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Title	R&D in Food Industries in Japan-A Review of Governmental Efforts
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Citation	Journal of the Faculty of Agriculture, Hokkaido University, 58(3), 307-320
Issue Date	1977-03
Doc URL	https://hdl.handle.net/2115/12904
Type	departmental bulletin paper
File Information	58(3)_p307-320.pdf



R&D IN FOOD INDUSTRIES IN JAPAN—A REVIEW OF GOVERNMENTAL EFFORTS

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Received Jan. 20, 1976

Introduction

The government has become an important single force in shaping the character, direction, and destiny of Research and Development (R&D) activities in a country. This trend can be seen by the increasing involvement of government. Such an increasing involvement may be due to the following development:

(a) Government policy has become an important factor in the total external environment for the company R&D which it has to balance with the internal pressures. Government policy can have an important influence on the resources, incentives, and barriers related to innovative process in companies. (b) The content and style of R&D in most industries are influenced by the government policy as national parameters are powerful in determining R&D in them. (c) Questions such as creation of new institutions or the realignment of existing ones which would strengthen R&D efforts in companies, the creation of R&D supporting systems etc., are matters that can be handled efficiently by the government. (d) R&D in recent years has come to assume major proportions. R&D problems have assumed greater dimensions beyond the national boundaries calling forth the direction, support, and participation of the government.

In short, the government is expected to undertake, promote, and consolidate the R&D activities in the country and lay a firm foundation for its future growth.

A comparison of industry-government borne funds ratio for R&D in various countries shows that the contribution of government to the total R&D effort in Japan is of less significance. But this does not mean that government in Japan did not take active participation in the development and promotion of R&D. The guiding principle of Japanese economy was non-intervention by the state and promotion of economic vitality of industries based on the initiative and ingenuity of enterprises through encour-

aging free competition. Government participation is more direct and major in industries where national parameters have great influence on the content and style of R&D, whereas it is primarily directive, supportive, and supplementary in industries where R&D can be left to the discretion of the companies. One such group of industries in the latter category is food manufacturing industries.

The main responsibility of promotion of R&D in food industries, where economic considerations are more important and which are more domestically oriented, was left to the companies. The responsibility of the government was to support and supplement the efforts of the companies and build a firm technological base for future development and growth.

Food industries, unlike other industries which were taken up for developmental purposes after II World War, were established early. As such their role had to be considered in the perspective of economy's rapid changes towards modernization. Hence, Government's measures were designed to bring about economic reorganization of food industries and build a technological adaptive system.

Status of Food Industries in Japan Before II World War

Prior to II World War, Japan's food industries structure was dominated by breweries, milling, fishery, livestock, and dairy products. These industries provided simple articles of food for general consumption.

The two notable features of the food industries during this period were: (i) this sector consisted of a big 'small units' sector and a small 'big units' sector; and (ii) the relative importance of food industries was greater in providing employment. This was chiefly due to their relatively low productivity. High employment orientation and low labour productivity were mainly due to the fact that much of the operations in this sector were done by manual labour with simple tools.

Due to the existence of few monopoly units and a large number of small and less-efficient units, the economic structure of food industries was not conducive for the operation of the innovative system. No special attempts were made by smaller units as processing of food was carried as joint undertaking with agricultural sector for use and benefit of the rural areas. No compelling need for the introduction of new technology was felt by even the bigger units as they were enjoying monopoly.

Review of Governmental Efforts to Facilitate R&D in Food Industries

Post-war Japan witnessed rapid structural changes with high rate of economic growth. Almost the first task of the government was to bring about structural and economic reorganization. Though the main concern of the government was to bring about structural shift leaning heavily towards non-food industries, efforts were also directed to restructure a number of low productivity, technologically stagnant and labour intensive branches.

The general industrial policy of Japan during this period was to break up monopolistic tendencies, encourage competition, remove various economic controls, increase internationalization of domestic industries through trade and capital liberalization and dissemination of technology.

