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# Regionalization of Science and Technology in Japan: The Framework of Partnership between Central and Regional Governments

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# Regionalization of Science and Technology in Japan: The Framework of Partnership between Central and Regional Governments

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CONTENTS

I. Introduction.....1

II. Basic Concepts: The Importance of "Thinking Locally".....2

III. General Framework for Regional S&T Policy in Japan.....4

IV. The Relationship between Central and Regional Governments.....6

V. Central Government Policies to Promote Regional Science and Technology.....7

A. Science and Technology Agency (STA).....8

B. Ministry of International Trade and Industry (MITI).....10

C. Other Ministries of the Central Government.....13

VI. Conclusions.....16

Appendix 1: Research Agenda and Schedule.....18

Appendix 2: Overview of Research Theme and Objective.....22

## I. Introduction

In December, 1995, Japan's Prime Minister issued a Cabinet Resolution entitled "A Basic Policy for Activating Regional Science and Technology" (*Chiiki ni okeru kagaku gijutsu katsudo no kasseika ni kansuru kihon shishin: Heisei 7 nen 12 gatsu naikakusori daijin kettei*). Along with the Science and Technology Basic Plan, and the Basic Law on which it was based, this document provides a blueprint for science and technology policy into the next century. Reflecting a new awareness of the contribution of regional economic vitality to national economic performance, this report was the first of its kind devoted solely to the theme of regional science and technology (S&T). Not only does it focus attention on the contribution of regional economic dynamism to national vitality, it urges policy makers to promote science and technology policies that take advantage of regional characteristics and encourage differentiation among regions. In response, governments at all levels have been developing new programs and strategies aimed at strengthening regional infrastructure in science and technology and stimulating technology transfer to regional industry.

The objective of this study is to identify and evaluate the ways in which central and local governments are developing new approaches to promoting research and technology development as a means of stimulating regional economic activity. In particular, it aims to clarify the role of the central government in the process of creating new frameworks for promoting regional S&T. In the past, S&T policies have been shaped mainly by national priorities, especially the need to mobilize economic resources on a grand scale; regional and local governments had a relatively minor role in determining how much and to what ends public funds for S&T would be utilized. In recent years, the accelerating pace of technological change, the hollowing out of Japan's industrial base, and a trend toward political and economic decentralization have placed new demands on science and technology. Consequently, regional governments have been asked to bear greater responsibility for setting priorities and determining how public funding will be spent. Precisely how responsibility and

resources will be shared between regional and local government, however, remains unclear. This project is a first step in clarifying the nature of this relationship.

In the following sections, I summarize key findings of my research. Because of the large quantity of data collected, my observations at this point are still superficial. Nonetheless, it is still possible to identify a general pattern of thinking at both the central and regional government levels that reflects a far deeper appreciation of the importance of tapping into and building on distinctive regional characteristics than at any time in the post-war era. The next section provides an overview of the conceptual framework that underpins my research, which attempts to connect regionalization of S&T policy to recent theoretical developments in the literature on regional economic development. Part III briefly summarizes the research agenda. Part IV summarizes findings from interviews with key ministries and agencies responsible for making and implementing S&T policy at the national level. Part V presents results of site visits and interviews to regional government offices in Miyagi and Kanagawa Prefectures. The report ends with concluding comments in Part VI.

## II. Basic Concepts: The Importance of "Thinking Locally"

A growing body of research suggests that research organizations and private companies tend to locate in regions already richly endowed in the requisite human, institutional, and knowledge resources. Frequently cited as examples of this trend are Silicon Valley, Boston's Route 128, North Carolina's Research Triangle, and Southern California's defense-aerospace complex.[1] Domestic and foreign firms alike cluster in such regions to take advantage of proximity to a major research university, research institute, or other firms that supply key inputs or markets; the existence of so-called external economies often sets up a self-reinforcing process of localized economic growth.[2] Networks of close relationships based on trust and free flow of knowledge contribute to the dynamism of industrial districts

[1] Annalee Saxenian, *Regional Advantage: Culture and Competition in* Silicon *Valley and Route 128* (Cambridge, MA: Harvard University Press, 1994); Allen Scott, "The Geographic Foundations of Industrial Performance," *Competition and Change* 1 (1995): 32-45.
[2] Paul Krugman, *Geography and Trade* (Cambridge: MIT Press, 1991); Michael Porter, *The Competitive Advantage of Nations* (New York: Free Press, 1990).

