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Promotion of the Biotech Industry as Regional Industrial Policy

: The Case of the Biotech Industry in the Kurume Area of Fukuoka Prefecture

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Ⅰ. Introduction

At present, countries around the world are working to establish industrial clusters, i.e. pursuing so-called “cluster policies”. These policies can be viewed as being either of the following two types of regional industrial policy. One is REGIONAL industrial policy, i.e. regional policy aimed at invigorating the local economy through the establishment of a cluster. The other is regional INDUSTRIAL policy, i.e. industrial/innovation policy whereby regions (clusters) are used to nurture industries, particularly ones that the national government regards as being particularly important strategically, and to encourage innovation.

This paper deals with the biotech industry, which has been positioned as a key industry in the cluster policies of numerous countries. It explores the significance of agglomeration in the biotech industry and the significance of bioclusters, and investigates the geographical scale of these clusters. To that end, it also includes some observations about biotech industry promotion in the Kurume area of Fukuoka Prefecture in order to shed light on the situation with biotech clusters in Japan.

Ⅱ. Innovation and agglomeration in the biotech industry

2.1. Agglomeration in the biotech industry

We will begin by looking at what the significance is of companies in a science-related industry like biotechnology being located in proximity to each other within a specific region, and the issue of why the biotech industry forms clusters.

In the United States, biotech clusters have already been established in several areas, most notably Boston, San Francisco, and San Diego, and these clusters are known to be driving the U.S. biotech industry nowadays. Japan, however, does not currently possess biotech clusters on a scale similar to

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those seen in the U.S. This difference stems from differences in the national innovation systems of the two countries. The U.S. innovation system draws most of its strength from domestic universities and other research organizations. This characteristic has resulted in research organiza-tions launching biotech start-up companies and led to the formation of clusters around them. Japan, however, has relied on foreign countries as sources of innovation, which has obviously not led to the establishment of clusters like these.

Under these circumstances, many empirical studies about bioclusters in the U.S. have been made in recent years.

For example, Audretsch and Stephan (1996) examined the proximity of biotechnology firms to scientists conducting research in the field of biotechnology. They suggested that the importance of proximity was shaped by the role played by the scientist; the proximity mattered more when the relationship involved the transfer of new economic knowledge than when the scientist was providing a service to the company that did not involve knowledge transfer.

Powell et al. (2002) focused on the spatial concentration of research-intensive biotech firms and venture capital firms that financed them in nine U.S. biotech clusters, and found that the geographic proximity of them mattered, and the significance of proximity declined as the biotech industry matures. Because many of the founders of biotech firms were research scientists, venture capitalists often did much more than monitored or advised; recruiting key staff and important collaborators, providing referrals to law and accounting firms, and eventually to investment banks. Such roles of monitoring, advising and managing were much more easily accomplished when the young firm was located nearby.

Both these studies showed that in the biotech industry person-to-person contact was essential, and that the frequency of this contact depended a great deal on the geographical distance between the people concerned.

The insights gained from all these empirical studies conducted in these leading regions allow three reasons why clusters are useful for innovation in the biotech industry to be identified:

The first is that proximity among related research organizations and researchers is essential. For innovation in the biotech industry, it is important to be able to exchange information face to face on certain occasions. This proximity can therefore be described as minimizing the distance people need to travel to exchange information. This is also due to the biotech industry being characterized by an R&D system based on the interactions of numerous actors rather than one based on central research centers that are centered on big companies

The second reason is that supporting industries need to be established nearby. This is due to a need for new services relating to the new industry and a need for contact with an “infrastructure of venture companies” (Imai, 1998), the kind of infrastructure required for startups, i.e. venture capitalists, lawyers, patent attorneys, and accountants etc., who understand the technology.

The third reason is the need for R&D facilities that meet certain standards. In the case of the biotech industry, action needs to be taken to prevent dangers such as biohazards, so companies are not allowed to build laboratories and so on wherever they wish. This means that specific areas and facilities that meet the prescribed standards are required.