In order to cope up with the sweeping changes that took place in the country, food industries, in line with other industries, had to incorporate efforts for creation of favourable environment for their survival and growth. They had to seek new ways of adjustments. These adjustments took the form of technical tie-ups in certain industries, diversification into high value added type of products in some other industries, large-scale equipment investment for rationalization and modernization in few others to effect efficiency and cost reduction, consolidation, cooperation, and joint action in buying, selling and other activities by small units, etc.

All these adjustments set in new trends in food industries, involved R&D in some form or the other and above all it created a system for food industries receptive, responsive, and adaptive to innovations, and prepared a fertile ground for break-through in newer areas.

The major objectives of the government of Japan in facilitating the development of food industries were through prevention of bottlenecks and creation of favourable environment for R&D activities like bottlenecks in scale, stock of knowledge, factor endowments, etc. Facilities were created for a smooth change over of food industries which were characterised by technological stagnation and low productivity into modernized units with R&D as a new factor built into it.

Several long term and short term measures were undertaken for facilitating the operation of innovative system. A protective-development policy matrix was designed to achieve the above set of objectives. A quick and brief review of the components of government's efforts to facilitate R&D in food industries is made and results presented below.

The guiding principle of the government in its R&D supportive role

in respect of food industries were :

- (a) acceptance of the principles of protection of these industries ;
- (b) give some sort of institutional and organizational guidance ; and
- (c) assumption of greater role and involvement by the government in selected areas of R&D.

Following sets of measures were designed to achieve the desired effects :

- one set of measure related to structural reformation ;
- the second set of measures related to building up of scientific and technological base ;
- the third set of measures related to designing of suitable mechanism for discerning the R&D needs and requirements for designing a clear, operational form of policy to give good shape, required support, and right direction ; and
- the fourth set of measures related to designing of suitable legal and legislative framework.

Assumption of greater role by the government in facilitating R&D in food industries took the form of :

- i) making an annual effort through budgetary allocation for R&D in food industries ;
- ii) building up of R&D supporting systems :
- iii) improving the existing stock of knowledge and encouragement of new disciplines akin to food industries through the establishment of research institutes and universities ; and
- iv) assisting food industries in private sector through :
 - a) administrative guidance ;
 - b) technical guidance ;
 - c) financial assistance through the use of monetary, fiscal, and other instruments, and
 - d) indirect assistance through price support and trade restrictions.

As a general rule, the government did not try to introduce unnecessary rigidity into food industrial development scheme or R&D in them. The government believed that competition among various units comprising the industry will encourage action. The government action was mostly restricted to identifying the bottlenecks to pursue R&D and giving broad guidelines and broad principles than interfering with the market system.

Guidance to Small Food Manufacturing Units

As big companies were already large-scale, administrative guidance by the government was not given. As regards small units the governmental

guidance aimed at amalgamation of small units to scale up the small units to appropriate level.

The Ministry of Agriculture and Forestry has undertaken a 5-year modernization plan for small and medium sized food industries. According to this plan, the Ministry designates what industries should be included in the plan. The program was initially made in 1960 and since then several industries were included until 1970. The government supported these industries in their technological progress. The industries selected for support under this plan were *sake*, flour milling, soy bean sauce, bakeries. Many more industries were also included in the scheme whenever it was deemed that government assistance for their development is necessary. Special mechanisms were also established in the Ministry of Agriculture and Forestry, Ministry of International Trade and Industry to assist small firms in selecting appropriate technology. This took the form of industrial advisory service.

Financial Assistance*

The government's obligation to promote R&D in food industries took the form of financing such activities. Financing of R&D by government was through making budgetary provisions for such activities and facilitating such activities in private sector by monetary, fiscal, and other concessions and incentives.

