which is its administrative organization, is responsible mainly for policy and systems, and the organization has the responsibilities to put these activities into practice.

3) Dealing with future directions

As explained above, a notable feature of industry in Ota City is that it forms a concentration of basic technology to support Japanese industry as a whole, especially in the fields of machinery and metals. Many mass-production factories have moved to outlying regions or abroad, while factories in fields relating to development prototype production or requiring special processing technology, or independent enterprises, although small, continue to exist as creative product manufactures taking full advantage of the high concentration of technology. These factories do their work as a network, so if a major set manufacturer moves overseas, they cannot follow. Although the great shift to overseas production and internationalization will not immediately de-industrialize Ota City, it will not do simply to stand idly by.

Under the currently severe economic conditions, with the potential for an active drain of technology and market development by the high growth regions in Asia. Mutual exchanges must be encouraged and the division of labor along international lines must be clarified. There is no doubt about the usefulness of this accumulated fundamental technology in developing the industries of Asia. However, it is essential to measure long-term outcome and expansion.

So since fiscal 1996 the city has sponsored "successor training seminars" to meet the need for trained people and "business startup seminars" to encourage the inauguration of new independent businesses. In addition, the Tokyo Metropolitan Southern District Small and Medium-sized business center is using its facilities and equipment to carry out "development cooperation activities" to offer assistance in development.

Furthermore, due the serious questions raised about the maintenance and improvement of technology and skills due to the "departure from manufacturing" of today's youth, from 1998 to 2002 the Ota City area has been singled out by the General Project the promotion of Regional Human Resources. Efforts are being made toward the promotion of human resources by the means of the creative power of the new generation of engineers and technicians designated as techno-creators.

From now on, it is thought, the technological base of the Asian region will improve, as will its international competitiveness. Back home in Japan, as production facilities are moved off-shore, the Ota City face the national danger of the hollowing out of industries. It is a crucial challenge for Ota City to form stronger links with other regions of industrial concentration in new production networks in order to build a

domestic system that will be able to face up to international networks in order to build a domestic system that will be able to face up to international competition. In order to make the conversion from a full-set industrial structure in a single region to and industrial structure involving a wide area network, it is required that there should be exchanges between enterprises in different regions, including collaboration between municipalities.

And to develop technology in new fields it is necessary to foster exchanges between industrial and the academic world to enhance the potential of a wide range of connections. Starting a new in fiscal 1997, activities to promote exchanges between industry, academia, and government will be carried out in which regional public bodies will provide the opportunity for the exchange of information. In addition, there is growing interest in the ISO 9000 and ISO 14000 international standards for quality control and environmental management. And these commercial conditions must be met in order to expand international trade. A good corporation presentation on the Internet is also thought to be of growing importance. Even for small-medium sized companies, it is mandatory for the survival of the company to have a good information strategy for developing sales channels for products and technology. The Ota City are building a comprehensive support structure by providing industrial information, disseminating information on the Internet, and assisting in information presentation through the third-sector O-net.

In conclude, the success of Ota City attribute to two aspects, one is the concentration of industries, especially the machinery and metal. The collaboration network generated from the concentration of industry is particularly advantageous in fabricating prototypes of product under development, as well as for processing of a high degree of difficulty, making the Ota City has the strong competition advantages in Japan even in the world. The second one is that the public funded organization like the City Industrial Promotion Organization and the Plaza Industry Ota (PiO) play a very important role, for information exchange and the cooperation between universities, research institutes and the industry. It provide strong impetus for the technology innovation in Ota City.

IV. Tohoku, Japan

1. Overview of the Tohoku region

Tohoku, the Northeast area of Japan, comprises seven prefectures, Aomori, Iwate, Akita, Miyagi, Yamagata, Fukushima and Niigata. Although the Tohoku region

covers 20.1% of Japan, its share of population is only around 10%. Tohoku's share of population in both 1920 and 1955 was about 13%. Meanwhile, the Tokyo metropolitan area's share of population increased from 13.7% to 17.3%. During the consequent period of high economic growth, the population of Tohoku declined rapidly, although, at all times since the war, inter-prefectural net migration has remained net emigration on balance.

Table 6-2 Inter-prefectural net migration (1000 persons per year)

	1955	1960	1965	1970	1975	1980	1985	1990	1991	1992	1993
Tohoku region	-96	-153	-136	-117	-24	-23	-43	-38	-27	-21	-12
3M	366	595	485	312	11	9	103	91	60	53	16
Tokyo Metro area	251	355	326	270	66	50	123	117	95	77	43

Source: Management and Coordination Agency, Statistics Bureau

Even from time after the end of the high-growth period, the Tohoku region still experienced the long-term shift in the balance of the industrial structure generally referred to as "industrialization". Furthermore, a change in the size of manufacturing establishments has been discernable since 1980 and it was attributable to the rapid increase in the number of factories in the Tohoku region. But the share of small and medium industry in Tohoku is still overwhelming, with only 5% of employment in firms of 100 persons or more in 1993.

