Success Factors of Managing Japanese R&D Centers in China and the United States

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Abstract--Purpose **– The purpose of this paper is to find out success factors of Japanese companies in managing R&D centers in China and in the United States and the differences between the two countries.**

Design/methodology/approach **– In parallel with interviews with managers of R&D centers of Japanese companies in China and managers in charge of overseas R&D in Japan, the research is mainly based on a questionnaire survey conducted in October 2009. Companies surveyed are Japanese companies that are listed on "Overseas Operating Companies 2008" issued by Toyo Keizai and that possess overseas production subsidiaries or R&D subsidiaries, their shares of which exceed 50 percent. The companies that possess R&D centers in China and those that possess R&D centers in the United States are divided into three categories according to the satisfaction levels in the light of the purpose of establishment. Then, R&D management practices are analyzed by these categories. Then, the differences of the success factors of Japanese companies in managing R&D centers between the two countries are examined.**

Findings **– The marked differences of the success factors in China and those in the United States are found. For example, in China, one of major positioning reasons is "for Japanese market" for satisfied companies; in the United States, one of major positioning reasons is "for global market" for satisfied companies. On one hand, in China, localization is low for unsatisfied companies; on the other hand, in the United States, localization is low for satisfied companies.**

Originality/value **– This paper finds out some successful management practices to make R&D centers of Japanese companies in China and in the United States satisfactory in the light of the purpose of their establishment. The analysis is based on an original questionnaire survey reinforced by the interviews with Japanese R&D center managers in China and managers in charge of overseas R&D in Japan and others. Since Japanese companies established R&D centers in China only recently, this kind of research work is still scarce. The results provide valuable information input to multinational company managers responsible for R&D in China as well as to those responsible for R&D in the United States.**

I. INTRODUCTION[1]

Open innovation to utilize external resources as well as internal resources for innovation is widely practiced in the global competition[2]. In this open innovation multinational corporations (MNCs) establish overseas research and development (R&D) centers to utilize R&D resources in other countries not only in developed countries but also in developing countries[3]. Open innovation occurs in the collaboration with other organizations – companies, universities and public research institutes[4] - domestically, overseas and cross borders. Companies collaborate with other organization in their home countries; they establish R&D centers overseas and those centers collaborate with other organization in host countries; and they collaborate with other organizations overseas, that is, cross borders.

Japanese companies are not exceptions. They are also active in establishing overseas R&D centers as well as in collaborating with other organizations in Japan and overseas. Recently, they are most interested in establishing R&D centers in China and are second most interested in the United States. For some companies, their overseas R&D centers are satisfactory in the light of the purposes of their establishment: for other companies, their overseas R&D centers are unsatisfactory in the light of the purposes of their establishment.

This paper aims to find out successful R&D management of Japanese companies to make their R&D centers in China and the United States satisfactory in the light of the purposes of their establishment and to find out the differences between the two countries. First, in the next section, the paper analyzes the trend of Japanese company overseas R&D, pointing out that Japanese companies are most interested in establishing R&D centers in China and are second most interested in the United States. In the following section, the research framework, hypotheses and research method are explained. The explanation of the research method includes the description of a questionnaire survey used for this research. Then, findings are discussed. Although Japanese companies established R&D centers in China only recently, they are fairly satisfied with their R&D centers in China in the light of the purposes of their establishment, comparable to Japanese company R&D centers in the United States. About 80 percent of the Japanese companies felt that their R&D centers are satisfactory in the light of the purposes of their establishment. For some questionnaire items, success factors are the same for the Japanese company R&D centers in China and those in the United States. For others, success factors are markedly different between the Japanese company R&D centers in China and those in the United States. Finally, some concluding remarks are stated.