The financial facilities provided by the government took the form of:

- 1) Direct Budget Provision :
 - (a) general budget, and (b) special project budget.
- 2) Facilities extended to promote R&D in private sector through :
 - (a) loans and other monetary instruments like
 - i) loan system for commercialization of new home technology,
 - ii) equipment investment loans, and
 - iii) interest rate differentials, etc.
 - (b) Grants :
 - i) subsidy for machinery, and
 - ii) subsidy for specific purpose, etc.
 - (c) Fiscal Instruments :**

* The problem of assessment of government's financial obligations is shrouded with difficulty as there is no unified, single R&D budget expressing a unified policy, a list of priority and a precise choice of food industries for promotion.

** Articles 42-, 43, 12 and 44, 12 and 45, 21 and 58 of the Taxes Special Action Law, Law Number 26, Enacted in 1957 gives the details regarding the fiscal provisions for R&D.

- i) Special deductions in corporate tax on expenses incurred on R&D,
- ii) Special tax deductions for income arising from technology transactions between Japan and other countries, and
- iii) Special repayment for rationalization and commercialization of new technology.

Government finance for R&D in food industries was mainly channelled through agencies like Japan Development Bank, Japan Food Industry Center, Ministry of Agriculture and Forestry, Ministry of International Trade and Industry, Cooperative Banks, Small Business Finance Corporation, etc.

The government facilitated R&D activities in food industries through making budget provisions for research carried out in National Research Institutes and Research Institute belonging to Local Governments. For instance, the government made a budget provision of 600 million Yen for research in Institutes of Local Governments*.

The budget provisions are made under two heads: General Budget without specifying the research content, and Special Project Budget. In view of the importance of indigenous R&D, the government is supporting certain selected R&D projects through Special Project Budget. The projects selected under this head were major research projects, too vast and complex, having a bearing on the Nation's future requirements. Through discussions it was found that there is increasing tendency of the government to finance under special projects budget and financing under general budget is becoming less important.

As regards government's financial support extended in the form of loans and other monetary instruments, mention may be made of the loan system for promotion of home technology and loan system for equipment investment.

The government provided large amounts of finance for new equipment investments and this formed the nucleus of the government's activity. This in turn facilitated levelling up of technology in food industries. The Small Business Finance Corporation is the major government agency extending large amounts of equipment loans to food industries. For instance, the amount of loan extended for equipment investment by the Small Business Finance Corporation increase from 26,575 Million Yen in 1965 to 69,922 Million Yen in 1972**. Japan Development Bank is another agency through which government extends such loans. But the amount extended by JDB is of less significance (The amount of loan extended increased from 6,262

* Source: Japan Food Industry Center, Japan.

** Source: Bank of Japan, Economic Statistics Annual.

Million Yen in 1965 to 11,117 Million Yen in 1972).

But the government provides large amounts of loans through Japan Development Bank under the head of Technology Development Loan. For example, total loans executed under this head increased from 20,556 Million Yen in 1968 to 47,715 Million Yen in 1973*. But the loans extended by JDB under this head for food industries constitutes less than 1%. It is hoped that the amount of loan to be extended will be doubled in 1975. It was also learnt from discussion that the amount to be extended to food industries may have to be remarkably increased in the years to come and a shift in the emphasis may be there from R&D projects on food manufacturing to R&D projects on food storage and conservation.

The R&D projects undertaken by private companies is financed by government agencies at two different stages. The financial assistance at the pilot plant trial stage in the total R&D process is financed by some government agencies, and when the companies undertake R&D for the commercialization of new technology, a further step in the total R&D process, they approach Japan Development Bank for loan. After project evaluation, JDB extends loans for the project. Small Business Finance Corporation is also responsible for extending loans to food industries for commercialization of new home technology.

Such loans are extended to compaies undertaking R&D at a concessional rate of interest and for a longer period. For instance, the loan system for promoting home technology by Japan Development Bank is: Rate—6.5%**; Term—within 15 years, amount—within 70%. The interest rate charged by Japan Development Bank in general on loans borrowed is around 10%. The loan system adopted by Small Business Finance Corporation for commercialization of new home technology is almost the same as JDB. Rate is between 6.5% to 7%, amount within 80 Million Yen.