GDP statistical data indicate some features of the Tohoku region. As mentioned, the region still experience the double structural changes of industrialization and de-industrialization, and Tohoku's share of GDP had been declining through the process of de-industrialization as well as in the process of industrialization.

Table 6-3 working person's distribution by industry

	Japan			Tohoku region		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
1955	41.1	23.4	35.5	58.4	14.2	27.3
1960	32.7	29.1	38.2	51.7	17.2	31.1
1965	24.7	31.5	43.7	43.8	20.2	36.0
1970	19.3	34.0	46.6	36.6	23.2	40.2
1975	13.8	34.1	51.8	28.5	26.4	45.1
1980	10.9	33.6	55.4	21.5	29.2	49.3
1985	9.3	33.1	57.3	19.0	30.2	50.8
1990	7.1	33.3	59.0	15.0	32.3	52.6

Source: Management and Coordination Agency

In either the secondary or tertiary industries, the shared percentage of output is continuously less than the shared percentage of working persons engaged in each industry in the Tohoku region. As for the agriculture, the reason that Tohoku's share of output is
relatively high is that the agriculture of this region has its mono-cultural concentrated in rice production. And for the same reason, many high-tech factories moved to locate

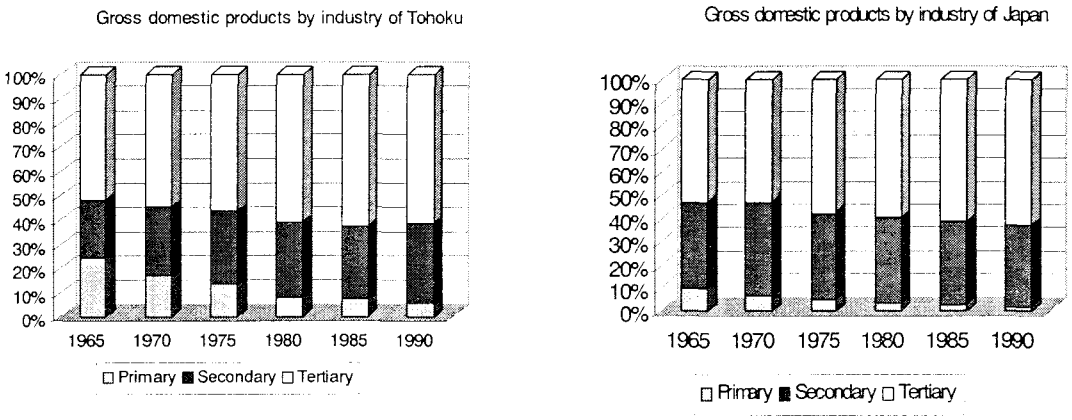


Fig.6-8 The Gross domestic products by industry of Tohoku and Japan

in Tohoku. In rice-farming regions where new factories rise like castles above rice paddies, eldest sons and their wives who live together with farming parents are employed in high-tech industries. Such households are also part-time farms, which, because of the modernization of rice farming, do not require constant work in the rice fields. On the other hand, the Tohoku region lags far behind metropolitan areas in new industries such as information technology (Tohoku's share of persons engaged in information service industry was 3.5% in 1990). The indices of foreign trade in the Tohoku region are also very low (Tohoku's share of value of exports is only 0.15% in 1990), although official statistics are based on Custom House location, so there may be some under-assessment. According to input-output analysis estimation, percentages of amount of exports and imports for Tohoku are 3.0% and 4.3% respectively of Japan's aggregate. This means that many high-tech firms located in Tohoku are export industries, much influenced by the exchange rate of Yen.

The enduring structure whereby the region's share of income is less that its share of population, and the region's share of local government expenditure and administrative investment in public works is more than that share of population is unchanging. The income differential between the Tohoku region and Greater Tokyo narrowed until 1975, but since then has widened again. Following table shows that much of the

administrative investment was concentrated on the metropolitan areas during the high growth era. During the Third NCD Plan and period since the oil shock, the emphasis in public works has been shifting to non-metropolitan areas, but since the beginning of the Fourth NCD Plan, the previous trend has been reversed slightly.

Table 6-4 Prefectural income, local government expenditure and administrative investment, per capita (national average=100)

	Prefectual income		Local government expenditure		Local taxes for all revenue (%)		Administrative invesment	
	Tohoku	Tokyo	Tohoku	Tokyo	Tohoku	Tokyo	Tohoku	Tokyo
1965	64.0	149.0	112.0	91.0	13.6	53.7	92.0	118.0
1970	71.0	152.0	116.0	92.0	17.6	60.2	95.0	107.0
1975	89.0	166.0	122.0	85.0	15.4	51.9	112.0	89.0
1980	87.0	160.0	128.0	81.0	12.0	57.8	129.0	82.0
1985	84.0	162.0	122.0	84.0	19.6	63.7	118.0	82.0
1990	80.0	152.0	118.0	90.0	20.9	64.9	111.0	100.0

Source: Economic Planning Agency Ministry of Home Affairs.