II. OVERSEAS R&D OF JAPANESE COMPANIES

Japanese companies started establishing R&D centers overseas in a visible way in the 1980s. These activities took place a little later than their counterparts in Europe and the United States. In the late 1980s, they established overseas R&D centers mainly in developed countries (Table 1). However, they shifted their overseas R&D center destination from developed countries to Asia in the 1990s and early 2000s[5].

[1] This paper is based on [1].

[2] See [2] for open innovation. This paper focuses on outside-in aspect of open innovation.

[3] For overseas MNC R&D centers in developed countries, there are many research papers such as [3] and [4]. For MNC R&D centers in China, there are some research papers such as [5] and [6].

[4] Although the amount of R&D fund flow between companies is about 10 times larger than that from companies to universities in Japan according to [7], university-industry collaboration has its significance because the character of information flow from universities differs from that from companies and the collaboration with universities is related to the recruitment of qualified students.

[5] See [8].

Recently, the intention of Japanese companies to establish R&D centers in Asia is clearer. They possess the largest number of R&D centers in China in 2012 according to [9] (Table 2). Also in the near future, they are most interested in establishing R&D centers in China for new product development, localization and even basic research according to [9] (Table 3, 4 and 5). According to [10], China is also the most popular destination of R&D for MNCs in the world.

For developed countries, Japanese companies are still interested in establishing R&D centers in the United States. They possess the second largest number of R&D centers in the United States in 2012 (Table 2). For the actions in the near future, they are second most interested in establishing R&D centers in the United States for localization and third most interested in establishing R&D centers in the United States for new product development and basic research (Table 3, 4 and 5). According to [10], the United States is the second most popular destination of R&D for MNCs in the world.

TABLE 1. CHANGE OF JAPANESE OVERSEAS R&D CENTER DESTINATION

period	1986－1990	1991－2005
North America	38.1%	25.9%
Europe	23.9%	14.4%
Asia	30.6%	54.1%

Source: Ueno, S., M. Kondo and A. Nagata （2008）, The Present Situation and Transition of R&D Globalization in Japanese Firms (in Japanese), NISTEP Research Material No. 151.

TABLE 2. JAPANESE COMPANY DESTINATION OF R&D FUNCTION IN 2012

ranking	country/region
1	China
2	United States
3	*Western Europe*
4	Thailand
5	Korea

Source: JETRO, 2012FY Survey on International Operations of Japanese Firms (in Japanese), March 2013.

TABLE 3. JAPANESE COMPANY DESTINATION OF NEW PRODUCT DEVELOPMENT FUNCTION IN THE NEAR FUTURE

ranking	country/region
1	China
2	United States
3	Thailand
4	Taiwan
5	Indonesia
6	*Western Europe*
7	Korea
8	Singapore
9	Malaysia, Vietnam

Source: JETRO, 2012FY Survey on International Operations of Japanese Firms (in Japanese), March 2013.

TABLE 4. JAPANESE COMPANY DESTINATION OF LOCALIZATION FUNCTION IN THE NEAR FUTURE

ranking	country/region
1	China
2	Thailand
3	United States
4	Indonesia
5	Taiwan
6	Korea
7	Vietnam, India
9	Malaysia
10	*Western Europe*

Source: JETRO, 2012FY Survey on International Operations of Japanese Firms (in Japanese), March 2013.

TABLE 5. JAPANESE COMPANY DESTINATION OF BASIC RESEARCH FUNCTION IN THE NEAR FUTURE

ranking	country/region
1	China
2	Taiwan
3	United States, Indonesia
5	Singapore, Thailand, Vietnam, Malaysia
9	Hong Kong, Korea, India, *Western Europe*

Note. The ratios of companies are fairly low.
Source: JETRO, 2012FY Survey on International Operations of Japanese Firms (in Japanese), March 2013.