2.2. The geographical scale of clusters

If clusters are, to a certain extent, conducive to industrial innovation, the next issue is what size to aim for when using policy measures to encourage their formation.

Following Porter (1998, p199), "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a group of neighboring countries".

Porter himself has stated that an area with a diameter of 100–200 miles, which would enable face-to-face interaction, should be the target (Kanai, 2003). The scale he envisages, therefore, encompasses a fairly large and diverse area. This is because his definition of a cluster is an area that includes a wide range of related industries.

To gain an insight into the geographical scale of clusters envisaged under Japanese cluster policy, we will refer to a book produced by Ishikura et al. (2003), researchers in the Ministry of Economy, Trade and Industry's industrial cluster research team. The book does not make much mention of the scale issue, and the writers do not seem to have a great deal of interest in it. Nevertheless, the sections that do address the issue contain statements such as this: "The factors determining geographical scope depend on the stage of the industrial cluster's development etc" (p.269). In industrial clusters in their early stages, distribution costs and materials procurement costs are determining factors, while in well-developed clusters possibilities for information exchange are determining factors. On the other hand, the book also states that "when attempting to establish a competitive industrial cluster in a developed country, there are limits to doing so in geographically small areas, like those of industrial areas in the past" (p.269), and that "it is effective to establish clusters in larger areas than covered by older industrial areas" (p.270).

Yamasaki (2003) also stresses the importance of establishing large geographical areas when formulating cluster strategies. In other words, the geographical range of clusters envisaged in this book is also, like Porter's, fairly large, so these views can probably be regarded as the basic position on geographical scale in current cluster policy.

So as long as cluster policy is based on the establishment of geographically large clusters, perhaps geographical scale need not be addressed as an issue at all. Admittedly, when a cluster policy is a REGIONAL industrial policy, as described earlier, the geographical area it covers is often automatically limited, because the entity pursuing the policy only has jurisdiction over a certain area. In such cases, geographical scale is not an issue. In the case of regional INDUSTRIAL policy, however, i.e. when a region is going to be positioned as a base for the promotion of innovation (i.e. as a cluster), policymakers will need to think about what kind of region is appropriate, so addressing the issue of the geographical scale of the cluster cannot be avoided.

Machida (2004) conducted research focusing on the optimal geographical scale of clusters. Based on the results of an empirical analysis of the machinery and metal industries in Osaka, and from the relationship between the costs of overcoming distance and the advantages of agglomeration, he identified

four types of geographical scope, “a central zone (within which round trips can be made on foot or by bicycle) ”, “an industrial area (within which round trips can be made in one to two hours by car) ”, “an urban economic area (within which workers can commute) ”, and “a wide economic area (within which round trips can be made within a day by car or using existing trains) ”, and examined the relationship between the geographical scope of clusters, and (1) the labor market, (2) the supply of intermediate goods and (3) the penetration of knowledge.

In addition, Yamamoto (2000) performed an empirical analysis of regional agglomeration by small and medium industrial machinery manufacturers in Germany, in which he made a distinction between locality scale industrial clusters, which generate Marshallian agglomeration economies, and larger scale industrial clusters with a diameter of 100–200km. Here, Marshallian agglomeration economies are the reasons that industries that have become concentrated in a particular locality tend to remain there indefinitely (Yamamoto, 2001). They comprise (1) the transmission of technology and knowledge (and the mechanism for generating new technology and knowledge that follows on from that), (2) the emergence of complimentary companies that play supporting roles (and the kind of cooperation between related sectors seen in supply chains), (3) the establishment of a labor market comprising skilled workers, and (4) friendly relationships between management and labor. Of these, it has been pointed out that while the first three occur over a wide geographical area, locality scale industrial clusters can be meaningful in the process of developing trust.

What these studies suggest is that it is important to be aware that the geographical scale of clusters differs according to agglomeration economies, and specifically, to realize that clusters will be of different scales depending on whether they are designed to encourage information exchange or to establish related, supporting industries. In other words, it must be borne in mind that clusters need to be seen as existing on multiple levels. If such perspectives are beneficial, they will obviously also be suitable for the empirical and policy-related analysis of bioclusters.