From the macroeconomic point of view, one explanation is that, in order to overcome the so-called the "Oil Shock" in the early 1970's, an increase in consumption and higher-yielding capital investment was needed domestically. Surplus capital poured into the Tohoku region (invested first in land speculation), because Tohoku's backwardness meant that it was the last remaining region in Japan that could potentially receive new industries. Induced by public investment, which increased along with the general rise of prices and income as a result of Oil Shock, housing and factory construction boomed in the Tohoku region for the first time. These investment were facilitated by an ideology of "the age of localism", advocated strongly from both ends of the political spectrum during the period, through which the adjustment of regional disparities generated new development gynamics.

From the Tohoku region's point of view, its advantages in terms of resource and space have resulted in a "high-tech land". There were many reasons that direct investment in the Tohoku regions have been made subsequently. First, the Tohoku Shinkansen and the Tohoku Expressway have facilitated the movement of people from all parts of Tohoku to the Tokyo metropolitan area. Secondly, there was an abundant supply of energy and water for industry use. Thirdly, rich farmland, virgin forests and the surrounding sea all made for the kind of attractive environment then sought by new high-tech industries. However, more than anything else. More specific reasons that business people should seriously consider direct regional investment were

land prices and the nature for the labor force available in Tohoku area. The average land price for manufacturing sites in coastal industry parks in metropolitan area was ten or more times that of industrial parks in the Tohoku region. Tohoku accounts for the one-fifth of the total area of Japan, and it land was very inexpensive by Tokyo standards. Another important reason was wage rates, which were on average approximately 20-30% lower in the Tohoku region than in metropolitan areas, and yet the standard of education was more or less uniform throughout the country. Rather, the people of Tohoku region were consistent, dedicated to the maintenance of harmony, and dependable, and their finished products were of high quality.

How much had the agri-industrial complex structure- formed as a result of the location of high-tech firms during recent decades- changed the indices that had been referred to as evidence of the "backwardness" of the Tohoku region was largely attributable to young workers moving from Tohoku to the Kanto industrial region. Even now, the percentage of student who go on to university is relatively low, and for university graduates seeking employment opportunities the environment is less favorable there.

The value added of manufactured goods shipments has certainly increased every five years and Tohoku's share of Japan's total has also steadily increased. But it is regrettable that regional differences in productivity between the Tohoku region and metropolitan areas had hardly been reduced. The more regional economies are buffeted not only by international competition and fluctuating currency rates but also regional competition within the national economy, the more the incentive factors attracting R&D functions and foreign investment become essential to respond to the global competitive challenge and secure the basis for self sustaining growth. But statistical data concerning the location of private R&D by region and patent applications by region show how poorly the Tohoku region fares in its share of regional strategic resource.

Looking in more detail at differential growth between industries to glimpse the prospects for "high-tech Tohoku", it is most striking that, in recent years, the leading industry in the Tohoku region is now electronics, which accounts for a quarter of all manufacturing in the 1990s, from only 5% at the beginning of the 1960s. However, excessive concentration in that particular industry and its relatively low productivity are to be interpreted rather as weakness in terms of the regional economy, because it is increasingly at the mercy of external economic changes. Since the late 1980s, the rush for a Tohoku location by high-tech firms reversed, resulting in the "hollowing

out" of the regional economy. According to a survey of the Hokkaido-Tohoku Development Finance Corporation, the electrical industry has begun to shift mass production functions and labor-intensive production to newly industrializing economies in response to the high exchange rate of the Yen since 1985, and to shift value added and capital-intensive production and part of production to China and ASENA in addition to new industrializing economies since the 1990s. The majority of high-tech industries located in the Tohoku region are branch plants, carried out routine production functions with relatively low-status jobs, whose top management and most research and development activities are located outside the region, usually in Tokyo. Branch plants purchase much input from outside the regions and have close technical links with others in the Tokyo metropolitan area.

The main cause of relatively low value-added productivity in the Tohoku region is largely attribute to the labor-intensive firms and the low rate of technological innovation. In seeking to link itself to the continuing global process of techno-industrial innovation, the Tohoku region faces strong disadvantages because of its initial conditions of relative backwardness, although opportunities to attract more advanced production are by no means ignored.

2. Innovation efforts in the local region

Under the governmental system of Japan, local governments had limited instruments available to encourage innovation and diversify their area's economic base. Major institutions sought to strengthen technological capability throughout the country. In SMEs the Public Experimental Station owned by prefecture government were of key importance. Half of all public research institutions owned by prefectural government were established before 1950. As the policy implication of the establishment of those institution was to modernize local technologies and to stimulate technological innovation activities in SMEs, the major functions of those institutions were focused on technical guidance, testing and analysis. Prefectural governments were not familiar with research management or know-how to utilize results of research for local regional economic development and enhancement of quality of life. They had mainly been modernizing local industries, which were principally SMEs, and attempting to develop new industrial zone by luring manufacturing enterprises.

In order to develop creativity, it is essential not only for industry, university and government to do their best in their respective capacities, but also for them to coordinate and share the work. Technological changes now require a higher level of cooperative R&D activities and close interaction between basic science and product

and process technology. Thus the university-industry connection is essential for enhancing basic research and innovation development linkage. Particularly in local regions, the university is a key center for basic research, but has difficulties pushing R&D itself without sufficient funds. Industry wants to acquire new innovative technology by utilizing human resource by utilizing the human resource and facilities in university.