and production systems in areas as diverse as northern Italy, Baden-Wurttemburg in Germany, the Catalan region of Spain, and Hollywood, California.[3] In Japan, too, a significant share of manufacturing takes place in highly localized industrial districts, which range in form and character from the urban *machi koba* in Tokyo's Ota Ward and Higashi Osaka to rural clusters of *jiba sangyo* in places like Ishikawa (textiles), Gifu (ceramics), and Niigata (cutlery) Prefectures.[4] Mindful of the potential economic stimulus such a concentration of industrial and high technology resources can provide, local and regional governments worldwide have made regional development projects a priority, hoping to create a critical mass of "home-grown" intellectual, financial, and entrepreneurial assets. The result, as one author puts it, has been the rapid emergence of "a new industrial space, defined both by the location of the new industrial sectors and by the use of new technologies by all sectors."[5]

Whether or not a new industrial space emerges and becomes self-sustaining depends strongly on the region's ability to generate and absorb technological innovations. But the propensity to innovate depends on the creation and diffusion of new knowledge, which itself is created or acquired through learning. Learning happens in organizations, and organizations learn more efficiently when they exchange information with the surrounding environment (by purchasing inputs, selling outputs, sharing ideas, etc.). At this point, geography becomes an important consideration. Distance is often a barrier to information exchange; organizations prefer to be near markets and other organizations with which they exchange information most frequently and intensively. To minimize the transaction costs associated with information exchange over long distances, firms concentrate their activities geographically. In some cases, a self-reinforcing process takes hold, resulting in a territorial agglomeration of production and exchange. By providing incentives for firms to locate in a particular region, breaking down barriers to information exchange, and supporting world-class research in regional public research institutes, S&T policy can make a region more attractive to private firms. Because

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[3] F. Pyke, G. Becattini, and W. Sengenberger (eds), *Industrial Districts and Local Economic Regeneration* (Geneva: International Institute for Labor Studies, 1990); Hans-Joachim Braczyk (eds), Philip Cooke, and Martin Heidenreich, *Regional Innovation Systems* (London: UCL Press, 1998).

[4] Mitsuhiro Seki and Masaki Nishizawa, *Chiiki Sangyo Jidai no Seisaku* (Tokyo: Shinhyoron, 1995); Hisaharu Ohara, *Chiiki Keizai o Sasaeru Jiba Sangyo, Sanchi no Shinkosaku* (Tokyo: Kobundo Shuppansha, 1996).

[5] Manuel Castells and Peter Hall (eds), *Technopoles of the World* (London: Routledge, 1993), pp. 6-7

firms are more likely to cluster in regions that offer unique resources or characteristics, policies should be geared to exploiting the distinctive qualities of regions.

Today, regions face growing pressures to adapt to global economic competition. As markets for goods and services become increasingly global, governments must confront the reality that capital, production, R&D, and even labor are free to move to wherever investment yields the greatest return. In Japan, as elsewhere, this has led to hollowing out of the basic industries in many regions, as firms have moved production to countries with lower labor costs and better access to key markets. In addition, environmental protection, the growing proportion of elderly in the population, and rising health care costs pose challenges that increasingly demand local solutions. For these reasons, the Japanese government has committed itself in recent years to helping the regions adjust to rapidly changing economic and social conditions. The following sections summarize these policies, where possible introducing concrete examples.

## III. General Framework for Regional S&T Policy in Japan

S&T policy in Japan today is carried out in accordance with the Science and Technology Basic Law enacted by the Diet in November 1995. 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 that "activate the distinctive character" of their respective regions.

The idea of promoting S&T at the regional level was further developed in a Prime Minster'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 standards of economic, social, and cultural 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 advantages 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 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, calls for the creation of a new R&D system that stresses the need for greater competition and freedom of movement among researchers, upgrading of R&D infrastructure, and technology transfer. In line with these goals, the plan calls for regions to "activate themselves as cultivators of economic frontiers" by actively promoting R&D based on local needs and resources. 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.

As a result of these changes, a new policy framework is taking shape. In the past, the main goal of S&T policy has been to develop the nation's research and technology infrastructure with a view to achieving broad national goals. This center-led framework focused on so-called Big Science projects in nuclear power, space exploration, and electronics, as well as mission-oriented research. Beginning in the mid 1990s, the S&T policy framework

has embraced a model based on center-regional collaboration. Not only are national S&T policies targeting regional economic development as a central policy objective, ministries and agencies responsible for these policies are making greater efforts to include regional governments in the planning and implementation phases.