Another form of governmental financial assistance for R&D in food industries is through granting subsidies. For instance, the government provided subsidy to***:

(1) Local Government	100 Million Yen
(2) For Food Industry Center	300 Million Yen
(3) For Industry—Company	300 Million Yen
(4) For Food Machinery—private Companies.	1,500 Million Yen
(Granted by M.I.T.I.)	

* Source: Japan Development Bank, Statistical Handbook.

** The rate has increased to 7.5% in recent years due to tight money policy.

*** Source: Japan Food Industry Center.

Government Assistance Through the Policy of Protection

A number of price and trade policies promulgated by the government provided shelter to the food industries, directly and indirectly. As is well known, such supports by the government reflects the transfer of income from the government to enterprises.

The basic protection provided for the food industries comes from the Food Control System.

In pursuance of the protectionist policy, the government intervenes in the market for food industrial products and in the agricultural commodity market which forms the basic raw material to these industries.

The protectionist policy of the government took the form of (1) price supports, and (2) trade restrictions. The level of such supports extended by the government differed from industry to industry and commodity to commodity.

For instance, under the Manufacturing Milk Producers Deficiency Payments Act of 1965, the Livestock Industry Promotion Corporation intervenes in the dairy market through the purchase and resale of the designated dairy products. A deficiency payments system for manufacturing milk was introduced in 1966 under the Manufacturing Milk Producers Deficiency Act in order to encourage domestic milk production through compensation for the milk producers. The difference between the guaranteed price and the standard sales price is paid as a subsidy to the producers. Government subsidies to producers in 1971-72 amounted to 10 Billion Yen*.

Protection through price support seems to be frequently followed rather than protection through trade restrictions. This trend might have been due to the adherence of the government recently to the policy of trade liberalization. As a result of this policy, agricultural products under residual import restrictions accounted for 23 items (including three marine products) in November 1972, compared with 73 items in February 1970. They include certain dairy products (milk, cream, processed cheese) beef, certain fruits and their products, rice flour and wheat flour.

Designing of Suitable Mechanisms for Promotion of R&D

The government, to give a right direction and required support to

* O.E.C.D: Agricultural Policy in Japan, 1974, p. 55.

R&D in food industries which was mainly in the hands of private companies, designed certain mechanisms like :

- (a) mechanism to discern the needs and requirements of the companies,
- (b) mechanism to coordinate R&D activities carried out by various units,
- (c) mechanism to administer R&D.

For instance, government-company dialogue, an effective approach to discern the needs and requirements of the companies, has been adopted.

Until recently, there was no mechanism to coordinate the R&D activities in food manufacturing companies with that of government's. Though the central government departments and agencies like Ministry of Agriculture and Forestry, Ministry of International Trade and Industry, Agency of Science and Technology, carried out such activities, they were not designated to carry out the activities in an active manner. The actions were ad-hoc to deal with particular situations. The structure for dealing with such matters was informal and there were no formal coordinating structures in these agencies and departments. The establishment of Japan Food Industry Center in 1970 filled this gap to certain extent which provides a meeting place for the concerned parties and a platform for discussion and exchange of views.

Provision of Legal and Legislative Framework

Another point of merit of Japanese policy towards R&D in food industries is that the government designed suitable legal and legislative framework for effecting its policies. For example, Acts were passed regarding financing, organization, modernization of small and medium scale firms, National University Founding Act was passed to facilitate the supply of technical manpower for food industries*. Thus, the technological and economic tone necessary for food industries was established by the above Acts.

Creation of R&D Supporting Systems

One of the essential requirements for the success of R&D is the existence of good supporting systems. R&D supporting systems means the organizations supplying essential inputs for R&D activities. They include :

- 1) Techno-economic environment scanning organizations and data Banks,
- 2) R&D counselling organizations,
- 3) Common facility centers,

* For details see Compendium of Laws of Japan.