Table 6-5 Science and technology budget of the Tohoku prefecture government(fiscal year)

	Annual constant S&T budget (million Y) A		Per capita (Y) A1		A/B (%)		A/C (%)		A1/D (%)	
	1990	1992	1990	1992	1990	1992	1990	1992	1990	1992
Aomori	8.943	10.250	6.030	6.964	0.24	0.26	1.36	1.43	0.27	0.31
Iwate	5.090	5.231	3.592	3.699	0.14	0.13	0.77	0.71	0.16	0.15
Miyagi	5.030	9.847	2.237	4.324	0.07	0.13	0.69	1.21	0.09	0.16
Akita	8.963	12.479	7.031	10.23	0.27	0.37	1.5	1.89	0.32	0.43
Yamagata	4.650	9.414	3.694	7.502	0.13	0.25	0.82	1.47	0.16	0.31
Fukushim	5.121	8.262	2.434	3.907	0.07	0.11	0.64	0.94	0.09	0.14
Niigata	6.815	7.662	2.753	3.096	0.09	0.09	0.66	0.65	0.11	0.12
Toholu	44.612	63.145	3.653	5.164	0.12	0.16	0.88	1.25	0.14	0.20
Total		421.10		3.384		0.09		0.89		0.11

Notes: B: gross prefectural product. C: total prefectural government budget. D: prefectual income per person

Source: Study of regional science and technology promotion, Science and Technology Agency

In terms of regional policy, the national government sought to redistribute growth spatially by establishing dispersed high-technology industrial complexes through stimulating and harnessing the innovative potential of SMEs and new enterprises. However, in local regions such as Tohoku, local government which had to take the initiative in acquiring the designation of the plan and implementation, tended to see it as a device to attract high-tech firms into hitherto empty state-led industrial sites.

3. Tohoku Intelligent Cosmos Plan [57]

The Tohoku Intelligent Cosmos Plan (TICP) was a regional development project jointly initiated in 1987 by the leading industrial, academic and administrative bodies of the entire region, which promoted the creation of bases for advancement of industrial technology and enhancement of the information function, technological capacity and academic expertise in the region, including seven prefectures in the global and longer-term perspective. The goal of this plan is to make Tohoku region Japan's "Center of basic science and technology in the 21 century". The strategy is accumulation and advancement of academic, technological and information function.

The four basic projects are R&D, support and incubate of new industries, advanced network, enhance infrastructure. But aiming at far more than regional development, it addressed the structural problems of Japan as a whole. It will provide more credible solutions for them, the aging population, the problem of investment, the nature of the future industrial structure, and the nation's need to find an ethically acceptable role suited to its capacities and ambitions.

"Cosmos", first of all, implies an ordered universe, one that neither degenerates into entropy, but in which the hand of design and of deliberate creation is visible. This universe would be "intelligent" in that it will make, to changes in its environment, response that are both rational and appropriate to its overriding concern with the quality life and humanity. It intends to be driven neither by a crass concern with mere profit mere by a headlong impulse to exploit all or any of the capacities of scientific discovery, comes what may.

Looking back upon its plan-making process, there were three unprecedented characteristics differing from other regional plans, first, this was a plan not from "top down" but from "bottom up". Since in the past, the regional development plan had been formulated by the central government, based on drafts written by central departments. In 1987, just before the Japanese government issued the fourth NCDP, some members of the TIC promotion committee (especially academic members) proposed their plan enthusiastically as the alternative to promote the future development of the Tohoku region. The conceptions of their plan and that of the national plan were not the same, but they worked on the national government in order to acquire resource to carry it into effect and they succeed in the attempt to incorporate the aims of their plan in the national plan. Secondly, this was not merely the sum of prefectural plans in the conventional mode of budgetary acquisition groups, but the regional plan in which seven prefectures are linked laterally with each other under the "holon" philosophy, meaning dynamic equilibrium between whole and individual or competition and collaboration. In the Japanese government system, where there are some regional bureaus of central government but no regional government, each prefectural government is usually very independent from the others and rather competitive in seeking subsidies and benefit from the central government, so mutual cooperation is difficult. In this case, it took ten months for them to agree to sit around the same table and to consent to make the regional plan from the bottom up, and another year and half to draw up the plan. However, in the end, they overcome the historical difficulties.

In this plan, the role of Tohoku University (founded in Sendai in 1907 as the third imperial university in Japan, comprising the College of Agriculture and College of Science, but now with ten faculties and seven research institutions) was crucial. Tohoku University, carried out as its ideal an "open-door" policy and the "research first" principle, from which stemmed such inventions as ferrite. The revival of the traditions in present circumstance was proposed as the slogan of TIC Academic Society. From a regional point of view and through its effort to advance creative research, its aim is to link regional development to national and global processes of techno-industrial innovation.