## IV. The Relationship between Central and Regional Governments

The regionalization of S&T policy cannot be understood without consideration of the general relationship between central and regional government. In the U.S., the spending and taxation policies of states are largely independent of those of the federal government. Although federal grants represent about 22 percent of state spending (and about 15 percent of the federal budget), states do not transfer a proportion of their tax revenue to the federal government. Japan, by contrast, is a unitary state in which 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 difference between this system and a federal system can be seen clearly in the area of finance. The salient feature of local government finance in Japan is the high degree of dependence on the central government for funds. Because local governments actually deliver most government services 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. On the other side of the ledger, most local governments supply less than half of their own funds through taxes or other sources 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. However, regions in Japan differ widely in their collection of tax revenue; the wealthiest prefectures receive from 3 to 4 times the tax revenue of the poorest

prefectures. To rectify this uneven distribution of revenue, the central government returns a share of revenue back to the regions in the form of "ordinary allocation grants." How much a region receives is based on a formula that calculates what the region needs to deliver public services; some wealthy regions with large tax revenues receive no transfers at all.

In light of the relatively large share of public spending that is expended at the regional level, science and technology is somewhat of an anomaly. Here, regional governments pay out a far smaller portion of the total than does the central government. In 1995 regions spent 714 billion yen (7.6 billion dollars at the then prevailing exchange rate) on promotion of science and technology, which was 28 percent of the amount spent by the central government. However, as noted above, in most other expenditure categories regional governments pay out considerably more than does the central government. At least in science and technology, the roles played by central and regional governments in terms of spending are reversed from what they are in most other spending categories. Consequently, there is plenty of room to shift some of the spending authority in S&T from the central to the regional level. And that is a major priority in Japan's current science and technology policy.

## V. Government Policies to Promote Regional Science and Technology

In accordance with the Basic Plan, virtually all the major ministries and agencies of the central government that promote S&T have made regional themes a high priority in their programs. One popular strategy is to subsidize collaborative R&D that brings together different types of regional research institutes, enables cooperation across regions, or supports initiatives that develop the distinctive character of regions. In making their policies, they all follow the guidelines presented in the Science and Technology Basic Plan and the Basic Plan for Promoting Regional Science and Technology.

Consider first the budgets for regional S&T. Table 1 shows that, among the major agencies promoting regional science and technology activities, the Science and Technology

Agency (STA) is by far the most significant source of funds, followed by the Ministry of International Trade and Industry (MITI). Interestingly, appropriations earmarked for regional science and technology are expected to increase significantly in the next fiscal year. The following sections summarize regional policies of the eight agencies studied over the course of the project.

A. Science and Technology Agency

The STA has high expectations for regional S&T policy. The budget for regional S&T requested for next year is 19.4 billion yen, up 19.5 percent from this year. Policy statements speak of a "paradigm shift" in the approach to S&T policy from one based on centrally guided policy to one that encourages regions to develop their own policies. The idea is to encourage regions to promote science and technology activities that take advantage of unique regional characteristics and that differentiate regions from each other. Because few regional governments have resources to promote S&T on their own, an important objective is to provide subsidies that offset the financial burden on regions, while encouraging regional governments to leverage the resources available locally.

Table 1

Budgets Related to Regional Science and Technology Policy of Concerned Ministries (units: million yen)

| Ministry/Agency | 1998 (budgeted) | 1999 (requested) | Change 98-99 (percent) |
|---|---|---|---|
| Science and Technology Agency | 16,192 | 19,354 | 20 |
| Ministry of International Trade and Industry | 5,673 | 6,198 | 9 |
| Ministry of Agriculture, Forestry, Fisheries | 2,477 | 2,466 | 0 |
| Ministry of Posts and Telecommunications | 1,040 | 1,180 | 13 |
| Environmental Protection Agency | 80 | 43 | -46 |

Source: Science and Technology Agency

Specific programs supporting regional S&T are organized around three themes: basic and leading edge R&D that contributes to creation of new enterprises, regional S&T that activates the distinctive character of regions, and activities that strengthen relations between the STA and regional policy making bodies. Among the programs that promote creation of new enterprises, the Joint Research Project for Regional Intensive is currently receiving the most funds. The objective of this project is to promote formation of regional network-type centers of excellence (COEs) in specially designated regions. In these regions, universities and public and private sector research institutes collaborate in the organization of a locally concentrated research network that harnesses the knowledge potential of the region to the needs of local industry. Interested organizations consult with prefectural governments in developing a proposal that addresses one of three themes: frontier technology (including information technology), technology related to society (environmental, food, energy, natural resources), or technology related to the livelihood of citizens (health, safety). Proposals are sent to the STA, which in turn submits them to an external committee for evaluation and review. Regions whose proposals pass the review process are eligible to receive public funds totaling 400 million yen per year for five years. Since the project's inception, eight prefectures have received awards: Ibaraki, Hiroshima, Osaka, Fukushima, Hokkaido, Miyagi, Yamagata, and Kanagawa.