III. RESEARCH FRAMEWORK, HYPOTHESES AND RESEARCH METHOD

To find out successful R&D management factors of Japanese companies in China and in the United States and to find out the differences between the successful R&D management factors of Japanese companies in China and those in the United States, the paper analyzes the differences of management practices between satisfactory R&D centers and unsatisfactory R&D centers in China and in the United States (Figure 1). The analysis was conducted regarding the following issues:

- Objectives,
- Positioning,
- Capital investment
- R&D resource inputs,
- Time of establishment
- Localization,
- Research contents
- Collaboration with universities and public research institutes,
- Organizational structure, and
- Challenges.

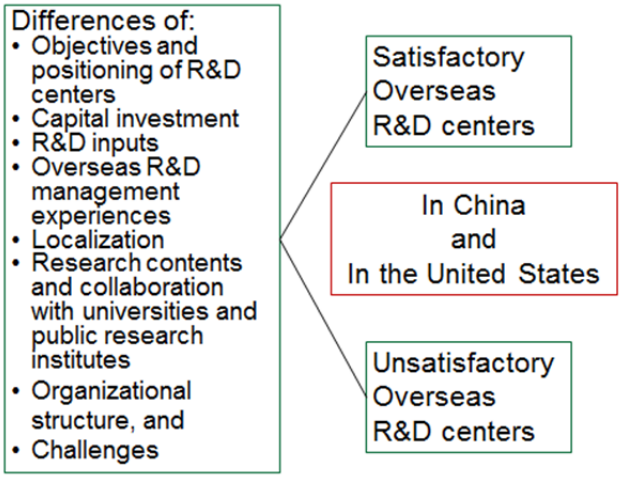

Figure 1: Research Framework

Hypotheses made for the issues above were as follows.

H1: *Objectives and Positioning of R&D centers. Satisfactory R&D centers have strategic objectives other than a low-cost objective (for China) and they position as the centers for local market.*

For objective, a more strategic objective other than a low-cost objective is needed for a successful R&D management, even though the cost to operate an R&D center in China is low[6]. For the positioning of R&D centers, a main role of an R&D center is supposed to be product development catered for local market. For the Chinese market, [12] point out that the major motivation to set up an R&D center in China is for local market.

H2: *Investment. Satisfactory R&D centers have larger capital and more R&D resources.*

A large capital and abundant R&D resources make an R&D center easier to fulfill its purpose.

H3: *Overseas R&D management experiences. Satisfactory R&D centers have longer histories.*

Overseas R&D management experiences are supposed to make overseas R&D centers successful. Thus, a longer history of an overseas R&D center in China is expected for satisfactory overseas R&D centers.

H4: *Localization. Satisfactory overseas R&D centers have a higher level of localization.*

Localization makes external business relation and internal management of an R&D center more fitted to the host country environment. Satisfactory overseas R&D centers need to make external business relation and internal management fitted to the host country environment.

H5: *Research activities. Satisfactory R&D centers conduct practical R&D and collaborate with universities and public research institutes well.*

For research contents, practical R&D is fitted to meet the demand of local markets. Thus, satisfactory R&D centers are supposed to conduct practical R&D.

One of the purposes to set up an R&D center overseas is

[6] The cost of running similar R&D facilities in China is about one tenth of the cost in the United States according to [11].

to collaborate with universities and public research institutes of a host country[7]. Thus, satisfactory R&D centers are likely to collaborate with universities and public research institutes of a host country well.

***H6**: Organizational structure. Satisfactory R&D centers are wholly owned companies.*

An organizational structure can be joint venture with a local company and foreign wholly owned company. To keep strategic information including IPR-related knowledge strictly inside an R&D center, being wholly owned is better.

***H7**: Challenges. Satisfactory R&D centers do not suffer from the leakage of IPRs (intellectual property rights) and know-hows.*

R&D involves IPR issues to a large extent. If the challenge of an R&D center is the leakage of IPRs, that would be a critical problem for that R&D center to fulfill its purpose.