The plan, encompassing a vision for the coming 30 years period and for goals and strategies appropriate to it, can also be interpreted as the region's bid for an enhanced status on both the national and global stage. For this to become a reality, the plan envisaged a twofold strategy. First, it seeks to achieve a qualitative enhancement and an absolute increase in the supply of information, technological capacity and academic expertise. Secondly, by establishing certain pivotal centers linked at various levels (personnel, information and research) to a wider network, seven prefectures will be able to function globally as a single unit.

More specifically, innovative research and development were to be promoted. Results of this concentrated drive towards greater scientific and technological creativity would then be funneled through to industry and economy by an applications system built for the purpose. It is considered of prime importance for strong and mutually supportive links to be forged between industry, pure science, and technology. An inherent part of this is an increased emphasis upon provision and availability of information, and expanded three way flow of knowledge between Tohoku and the rest of Japan, and then to the rest of the world. This in turn necessitates attracting many scientists and other professionals in various fields from both Japan and overseas and creating conditions specifically to facilitate such mobility.

The TIC plan has been steadily advancing it course since it proposal in 1987. In the implementation of its first objective to promote innovative scientific and technological R&D, a systematic institutional structure is currently under development for this purpose, as is the design of a research friendly environment. In addition, the foundation of actual R&D companies and organizations is already being promoted, and an integrated network for the most efficient and coordinated management is being formed. One example is ICR (Intelligent Cosmos Research), [58] an organization specifically designed to support strategic R&D efforts and to

facilitate industrial applications of R&D. The capital is 8.3 billion yen, only 13 employees, the revenues is from interest and room rents. It was supported by local government but "independent". As of 2000, 14 R&D corporations had been established through joint investments by national and local governments and private companies, 2 of them had been commercialized. The targets of these corporations are both generic and specific technologies making a special contribution towards solving problems peculiar to Tohoku.

According to the plan, each R&D company passes through two-stage processes consisting of an academic R&D phase limited to six years, followed by six years of industrial application. Since 1987, basic academic guidelines for research projects were submitted by researchers from universities in each of the region's prefectures. At the present stage, an immediate concern for project planners is transformation of companies from the R&D phase to the next phase of industrial application. Achieving this requires two groups of managers with specialized competence in two areas, the first group must be able to interpret scientific results obtained from research, and the second group must be able to apply these results to future industrial projects. These are the same requirements for the second program of the plan to foster development of "ventures", to which the positive commitment of the industrial community is to be expected.

In parallel with implementation efforts inside the region, the TIC group worked on the national government to localize regional policy, eventually leading to support and encouragement of regional initiatives, since carrying their plan into effect would require both radical policy changes at the national level and regional institutional innovation. They won governmental approval to make a comprehensive survey of measures for promoting the TIC plan, and survey committees made up of members of the academic, industrial and governmental communities from Tohoku as well as Tokyo respectively.

A very new organization, New Industry Creation Hatchery Center (NICHE),[59,60] was established in April, 1998 and completed in April, 1999 as a collaboration center between the Tohoku University and the industry. The characteristics of NICHE is to nurture and develop new technologies and industries by utilizing the academic and applied research results. NICHE has different and complementary purposes with other centers at Tohoku University such as Center for Interdisciplinary Research for creating basic idea and principle and Venture Business Laboratory for training center for graduate students with advanced technology. NICHE employs a liaison office with

a full time professor, an associate professor and two research associates to facilitate communication and discussion with the small and medium sized enterprises and society. In NICHE ten research groups have been carrying out collaborative researches with industries at a newly constructed building in February, 2000. Each group is composed a full time professor, a cooperative professor from outside university, researchers and post doctoral follows. In NICHE there are over 200 cooperative researchs in Tohoku University to do research developments and liaison activities. In November, 1998, TLO was established for claiming intellectual property right of the inventions from research results by professor et al. and technology transfer to industries. This TLO is a private company named TOHOKU TECHNO ARCH CO., Ltd. was invested by researchers in national universities and technical colleges in Tohoku area including Niigata prefecture. NICHE had been contributing for creating a new industry as a final target, based on the intellectual properties accumulated in the universities through actively created collaborative researches with the industries.

4. Prospect and the policy implication

In the future, a shift from responsive adjustment strategies to offensive ones was needed for the Tohoku regions to be involved in its own initiatives for the future. Experience of Tohoku region shows that the response to the ever-changing environment should be reflexive, and a shift from responsive adjustment strategies to offensive ones was needed for the Tohoku region to be involved in its own initiative in the future. It also required redefining the concept of the Tohoku region, not only as a product of its history and tradition but also as a challenging space for constructing a region-based consortium which would encourage vigorous experimental action and innovation among people living, studying, and working in Tohoku. TICP was a beginning in this age of growing globalization. At the first stage of this change, plan organization itself had to be set up as a dynamic system of positive feedback, in which the knowledge and energy of individuals and collective agents were able to be exploited to the full, while overcoming the inertia of previous thinking and removing existing institutional framework constraints. Most important issue for the development and innovation of Tohoku region is to change from the "catch-up oriented" to a "innovation oriented" ones.