The second program that has received considerable attention recently is the Regional Science Promoter Program (RSP). Launched in 1996, the RSP program focuses on coordination of collaborative R&D and technology development among universities, firms, and research institutes in designated prefectures. The appointment of a coordinating institute to facilitate joint R&D, information exchange, and technology transfer within the region makes this a unique initiative in the STA. The coordinator is responsible for developing the necessary institutional and personal networks within the region, researching technical needs, matching seeds to needs, planning R&D activities, and reporting to the public. As in the Joint Research Project for Regional Intensive, the STA invites proposals from interested regions. Selected regions are eligible to receive up to 40 million yen per year for four years. To date,

twenty regions have received designations under this program; coordinators tend to be technopolis foundations or prefectural / municipal research institutes (*kosetsushi*).

As further evidence of a deepening commitment to regional S&T, the STA has launched a new initiative from fiscal year 1999: the Project for Promoting Application of the Results of Collaborative Research with Universities (my translation of *Daigaku renkeigata kenkyu seika katsuyo sokushin kyoten ikusei jigyo*). Aimed specifically at regions that are building R&D networks between firms and universities, this program leverages resources of the STA, the Japan Science and Technology Corporation, and regional governments to support the early-stage commercialization of university R&D. In 1999 five regions are expected to be selected, each of which will be eligible to receive roughly 100 million yen annually over four years.

While expanding its support of regional R&D, the STA has maintained a flexible framework for deliberating and deciding on regional policies. According to my interviews, STA officials serve as advisors to regional governments in implementing policies in accordance with the Basic Plan. Unlike MITI and the Home Affairs Ministry, the STA has no formal system for dispatching officials to regional governments, though officials from local governments sometimes are dispatched to STA. The philosophy underpinning regional programs is that the STA sets broad goals based on national needs and provides funds; regional organizations have responsibility for deciding which fields to develop and the appropriate means for doing so based on local needs and resources. Interestingly, one official noted that the real cleavage in S&T policy is not between central and regional government but between the vertical groupings of central and regional officials associated with each major ministry--MITI, the Ministry of Agriculture, STA, etc. This is the well-known *tatewari gyosei* that is seen in so many other issue areas of Japanese politics. To increase the effectiveness of regional policies, policy makers in the future may need to devote more attention to coordinating programs across ministries.

B. The Ministry of International Trade & Industry (MITI)

MITI has for decades been actively committed to upgrading the nation's industrial structure. Policies have been targeted not only at bolstering the country's industrial technology base, but also at maintaining an appropriate spatial allocation of the technology base consistent with national economic goals. Until recently, MITI's policies have been driven more by national imperatives; regional economies have been viewed mainly in terms of how they contribute to the national economy in the aggregate. This is no longer the case. Like STA, MITI is in the process of revising its approach to national policies; building up regional economies in accordance with their respective comparative advantages has become an important goal in its own right.

MITI's regional policies have progressed through several stages since the end of the Second World War. During the 1950s, emphasis was placed on reconstruction of the heavy industrial corridor along the Pacific coast, which would become the backbone of the economic miracle over the next twenty years. By the late 1950s, however, the harmful effects of excessive concentration of industry in the Pacific Belt had prompted a shift in policy; over the next twenty years, the thrust of policy would be to encourage relocation of industry into rural areas, especially those that had become depopulated as a result of earlier migration to the Pacific coast. The oil shocks of the 1970s brought forth new imperatives: the transformation of industrial structure from heavy to technology intensive industry became the cornerstone of MITI's industrial policy. The Technopolis, Brain Center, and Base Region programs were launched during this period to encourage the formation of knowledge-intensive industrial clusters in regions generally outside the heavily populated Pacific belt. Like the policies of the 1960s, however, these programs were geared more toward rectifying the geographical imbalance in industrial location than in developing industrial districts with distinct comparative advantages.