- 4) R&D financing organizations, and
- 5) Research organizations.

In Japan, these R&D supporting structures for food industries are built on different principles with differing extent of involvement of the government. Different formulas are adopted for setting up these bodies. For example, there are mixed bodies receiving aid from private organizations to which government pays a regular contribution or grants; few others are connected with a government department but are legally distinct; few others are set up under private law.

But the government's participation was major in building the technology base for food industries, and in establishing techno-economic environment scanning organization and information banks. Its participation was supplementary in respect of establishment and promotion of other supporting systems. A brief review of government's role in building technology base and information systems was made and observations are presented below.

(a) Building of Technology Base:

R&D in food industries to be effective, a number of conditions must be satisfied. They are:

- 1) existence of a network of research institutions catering to the R&D needs of the food industries,
- 2) existence of educational institutions and universities to train and develop manpower for new careers and skills demanded by the new system, and raised status for the people engaged in food research,
- 3) a higher interest in research and academic circles in the problems in many disciplines related to food industries,
- 4) close cooperation of research institutes, universities, and industries for experiments and enquiry for discerning the R&D needs and requirements and delivering the package of R&D results.

Satisfaction of the above conditions calls forth long-term measures with involvement of the government.

The most important contribution made by the government of Japan in this direction was:

- (a) establishment of national research institutes with public funds,
- (b) establishment of prefectural experiment stations with public funds to cater to the local problems,
- (c) creation of disciplines akin to food industries in various universities,
- (d) promotion of cooperation between industrial circles and government and other research organizations.

The government established national research institutes—general and

specialized. These institutes were established under the management and supervision of Ministries and government agencies. The major orientation of these institutes were towards long term R&D goals and towards projects of basic research type and special projects of national importance requiring huge amounts.

Such an orientation was thought necessary by the government as there were well reputed research organizations and think tanks like Nomura Institute of Technology and Economics, which stressed the importance of applied research, mostly undertook commissioned and contract research work, defined the needs of the clients and delivered packages of scientific findings appropriate to particular issues of immediate concern.

Prefectural governments also established experiment and research stations to cater to the R&D needs of food industries. For instance, Tochigi, Yamanashi, Niigata, Aichi, Tottori, Hiroshima, Tokushima, Kagawa, Ehime prefectures have research institutes for carrying out research activities essential for food industries. The research activities of these prefectural institutes cover a wide range of R&D problems including better processing, storing, and packaging methods of food and agricultural products, research on processing machines and techniques, development of high protein from plant sources, development of new uses for agricultural products, etc.

As the government and private research institutes were designed to cater to the long term and short term objectives and requirements, basic and applied research, the responsibility of universities in this regard was to train and supply the manpower required to handle R&D problems in these research institutes and research institutes attached to industries.

Thus, some sort of division of labour among the various organizations concerned in the total R&D efforts in food industries is noticeable though occasional overlapping of efforts are not ruled out.

(b) Techno-economic Environment Scanning Organizations and Data Banks :

The importance given to the need for R&D information and the urgent necessity recognised to build up R&D information network in respect of food and agriculture by the Government of Japan is revealed by its taking charge of practical affairs of information service for the International Information System for the Agricultural Science and Technology (AGRIS).

The government created few organizations, specialized and general, for carrying out the function of scanning, collection, and dissemination of techno-economic information to food industries. For example, Japan Information Center for Science and Technology and Japan Food Industry Center

are the major government organizations involved in this function. Collection of R&D information as a routine under selected heads was carried out and the results were published periodically. Exchange of techno-economic information was also facilitated by these organizations through conducting seminars and conferences.