CONCLUSION

Under the globalization of world economy, regional development and innovation are becoming more important than ever. Perfecting the regional innovation systems that support the technology innovation and economic development in the region is a critical issue. Although every regional innovation systems in different country are varied greatly, the kernel of one area can be applied to other areas.

Japan is a developed country, has distinct characteristics on technology innovation and regional development. As the biggest developing country, China implemented the reform and opening up policy from the end of 1970's, has great developing potential. The comparative study of the regional innovation system can give us clearer recognition and policy implications. Both Japan and China had made great effort to promote the technology innovation and economic development in region. Especially the regional science and technology promotion policies and many programs that aimed at promote technology innovation and new business starts up. All these policies and programs had become the important tools to push forward technology innovation and regional development.

Regional Innovation System is a complex mixture of institutions and policies that influence the innovation process at the regional level. The region is a territorial unit and its innovation system is not a single systematic mechanism but rather a cluster of various internal and external policies and institutions operating in that space. Generally, the regional innovation system consists of enterprises, universities and research institutions that participate in technology development and dissemination, the policies and programs, is a regional innovation network system with market intermediary and government take part in and for the creation, reservation, and transition of knowledge, skill and new products. There are many kinds of regional innovation systems depending on the different country's developing background, different industrial type and different region's characters.

Enterprises are the core of regional innovation system, especially the Small and Medium Enterprises are the most active and creative ones, has significant meaning for the regional development and technology innovation. Both Japan and China had paid great attention to the development of SMEs, Japan will support the new start-ups and job creation, support for the business innovation at SMEs, and creating environments conducive to growth for the entrepreneurs, ventures and small business, supporting

for business reform at the small business that provide energy and vitality for local economies, programs to revitalize local economies. China's SME policies focus on perfecting the overall administrative agency for SMEs, establishing and perfecting the law and policies system for the development of SMEs, and strengthening the financial support to SMEs, etc.

Financial supporting institutions such as the Japan Finance Corporation for Small Business and the Small and Medium Enterprises Innovation Fund of China is very important for the development of SMEs and regional innovation. Compared with Japan Finance Corporation for Small Business, China's Small and Medium Enterprises Innovation Fund is quite young, many of the fine experience of Japan Finance Corporation for Small Business can be taken as the reference. For playing the role of the Fund more efficiently, the Fund should provide the small business with effective and useful information and supporting them continuously, adjust and add the kinds of loan to meet the changing need of small business.

The case study from both of Japan and China shows that, every regional innovation systems has their distinguished characteristics, but to be successful it must be the "innovation oriented" rather than "follow up oriented". Every region facing some challenges, just during the overcoming challenges and interacting from inside and out side, the region can be success and can be always creative.

Although Japan carries out market economy, the government plays a very active and important role in promoting technology innovation and economic development in the region. National and regional government and many public supported sectors provided information, fund, exchange avenue for the industries, universities and research institutes. Many effective programs and institutions to promote the science and technology development in region had established implemented and played a great role.

But most of these efforts are the kind of "Up-to-Down" ones, these kinds of efforts sometimes lack of the endogenous enthusiasm, it is difficult to reach the desirable results. So while keeping the "Up-to-Down" efforts, some "Down-to-Up" works should be down. Some excellent local practice experience should be paid more attention and be concluded as the policy measures. And the local government, which is much close to the market, should have more autonomous power to formulate more flexible and suitable policies for the regional development. The implementation of

science and technology promoting project should be reviewed and given new contents according with the change of developing situation.

For the physical and non-physical mechanisms of the regional innovation system, how to further play the role of non-physical mechanism is a very important issue in regional innovation promotion. In promoting the regional development, it should be paid much attention on the supporting system construct rather than only on some aspects of them, to improve the whole efficiency of the system.

In the future, Japan should perfect and further strengthen the evaluation system to the national research institutes and universities, and make the evaluation result be related with the research budget allocation and the promotion of the research personnel, to promote the improving of research level. The commercialization and industrialization of research results should be paid more attention, and to be taken as one of the important evaluation index.

More attention should be paid to the SMEs. For the SMEs especially the new start ups in both these two country, lack of fund is the biggest difficult, the country's support like Japan's SFS and China's Innovation Fund is important but insufficient for the rapid development of SMEs, so the venture capital and other kinds of investment should be greatly encouraged to develop.

As for the technology transfer and new business start up in universities, the professors should be given more loose policy environment to conducive the spill off effect in university. In the process of innovation and new business start up, strengthen the pulling force and the government pushing force, through the perfecting of policy and social environment to improve the creative capability of the region. In promoting regional development and technology innovation, the role of university should be fully played. In the building of China's university S&T Park, the experience of Japan's TLOs, University and Industrial Cooperative Study and the Regional Science Promoter (RSP) program can be used for reference.

With the globalization, science and technology will play more and more important role in regional development. How to improve the life quality of people in region relying on the progress of science and technology, how to improve the capability to prevent every kinds of risk and disaster, how to improve the knowledge stock of the region and how to improve the competitive ability of the region in the country, even

in the world are all very important issues for the regional science and technology policy.