Ⅲ. Current situation and issues with bioclusters in provincial cities : The case of the Kurume area of Fukuoka Prefecture

3.1. Biotech industry promotion in the Kurume area

1) The biotech industry in the Kurume area

In recent years, an increasing number of biotech-related companies have been establishing operations in the Kurume area, and this has been gathering attention. Direct promotion of the biotech industry in the Kurume area began in 2001 with the launch of the Fukuoka Bio Valley Project.

This Project “aims to create new industries and venture business focusing on biotechnology, thus forming a major integration of bio-related companies and research institutes (a biocluster) in the Kurume area, and promote its activities with an eye toward networking with Asian countries”. At present, in

addition to biotech-related companies, some bio-related institutions, Kurume University School of Medicine, Biotechnology and Food Research Institute Fukuoka Industrial Technology Center, Kurume School of Technology, locate in this area.

The biotech industry encompasses a huge range of fields, from so-called “old bio”, i.e. brewing/distillation and fermentation to produce such products as sake, miso, and soy sauce, to bioinformatics, which fuses biotechnology with information technology, bio remediation, which involves the use of microorganisms to clean up the environment, and medical- and drug-development-related fields such as gene therapy and biopharmaceuticals. The biotech industry is therefore extremely difficult to define. These difficulties also stem from the fact that the biotech industry “is not an industry whose product is biotechnology related, but rather one that employs biotechnology as a tool” (Odagiri, 2006). In fact, when government organizations promote the biotech industry and select companies to support, they often apply a fairly broad definition to the biotech industry. This paper therefore also adopts a broad definition, viewing the biotech industry as an industry that employs biotechnology as a tool in some way or another.

2) Background to the promotion of the biotech industry

This section discusses the background to the adoption of measures to encourage the development of the biotech industry in the Kurume area.

The first factor was regional policy and industrial policy in Fukuoka Prefecture and the city of Kurume. The north of Fukuoka Prefecture is a commercial and industrial area comprising the cities of Fukuoka and Kitakyushu, and in recent years has become a base for the automobile industry. The local economy of the Kurume area in the south of the prefecture, meanwhile, has been at risk of stagnation due to the decline of the rubber industry, which was formerly the leading industry there. As a result, revitalizing the south of the prefecture became an urgent policy task.

In addition, with manufacturing industry increasingly shifting overseas because of globalization, another key task for Fukuoka Prefecture was to make its industrial structure more knowledge intensive and to nurture next-generation growth industries to drive this process.

To achieve more of a regional balance within the prefecture in terms of industrial structure, it was decided to try to encourage the development of the biotech industry.

Another reason that Kurume was chosen as the base for the biotech industry was its bio industrial potential.

With fertile soil provided by the Chikugo River, Kurume has flourished as a farming area for centuries, with the value of its agricultural output higher than any other city, town, or village in northern Kyushu. The area also developed into an “old bio” cluster as a food industry developed to process the local produce, with the brewing/distillation and fermentation of products such as sake, miso, and soy sauce becoming particularly important.

Kurume has also been long known for having a large number of doctors and hospitals, and today the concentration of hospitals and medical institutions is among the highest in the country. There are 535.3 physicians for every 100,000 people, the second highest figure among the 49 core cities nationwide. It is also number two in terms of hospital beds, with 2,710.7 beds per 100,000 people.