By the middle 1990s, hollowing out of key industries as a result of the strong yen, coupled with economic stagnation of the post-bubble period, had become the chief worry of MITI policy makers. A particular concern was the hollowing out of key manufacturing clusters that had been a driving force behind the country's economic success. According to the White Paper on Small and Medium Sized Enterprises, the 175 localities designated as

concentrated industrial districts have experienced slower growth in shipments and a steeper drop in numbers of enterprises than have other localities.[6] Thus, MITI officials faced the need both to strengthen existing industrial districts, as well as promote the development of new technologies and industries across the economy. Merging these imperatives led to the introduction in 1997 of the Temporary Measures Law Concerning Activation of Designated Industry Clusters (*Tokutei sangyo shuseki no kasseika ni kansuru rinji sochiho*).

The objective of the Temporary Measures Law is to reverse the decline of industrial districts by upgrading technology and promoting entry into new markets. Designated districts include twenty-two so-called base technology industrial clusters (*kibanteki gijutsu sangyo shuuseki*), which are regions less than 70 thousand hectares in area that contain more than 100 parts or small-lot manufactureres and/or ship at least 100 billion yen of output. Also included are so-called "specially designated SME clusters" that are home to at least 50 companies and/or have shipped at least 10 billion yen of output, and have experienced a growth in product shipments less than the national average over the past five years. Firms located in one of these districts may apply for special subisies, low-interest loans, and favorable tax treatment. Interested firms or industry associations submit proposals (*kasseika keikaku*) to the prefectural governor, whose approval is required before assistance can be provided. Assistance is also available to regional (*todofuken*) governments in the form of subsidies for training, R&D, and expansion of infrastructure (e.g., harbors, ports, highways). In 1997, MITI spent a little more than six million yen on this program.

A new goal of the Environment and Location Bureau is to shift the weight of industrial location policy from the central government to the prefectures. The shift has been prompted by growing realization that the wide diversity in economic conditions across the 47 prefectures demands policies more finely tuned to regional problems; regional governments themselves are in the best position to make the assessments. To put this new thinking into action, MITI has requested funding this year for a new initiative, which has been dubbed Deliberation on Policy Methods for Autonomous Development of Regional Economies

[6] According to MITI sources, the value of products shipped from manufacturers in the 175 designated industrial districts plunged 20 percent from 1991 to 1995.

(*Chiiki keizai no dokuritsuteki kaihatsu no tame no seisaku no arikatano kento*). The logic behind the program is to promote autonomous industrial and high technology development of regions with a goal to building internal comparative advantage that is based on distinctive regional resources and cababilities. To move the process forward, MITI recently set up a subcommittee on regional economies within the influential Industrial Structure Council. By shifting attention to the development of unique regional economies whose development policies draw on local conditions, MITI is clearly moving in the same direction as STA in decentralizing the conception and implementation of S&T policies.

C. Other Ministries of the Central Government

In addition to STA and MITI, this study also collected information on the regional S&T policies of the Ministry of Agriculture, Forestry, and Fisheries; Ministry of Education, Home Affairs Ministry, and Ministry of Posts and Telecommunications. Although the data is still being analyzed, two common characteristics stand out. First, the ministries involved with S&T policy are making clear efforts to involve regional and local governments in the policy planning process. This is seen most clearly in the case of the Ministry of Agriculture, Forestry, and Fisheries, which has recently moved to establish annual meetings with regional policy makers involved in agricultural science and technology; just as MITI is gearing industrial location and SME policies to the particular needs of regions, so too is the Ministry of Agriculture working with regions to develop new varieties of crops and related technologies that encourage regional specializztion. The Ministry of Home Affairs, moreover, works closely with regional governing bodies when it makes its annual assessment of local and regional revenue needs; science and technology promotion, though dwarfed by social welfare, education, and other spending categories, is drawing increasing attention in the public finances of regional and local bodies.

Second, many ministries working in S&T are actively promoting technology transfer policies that, while targeting different types of firms and industries, share the same basic structure. The Ministry of Posts and Telecommunications, for example, has launched an initiative aimed at promoting collaborative research and technology transfer between

universities and telecommunications firms located in the same region as the university. The Ministry of Agriculture is employing much the same scheme in agriculture, and even STA has launched a major initiative aimed at accelerating the flow of technology from universities and research institutes to nearby firms from the standpoint of developing and strengthening regional innovation systems.