There are great mutual benefit and mutual compensating rooms between Japan and China, especially in the field of regional science and technology promoting and regional innovation. For example the cooperative study of cluster and university's Science Park. The study of cluster is a very new field, cluster in fact is a kind of typical innovation system, with very strong innovation capability and potential. Both in Japan and China, there arise many clusters with distinguished features. So the overall and comparative study of the clusters in these two countries can give much clear feature description and recognition, reflect the diversification of the clusters. And further from which get some policy implications to promote the development of every kind of clusters, not only the information industry and not only the model of silicon valley in these two countries and even other countries in transition.

University Science Park is also a very new and important topic for Japan and China, both of these two countries had carried out many measures on the establishment and development of University Science Park. For example Japan Tohoku University's NICHE is a very new and distinguished organization, China had issued many effective policies on promoting the technology transfer and new business start up in universities, and get great achievement. But under the new development situation, some new problems arise, for example the ownership of new business, the capital and investment, the personnel and facilities of new business in university, and the revenue allocation, etc. All these problems need to be carefully studied and practiced, to facilitate the further smooth development.

In the cooperation of science and technology policy research between Japan and China, one kind of international forum or virtual international network should be setup, to keep the regular exchanging and stable communication between the policymaker, scholar and researcher, and conduct some collaborative research projects, it will greatly benefit the both sides.

REFERENCE

1. Hans-Jochim Braczyk, Philip Cooke etl, Regional Innovation Systems, UCL Press, 1998.
2. John de la Mothe and Gilles Paquet, Local and Regional Systems of Innovation, Kluwer Academic Publishers, 1998
3. NISTEP Report No.39, Study of Regional Science and Technology Promotion-Analysis of Science and Technology Policies by Local Government. 1995
4. K. Gonda & F. Kakizaki, Structure of Science, Technology and Industrial Competitiveness, the proceedings of NISTEP the Third International Conference on Science and Technology Policy Research
5. Ministry of Science and Technology of China, Development Report on China's New & High-tech Industry. 1999.
6. Japan Industrial location center, The Technopolis Project in Japan- it historical background and present situation, 1986
7. Science and Technology Agency of Japan, White Paper on Science and Technology, 1997, Striving for an open Research Community.
8. Yukio Sato, The structure and perspective of regional science and technology policy in Japan, The Fourth Regional Science and Technology Policy Research Symposium, 21-24 November, 1998 Chapel Hill, North Carolina
9. Annual report on the promotion of Science and Technology 2000 – towards the 21st century, Science and Technology Agency, Japan, June, 2000
10. China's Industrial Development Report 1999, China Zhigong Publishing House, Dec.1999
11. China Statistical Yearbook on Science and Technology 1999, China Statistical Publishing House, April, 2000
12. China Science and Technology Development Report, 1999, Economical Management Press of China
13. George Papaconstantinou and Wolfgang Polt, Policy evaluation in innovation and technology – towards best practices, http://www.oecd.org/dsti/sti/stat-ana/prod/evaluation.html
14. Marius T.H. Meeus, Regional Systems of Innovation From With- an empirical specification of the relation between technological dynamics and interaction between multiple actors in a Dutch region
15. Chu Xuelin and Li Hongyan, University Role in Regional Development, Sino-American Forum on Technology Policy, 1999

16. The Science and Technology Basic Law, Law No. 130 of 1995, Effective on November 15, 1995, http://www.sta.go.jp/policy/kihonhou/kihon-e.html
17. Science and Technology Agency of Japan, Promoting regional science and technology, http://www.sta.go.jp/shokai/98eg/2_12.html
18. NISTEP REPORT No.38, Comparative Studies on Science and Technology Parks for Regional Innovation throughout the World, 1999
19. Ministry of International Trade and Industry, Japan, Fiscal 2000 Priority Trade and Industry Policies, http://www.miti.go.jp/info-e/clP9982e.html
20. Ministry of International Trade and Industry, February, 1999, Law for facilitating the creation of New Business, http://www.miti.go.jp/report-e/gI1102e.html
21. Science and Technology Agency of Japan, Promoting regional science and technology, http://www.sta.go.jp/shokai/98eg/2_12.html
22. A vision of Universities in the 21st , versities in a competitive environment, http://www.monbu.go.jp/news-en/
23. Ministry of Science and Technology of China, White Paper on China's Science and Technology- guideline to China's Science and Technology Policy, 1997
24. Ministry of Science and Technology of China, Development Report on China's New & High-tech Industry. 1999.
25. Selected Chinese Policies for Promoting Technology Innovation and Accelerating Commercializing of High and New Technologies, Ministry of Science and Technology of China, 1999
26. Japan industrial location center, Present Situation of Technopolis and Techno-Network,1989
27. K. Gonda, Framework of Industrial Location Policy and Roles of Regional Science &Technology Policy in Japan, the proceedings of NISTEP the Third International Conference on Science and Technology Policy Research
28. Japan Regional Development Corporation (JRDC), http://www.jef.or.jp/news/
29. For the establishment of a New Technology Transfer System Related to Patent, http://www.monbu.go.jp/news-e/
30. Moves to establish Technology Licensing Office, http://jba.or.jp/jbl/no3/no3-6.html
31. NISTEP REPORT No.38, Comparative Studies on Science and Technology Parks for Regional Innovation throughout the World, 1999
32. Industrial location creates the future of the region, http://jilc.or.jp/home/pro/p04.html,
33. JANBO-Japan Association of New Business Incubation Organizations, http://www.jilc.isdn.ne.jp/e_index.html,