In addition to the above organizations, several Ministries through their technical information division are facilitating technological and economic information collection and communication to food industries. The involvement of the Ministry of Agriculture and Forestry in this task is noteworthy. The other Ministries engaged in this task are Science and Technology Agency (attached to the Prime Minister's Office) and Technical Information Division of the Agency for Industrial Science and Technology (attached to the Ministry of International Trade and Industry) are concerned with the collection of information on R&D and is serving the widening requirements of information by food industries.

Besides, various research institutes, national and prefectural, are also involved in the task of techno-economic information collection and dissemination. These institutes are well stocked with R&D information and the companies can avail themselves of such facilities.

Though from the above description it appears that techno-economic environment scanning and information collection agencies are many and active, further probe into their functioning revealed that excepting one or two most of the organizations are of general in nature comprising all industries including food industries, and their extent of involvement in respect of food industries is peripheral and utilization of their services by food manufacturing companies is negligible.

Summary and Suggestions

The aspects of Japanese Government's effort for the promotion of R&D which merit mention are the following :

1) Building of conducive economic organizational structure :

As is well known, from the point of view of technological development, the small and splintered nature of the industrial structure provides a poor technological base. Structural reformation was facilitated by the government policy and food manufacturing companies responded to it resulting in an economic structure conducive for technological development.

2) Policy of non-intervention :

The laissez-faire policy and supportive role played by the government worked well in the post-war Japan. The government did not try to intro-

duce unnecessary rigidity into R&D activities and food industrial developmental schemes. The government action was mostly restricted to identifying the bottlenecks to pursue R&D and giving broad guidelines, and determining certain standards concerning food safety, consumer health, and environmental maintenance standards, etc., which the companies were required to adhere to. The facility of freedom given by the government was rightly utilized by the companies to strengthen their economic and technological capabilities.

3) Building Technology Base :

The most important and long lasting contribution made by the government was building the technology base through establishment of research institutes and creation of various disciplines akin to food industries in various universities.

With the mention of the above points of merit, it is worth mentioning here few suggestions for consideration.

The overall strategy of the Government of Japan in the post-war period was internationalization of the economy, expansion of non-agricultural sector, and national specialization in certain selected industries. Some sectors which were not included for priority dealing but were economically weak and technologically stagnant were also considered for support. Within this overall strategy, policies and programs for R&D in food industries grouped under the latter category, were built around. The participation of the government was supplementary and supportive, the R&D requirements met by the government was periphery where as the major responsibility was borne by the food manufacturing companies.

The intention here is, though not questioning the national specialization in R&D in certain industries and the validity of the government policies, not to doubt the capability of the food manufacturing companies in taking the full responsibility of R&D function, to see whether the continuation of the same strategy of the government will work well in the changed domestic and international food situation, or a new policy matrix with a different emphasis is needed.

Existence of persistence dualism in the development levels of different industries, persistent imbalance in the world food supply and demand position, the continuously falling food and feed self-sufficiency ratio in Japan show that in coming years Japan may not be in an advantageous position in internationally shopping for its food and feed requirements. In such a context, though Japan due to certain natural disadvantages may not be in a position to achieve full self-sufficiency in food and feed requirements

in a foreseeable future, a deeper commitment by the government for the promotion of R&D in these sectors may prove beneficial in the long run. It is too early to judge the potential scope of R&D in food industries. It is premature to decide to what extent the government should commit itself to the function without determining the details about 'how much' is needed. It is hoped their contribution more needing. Continuous stream of R&D in these sectors appears necessary to justify the adherence of Japan's economic policy to raise the food self-sufficiency ratio and international cooperation.

Apart from the change that is needed in the government strategy for R&D in food industries, rectification by the government few minor details hitherto not given attention to may be beneficial. For example, absence of a unified single R&D budget for industries experssing a unified policy, absence of a list of priority and precise choice of R&D in food industries which were observed could be easily rectified by the government.

Institutions, specialized and general, concerned with providing R&D inputs to food industries may be made to involve more and give greater bias towards R&D requirements of food industries.