The collaborative research programs are especially interesting in light of the fact that they explicitly embrace the notion that geography is an important factor in the process of technological innovation. Consequently, the ministries and agencies sponsoring these programs generally require interested parties to organize a research consortium or other collaborative body whose members come from the same region. The thinking behind this approach is that any ensuing technological innovation will have important spillover effects in the regional economy. Presently, four ministries are implementing this kind of regional cooperative R&D project (Table 2).

Table 2

Regional Cooperative R&D Projects by Sponsoring Ministry/ Agency

| Ministry/ Agency | Science and Technology Agency | Ministry of Agriculture, Forestry, and Fisheries | Ministry of International Trade and Industry | Ministry of Posts and Telecommunications |
|---|---|---|---|---|
| Program Name | Cooperative Research in Industrial Cluster Type Regions | Promotion System for Regional Advanced Technology Cooperative R&D | Regional Consortium R&D System | Regional Proposal-Style R&D System |
| Responsible Organization | Japan Science and Technology Corporation | Ministry of Agriculture, Forestry, and Fisheries | NEDO | Telecom-munications and Broadcasting Research Institute |
| Year Started | 1997 | 1996 | 1997 | 1998 |
| Purpose | Development of new industries based on regional networks and COE | Revitalization of agri/forest/fishery industries based on biotechnology and other new technologies | R&D to create new industries by matching "seeds" to "needs" in a consortium-type organization | Promotion of telecoms/ broad-casting R&D capitalizing on potential of regional firms, universities, research institutes |
| Summary | *regions receive designation from STA; commence joint R&D with government (JST)<br>*400 mil yen per region per year for 5 years<br>*1998: 8 continuing regions; 4 new regions | *universities, firms, research institutes form regionally based partnership (research sector);<br>*up to 4 mil yen per year for up to 6 years<br>*1998: 13 continuing projects | *consortium submits proposal to NEDO<br>*up to 100 mil yen per project per year for up to 3 years<br>*1998: 27 continuing projects; 6 new projects | *collaborating institutions submit proposal<br>*up to 4 mil yen per theme per year for 3-5 years<br>*1998: 3 continuing projects; 3 new projects |

Regional cooperative R&D projects have gained greater visibility over the past year as a result of the passage of the University Technology Transfer Promotion Law last spring. The purpose of this legislation, sponsored by the Ministry of Education, is to encourage the technology transfer from national universities to industry by providing assistance to universities establishing "technology transfer offices" (TLOs). TLOs, though common at American research universities, have only recently gained attention in Japan. As a result of this law, interest in technology transfer has surged: according to a survey conducted by the Nihon Keizai Shimbun in October, 40 percent of the 286 responding universities are planning or seriously discussing the establishment of TLO offices (60 percent of universities with science and technology departments).

There are already several examples of the merging of regional and technology transfer policies with the aim of creating dynamic high technology business clusters. In Kanagawa Prefecture, the Kanagawa Industrial Technology Research Institute (KITRI) is working closely with the prefecture's 13 technical colleges to match research and technical resources with the needs of the region's small and medium-sized enterprises (SMEs). Also in Kanagawa, the Yokohama city government recently announced it would soon break ground on a new research institute that will bring together researchers from the city's eight universities to collaborate with researchers from local industry on a broad range of projects. Topics can range from energy to waste disposal and medicine; it is hoped that the results will stimulate the region's energy, materials, and automobile parts industries. And in Osaka, the Osaka Patent Information Center has established the post of "patent circulation advisor," who's mission is to scour the prefecture's university's and firms for so-called "sleeping patents" (*suimin tokkyo*) that have the potential to be commercialized by the region's thousands of SMEs. In 1997, more than 130 "sleeping patents" were selected as candidates for commercialization, and negotiations are presently underway to license them to area businesses. Although it is far too early to assess the results of regional projects, there is strong consensus that technology transfer from regional universities will be increasingly vital as a source of dynamism to regional economies.

Finally, I also had an opportunity to visit and obtain data from several regional research institutes and government organizations in Miyagi and Kanagawa Prefectures. Although analysis of this data is not yet complete, it is clear not only that these regions have greatly accelerated their own initiatives in promoting regional S&T, they also have heightened expectations of the central government. Interviews revealed both excitement over the newly heightened interest in decentralization and confusion over the many central government programs for supporting regional S&T. This would suggest that the central government should continue favoring policies that respect and promote the specialization of regional economies, while at the same time making greater efforts to educate regional policymakers and citizens on the availability, rationale, and expected impacts of these new initiatives.