34. Ministry of Science and Technology of China, Development Report on China's New & High-tech Industry. 1999.
35. Beijing will become the city that has the most incubators in the world. http://www.bestinfo.net.cn/gei/cxxw
36. Ministry of Science and Technology of China, Development Report on China's New & High-tech Industry. 1999.
37. Small and Medium Enterprises Agency, MITI of Japan, White Paper on Small and Enterprises in Japan, 1999
38. Outline of Small and Medium Enterprises Policies of the Japanese Government, http://www.sme.ne.jp/sesaku/smeplcys/sme00html/
39. Points of White Paper on Small and Medium Enterprises in Japan, 2000, http://www.chusho.miti.go.jp/english/wp2000.html
40. Japan's SME Policies in relation to the country's economic development, small and medium enterprise agency, MITI, Japan, http://www.chusho.miti.go.jp/english/policies.html,
41. SME-related policies and information, http://www.chusho.miti.go.jp/english/index.html,
42. Small and medium Enterprises Agency, September 22, 1999, Outline of Recommendations from the Small and Medium Enterprises Policy-making Council.
43. Characteristics of JFS – Adopting a fair and impartial viewpoint as a government financial institution, http://jfs.go.jp/eng/approache.html,
44. Assessing business potential and assisting new business and business innovation – a sure eye for small business, http://www.jfs.jp/eng/operationse.html,
45. China's Small and Medium Enterprises- information and prospect, http://www.cnsme.com/chsme/zjlt/20042501.html
46. Wei Dong, The development and guide of China's Small and Medium Enterprises, http://forum50.cei.gov.cn/cdf/report/
47. Selected Chinese Policies for Promoting Technology Innovation and Accelerating Commercializing of High and New Technologies, Ministry of Science and Technology of China, 1999
48. The Study of Zhongguancun's Starting-up Support Policy, (research report) Mar, 2000, Great Wall Enterprises Strategy Research Institute.
49. Wang jici, Wang Jixian, An analysis of new-tech agglomeration in Beijing: a new industrial district in the making? Environment and Planning.
50. The Study of regional innovation capacity of Zhongguancun, (Research report) Mar. 1999, Great Wall Enterprises Strategy Research Institute.

51. Ministry of Science and Technology of China, Development Report on China's New & High-tech Industry. 1999.
52. Industrial promotion organization of Ota, http://www.o-net.or.jp/index-e.html
53. From a national Technopolis to a global Technopolis – guide to industry in Ota City.
54. Pamphlet, Ota City, Industrial Promotion Organization,
55. Pamphlet, Ota City Industrial Plaza
56. Unusual Characteristics of Ota City, http://www.o-net.or.jp/otapio/index-e.html
57. Pamphlet, Tohoku intelligent cosmos plan, and the interview 2000, 10,11.
58. Intelligent Cosmos Research Institute, http://www.tree.or.jp/tree/icrhp/icr.html,
59. Pamphlet, NICHE- New Industry Creation Hatchery Center, Tohoku University.
60. New Industry Creation Hatchery Center, http://www.niche.tohoku.ac.jp/

Acknowledgement

I would like to sincerely thank STA, JST/JISTEC provide with me such a opportunity for I can conduct my STA Fellow research in Japan for one year from November 10,1999 to November 9, 2000. I also wish to express my deep appreciation to Mr. Shigeru Aoe, the Director-General of National Institute of Science and Technology Policy (NISTEP); Mr. Jiro Shibata, former Director-General of NISTEP; Mr. Toshihiko Watanabe, my host researcher and the Director of the Third Policy-Oriented Research Group; Dr. Kinji Gonda, Professor of Tokai University and Senior Director in research, with the guidance and help of them, I can conduct my research and visiting many places in Japan smoothly and fruitfully.

I also want to give my deep thanks to my colleagues and friends in the Third Policy-Oriented Research Group, Mr. Masato Kyui, Mr. Fumihiko Kakizaki, Mr.Yoichi Arafune, Mr. Harunari Morikawa and Ms. Mari Mishima, who arranged every thing for my work and life in Japan. They often say I can tell them whenever I need any help. In fact, whenever I encountered any difficult or puzzle in my work or life, they thought of that before me and give me the help. Work together with them, I always feel happy and never lonely.

NISTEP is a very open and vigorous institute for the top-ranking science and technology policy research in Japan, almost all my colleagues worked very hard and late every day, I am very happy that I can stay here for one year. One year is very short, but I hope in the future I can keep contact with her and have more cooperation work.