<Table 1> The ratio of inpatients going out and coming into the secondary medical area

	The ratio of inpatients coming into the secondary medical area	The ratio of inpatients going out the secondary medical area
Fukuoka and Itoshima	19.8	12.2
Kasuya	37.5	34.4
Munakata	34.6	37.9
Chikushi	31.7	39.5
Amagi and Asakura	21.9	38.4
Kurume	34.7	22.6
Yame, Chikugo	24.5	27.9
Ariake	23.9	22.5
Iduka	21.8	22.6
Nogata and Kurate	19.2	35.7
Tagawa	18.6	25.4
Kitakyusyu	9.0	7.3
Keichiku	15.8	31.3
Fukuoka Pref.	21.1	19.9
Total	23.9	23.9

Sauce: Ministry of Health, Labour, and Welfare, 2005 PatientSurvey

This agglomeration in the field of medical care is not just quantitative, either. The area offers high-quality, cutting-edge health care, particularly at leading hospitals such as Kurume University Hospital and St. Mary's Hospital, and as a result large numbers of people visit Kurume for medical care. Table 1 shows the ratio of inpatients going out and coming into the secondary medical area for treatment, and shows that the number of patients coming into the zone is higher.

In other words, Kurume was chosen as a base for the biotech industry because it already offered a broad foundation in the field.

3) A steady increase in the number of biotech companies

Because many of the biotech companies are new startups, because it takes time to start generating profits in the biotech industry, and so on, it is difficult to get an accurate picture of the current scale of the biotech industry in Kurume in terms of indicators such as sales and numbers of people employed.

The number of biotech-related companies, however, can be tracked. In 2001, when the Bio Valley Project was launched, there were 23 such firms in Fukuoka Prefecture. By 2010, though, this figure had risen to 99 (Table 2). In addition, a survey of biotech startups in the city of Kurume conducted by the city government reveals a significant increase from 9 companies in 2004, when the survey began being conducted, to 28 in 2010.

Moreover, while similar efforts are currently being made to establish bioclusters in Hokkaido, north Osaka, and Kobe, and several other parts of Japan, Kurume is performing well in the national biocluster rankings (Nikkei BP, 2006), placing fourth out of 32 areas nationwide.

<Table 2> Transitions in the number of biotech-related companies

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fukuoka Prefecture	23	24	35	47	54	62	78	83	89	99
Kurume City	-	-	-	9	11	15	19	26	29	28

Sauce: Fukuoka Prefecture and Kurume City

3.2. Measures to establish bioclusters

1) Incubation facilities dedicated to biotech

For the biotech industry, policy-related support plays a very important role. This is due to the characteristics of the industry and the fact that most of the companies involved in it are startups, and it is no exaggeration to say that the kind of assistance provided holds the key to the development of the industry. Below, we will examine the nature and outcomes of three types of support policy pursued by the prefectural, city, and national governments: (1) “hard” support policies such as infrastructure construction, (2) “soft” support policies centered on various types of human assistance, and (3) relating to the first two types, various support policies, mainly of a financial nature, for promoting R&D and nurturing companies.

As an example of a “hard” support policy, let us begin by discussing the construction of incubation facilities. In the past, efforts to reinvigorate local economies have tended to focus on attracting factories, but these incubation facilities are actually constructed by local governments across the country with the aim of generating and nurturing new companies and industries. Moreover, in recent years incubation facilities specifically designed for the biotech industry have begun to appear, and Kurume is home to two such biotech-dedicated facilities: Fukuoka Bio Incubation Center and Fukuoka Bio Factory.

Fukuoka Bio Incubation Center was established in 2004. It offers the low-cost rental research laboratories for individuals concerned in bio-related research or individuals with an original business plan or corporations with plans to expand their business through research and development in biotechno- logy or a related field.

Fukuoka Bio Factory was established in 2007. It serves as a core facility for new ventures moving to the prototyping and manufacturing stage.

As it has been mentioned above, the reasons why clusters are useful for innovation in the biotech industry to be identified were (1) the increase in availability of information, (2) the supporting industries need to be established nearby, (3) the need for R&D facilities that meet certain standards. Therefore, the incubation facilities are stage settings to generate agglomeration economies.

2) A support structure administered by expert personnel

The construction of such facilities is extremely important for the biotech industry because it has a particularly strong need for dedicated facilities. Nevertheless, the fact is that in Japan support for R&D and the nurturing of companies has hitherto focused excessively on the “hard” side. This is because it has been easier to obtain budget funding for the construction of “hard”, visible infrastructure than for

“soft” support measures (Kazumi, 2007).