## VI. Conclusions

Although my analysis is still incomplete, the body of research studied thus far provides clear evidence that the central government is giving far greater attention than ever before to the regional impact of S&T policies. These new programs reflect not only an awareness of the importance of regional innovation systems in stimulating regional economic development but a strong desire to use S&T policy as an instrument for encouraging specialization of regional economies. At the very least, they embrace the concept that "space" is a crucial factor to be considered in economic development policy; regions grow and prosper when private firms, universities, research institutes, government policies, and the natural resource endowments work in harmony, generating the synergies that increasingly drive high technology-based economies.

Regarding concrete policies, it is clear that policy initiatives reflect the needs and resources of the respective ministries promoting them. Even so, they embrace the common objective of raising standards of R&D and boosting innovative potential based on the distinctive qualities of each region. In summary, policies aim to accomplish the following:

1) Provision of research facilities and training programs that strengthen the research base of regions.

2) 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.
3) Strengthening of the regional research institutes (*kosetsushi*) to enable them to play a leading role as R&D and technology development organizations.
4) Boosting the capabilities of national research institutes, while promoting collaborative research between national and regional institutes.

To conclude, 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 governments are also boosting their efforts in this area. The goals will continue to emphasize collaborative research, the matching of innovative "seeds" in universities and research institutes to the specialized "needs" of regional industries, and where possible collaborative R&D among complementary institutions that span regions. Special attention is also being paid to the development of innovative industry clusters that bring together, or "platform," complementary technologies in ways similar to what's being done in Silicon Valley and the Research Triangle Park in the U.S. As has been the case for many decades, the scores of regional public testing and experiment stations will continue to be a lynch pin in regional innovation systems. By harnessing the creative potential of firms, researchers, and entrepreneurs throughout Japan's rich and varied regions, we have high hopes for the creation of new technologies and new industries as we enter the 21st century.

## Appendix 1

### Schedule of Research Activities (September-December 1998)

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|---|---|
| September 4: | Arrival at NISTEP |
| September 15-20: | Research Presentation at the Pan-European International Relations Conference and Joint Meeting with the International Studies Association, Vienna, Austria |
| December 2: | Research Presentation at NISTEP ("Promoting Regional Innovation: Thoughts on Japan's Regional Science and Technology Policy") |
| December 3: | End of Fellowship Term |
| December 5: | Return to U.S. |

### Conferences and Symposia Attended

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| October 8, 9: | NISTEP, Tenth Anniversary Conference, Tokyo |
| October 8: | MITI, Conference on "Platforming" for Support of New Industry, Tokyo |
| October 12: | Symposium on "Ba," Working Group Meeting, Tokyo |
| October 14-16: | Sixth Training Conference on Regional S&T Policy to Activate Regions, Himeji |
| October 24-25: | Thirteenth Annual Conference on Management of Technology, Tokyo |
| October 27: | Workshop on "Ba": Essence and Application, Tokyo |

## Site Visits and Interviews at Local Governmental Organizations

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| October 16: | Harima SPRING 8 Synchrotron Facility, Hyogo Prefecture |
| November 1-3: | Tohoku Intelligent Cosmos, Izumi Soft Park, 21st Century Plaza, and Prefectural Office, Miyagi Prefecture |
| November 25: | Kanagawa Science Park (KSP), Kanagawa Prefecture |
| December 4: | Kanagawa Technology Foundation (KTF), Kanagawa Prefecture |

Schedule of Inteviews

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| October 6: | Ministry of Education, Director General of Culture Agency (lunch) |
| October 13: | MITI, Environment and Location Bureau, Regional Industry Promotion Section, Section Head |
| October 19: | MITI, Agency of Industrial Science and Technology, Regional Technology Section, Assistant Section Chief |
| October 23: | STA, Research Foundation Section, Regional S&T Promotion Section, Section Chief |
| October 23: | Ministry of Agriculture, Forestry & Fisheries; Agriculture, Forestry & Fisheries Industry Technology Council Secretariat, Regional Research Promotion Section, Section Chief |
| October 29: | Ministry of Local Autonomy, Minister's Secretariat, Planning Section, Assistant Section Chief |
| November 2: | Miyagi Prefectural Government; Industry, Commerce, and Labor Division; General Affairs Section, Senior Manager |
| November 2: | Tohoku Intelligent Cosmos Promotion Council, Intelligent Cosmos Academic Foundation, Academic Promotion Division, Division Head |
| November 2: | Intelligent Cosmos Research Institute, Co., Managing Director |
| November 9: | Tokai University Professor, Hajime Karatsu (lunch) |

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| November 10: | Ministry of Posts & Telecommunications, Telecommunications Policy Bureau, Technology Policy Section, Assistant Section Chief |
| November 16: | Japan Reporter's Club, Freelance Science Journalist, Kazumasa Iinuma |
| November 19: | STA, Research Foundation Section, Regional S&T Promotion Section, Section Chief (second interview) |
| November 19: | Kanagawa Prefectural Government, Planning Division, S&T Policy Section, Section Chief, Chiaki Wada |
| November 25: | Kanagawa Science Park (KSP), Managing Director, Akio Baba |
| November 30: | Tokai University, Professor, Hajime Karatsu (second interview) |
| December 4: | Kanagawa Technology Foundation, Director, Yoshiro Shibata |

## Appendix 2

## Overview of Research Theme and Objective

In November, 1995, the Japanese Council on Science Technology issued a policy statement entitled "A Basic Policy for Activating Regional Science and Technology." In response to this policy, both central and regional governments have stepped up their promotion of research and technological innovation at the regional level as a means of revitalizing regional economies. Across Japan, however, prefectural and local governments have responded in different ways to this new policy, depending on local economic conditions, the presence of existing science and technology resources, and the priority attached to science and technology (S&T) by local governments. In some prefectures, such as Kanagawa, the prefectural government has given high priority to strengthening S&T infrastructure and promoting R&D to stimulate small and medium sized enterprises. In other regions, such as Osaka, the government's response has been more muted; public officials have only recently begun to development a comprehensive framework for regional S&T policy. In still other regions, such as Tohoku, governments are exploring unique and innovative ways of stimulating regional S&T through such mechanisms as cross-regional and international collaboration.

The objective of my research is to study and evaluate the ways in which central and local governments are developing new approaches to promoting research and technology development as a means of stimulating regional economic activity. In particular, it aims to clarify the role of the central government in the process of creating new frameworks for promoting regional S&T. In the past, S&T policies have been shaped mainly by national priorities, especially the need to mobilize economic resources on a grand scale; regional and local governments had a relatively minor role in determining how much and to what ends public funds for S&T would be utilized. In recent years, the accelerating pace of technological change, the hollowing out of Japan's industrial base, and a trend toward political and economic decentralization have placed new demands on science and technology. Consequently, regional governments have been asked to bear greater responsibility for setting priorities and determining how public funding will be spent. Precisely how responsibility and resources will be shared between regional and local government, however, remains unclear.

The primary goal of this research is to clarify the nature of this relationship. Key questions include the following: What kinds of partnerships have been formed between central and regional governments to promote S&T activities? What should the role of such partnerships be? How are they funded? Through what mechanisms are representatives of central and regional governments exchanging information and deciding policy? Do these vary significantly across regions? Answers to these questions will give insight not only into the changes in the S&T policy environment but into the evolving relationship between central and local governments.

My reasons for proposing this project are three-fold: First, it builds on my current research as STA Fellow at the Kanagawa Industrial Technology Research Institute (KITRI) from September, 1997, to September, 1998. The focus of this research is to analyze what I call the "Kanagawa Regional Innovation System" and to compare its features with those of Osaka, where I had done previous research. In particular, I've been interested in the spatial allocation of S&T resources in Kanagawa, how they've changed over time, the policy environment, and the degree to which firms rely on S&T resources available locally. The research I propose to do at NISTEP would extend my analysis to the national level, allowing me to situate the results of my current work into a broader national context and to better understand how central and regional governments interact to shape new policies. Second, from a theoretical point of view, I'm interested in determining the most suitable unit of analysis for understanding Japan's S&T system. Is Japan best thought of as a "national innovation system," as the work of Richard Nelson, Christopher Freeman, Richard Samuels, and others suggest? Or rather should we think of Japan as a collection of "regional innovation systems," each with its own distinctive identity, as the work of Dr. Kinji Gonda and others suggest? Finally, there remains little research published in English on regional S&T in Japan. Most studies in the U.S. tend to assume that national policies and activities of large firms overshadow activities at the local level; hence, important and fascinating regional variations often are overlooked. My work aims to counter this trend and to increase understanding of Japanese regions and localities in the U.S. In addition, my ability to read and speak Japanese, combined with a background in both engineering and social science, provides strong qualifications for performing this kind of research effectively.