However, “soft” support is also undoubtedly important for the biotech industry, and in Kurume a wealth of human support is being provided. This includes support for research, assistance with making research outcomes commercially viable, and business-related support.

Among these human support measures, incubation managers provide carefully tailored assistance on a day-to-day basis. Incubation managers are always on site at the facilities, where they help with the preparation of business plans, the securing of sales channels, applications for public subsidies, and so on. And because most of this support can be provided face to face and on a daily basis, it can lead to real outcomes, and is therefore extremely important for biotech startups, which have only recently been established and have few personnel.

3) Support for a broad range of R&D projects

In the biotech industry, which mainly comprises R&D-oriented companies and startups, which do not have a lot of financial resources, a key issue is how to secure funding for R&D and cover the expenses relating to it. Naturally, therefore, public assistance for R&D plays an important role.

Table 3 summarizes the biotech-industry-related R&D support measures that have been offered in Kurume until now. It shows that funding has continuously been secured for large-scale R&D projects at universities etc., such as research on cancer peptides at Kurume University. In addition, this series of support measures has already produced results, and in Fiscal 2009 the measures were officially recognized and the Kurume Cutting-Edge Medical Research Cluster was adopted as a project of the national government’s Knowledge Cluster Initiative.

Alongside this support for leading-edge research, Fukuoka Biotechnology Basic Technology Develop-nt Project exists to provide support for budding R&D projects. This project targets small and medium startups and individuals with business plans that are aiming to develop new technologies or products or launch new businesses in the biotech field in Fukuoka Prefecture.

<Table 3> Support policies for promoting R&D and nurturing companies

■ Ministry of Education, Culture, Sports, Science and Technology
· The City Area Program (basic stage) [2003-2005]
· The City Area Program (development stage) [2006-2008]
· Knowledge Cluster Initiative [2009-2013]
· 21st Century COE Program (Kurume University) [2003-2007]
■ Ministry of Economy, Trade and Industry
· Regional New Consortium Project [2005-2006]
■ Cabinet Office
· Kurume Asia Bio Area (Structural Reorganisation of Special Areas) [2003-]
· Super Special Consortium for supporting the development of cutting-edge medical care [2008-]
■ Fukuoka Prefecture
· Fukuoka Biotechnology Basic Technology Development Project [2001-]

Sauce: Kurume Research Park Co., Ltd. and Kurume City

The fact that two biotech fields (an advanced medical field centered on cancer research, and a broader field focused on agriculture, the environment, and so on) coexist can be said to be one of the characteristics of the Kurume biotech industrial cluster, and R&D support programs designed to support them both have also been created.

3.3. ssues with biotech clusters and limits to the potential of biotech startups

As mentioned earlier, in Kurume efforts are being made to promote advanced medical care and a range of other biotech industries, and to establish a biotech industrial cluster there, and these efforts can be acknowledged as resulting in the generally smooth development of the industry, with the number of biotech companies steadily increasing so far, for example.

Issues for the future in this area are to promote clustering based on the multi-level perspectives described earlier, to help existing companies grow, and to produce large numbers of outstandingly successful companies. The generation of numerous successful companies is particularly important for improving the quality and raising the presence of the cluster, and should lead to more companies locating there and the quantitative expansion of the cluster. In other words, a success feedback loop can be expected to be generated.

Having said that, promotion of the biotech industry within a certain region brings with it problems that are specific to the industry. Miyata (2009) identifies limits to the potential of the biotech startups generated by the industry. To begin with, in the biotech industry it is difficult for companies to become successful, and to do so they often have to spend a great deal of money and time. In addition, unlike some IT-related startups, they cannot be expected to create large numbers of jobs within a short time frame. Moreover, upon reaching the manufacturing stage, when jobs can be expected to be created, the companies may leave the area. A key challenge that cannot be avoided, therefore, is how to address this issue, given that taxes are used to fund the regional and industrial policies designed to develop the biotech industry and quantitatively and qualitatively enhance biotech industrial clusters.

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