The methods used are interviews and a questionnaire survey. The interviews were conducted to understand the current operation of R&D centers of Japanese companies in China and in the United States and to understand the results of the questionnaire survey. In Japan, the managers of Japanese companies and MNCs from other countries and some experts on overseas R&D management were interviewed. In China, the managers of Japanese R&D centers and various agencies including Chinese universities were interviewed.

The questionnaire survey was conducted in October 2009. Companies surveyed were those that were listed on "Overseas Operating Companies 2008" issued by Toyo Keizai and that possessed overseas production subsidiaries or R&D subsidiaries their shares of which exceeded 50 percent, that is, 652 companies. The return ratio was 19.2 percent, 125 companies (17 companies of which possessed R&D centers in China and 34 companies of which possessed R&D centers in the United States).

The analysis was conducted as follows. First, the satisfaction levels of representative R&D centers in China and in the United States of all companies were checked. Second, those R&D centers in China and in the United States were divided into three categories depending on their satisfaction levels. Then, the differences of R&D management practices were analyzed by these categories. Finally, the differences between the success factors in China and those in the United States were analyzed.

IV. RESULTS - SUCCESS FACTORS OF JAPANESE OVERSEAS R&D CENTER MANAGEMENT

A. Satisfaction Levels of Japanese R&D Centers in China

A large part of companies thought that their R&D centers in China were satisfactory in the light of the purposes of establishment. The companies that responded "satisfied" occupied 44 percent; those that responded "satisfied to some extent" occupied 31 percent; and those that responded "yes and no" or "unsatisfied" occupied 25 percent. The average score was 1.1 points when the average score was calculated by allocating 2 points to "satisfied," 1 point to "satisfied to some extent," 0 points to "yes and no" and -2 points to "unsatisfied."

Henceforth, the analyses will be conducted by the three categories of companies: the companies that responded "satisfied," the companies that responded "satisfied to some extent" and the companies that responded "yes and no" or "unsatisfied."

B. Success Factors of Japanese R&D Centers in China[8]

1. Objectives and positioning of R&D centers

For all the companies that had R&D centers in China, the shares of companies by the objectives of establishing R&D centers were as follows: "supporting local needs" 30 percent, "cost" 16 percent, "qualified human resources" 14 percent, and "integration of research, production and marketing" 14 percent.

For the category of companies that responded "satisfied," the shares of companies by the objectives of establishing R&D centers were as follows: "supporting local needs" 30 percent, "integration of research, production and marketing" 22 percent, and "qualified human resources" 13 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by the objectives of establishing R&D centers were as follows: "supporting local needs" 25 percent, and "cost" 25 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by the objectives of establishing R&D centers were as follows: "supporting local needs" 33 percent, and "cost" 22 percent.

On one hand, the companies that are not satisfied or satisfied to some extent with their R&D centers in China tend to respond that one of important objectives of establishing R&D centers in China is "cost." On the other hand, the companies that are satisfied with their R&D centers in China tend to respond that one of important objectives of establishing R&D centers in China is "integration of research, production and marketing." The objective of "supporting local needs" is most important for all the categories.

Thus, the former half of Hypothesis 1 is supported. The category of companies that responded "satisfied" do not think "cost" is an important objective of establishment unlike the other categories of companies.

For the positioning of R&D centers in China, the results are as follows.

For all the companies that had R&D centers in China, the

[7] For China, see [13].

[8] This section is based on [14].

shares of companies by the positioning of R&D centers were: "for local market" 57 percent, "for Japanese market" 13 percent, "basic research" 13 percent, and "for global market" 13 percent.

For the category of companies that responded "satisfied," the shares of companies by the positioning of R&D centers were as follows: "for local market" 60 percent, "for Japanese market" 20 percent, "basic research" 10 percent, and "for global market" 10 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by the positioning of R&D centers were as follows: "for local market" 57 percent, "for Japanese market" 14 percent, and "basic research" 14 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by the positioning of R&D centers were as follows: "for local market" 50 percent, "for global market" 33 percent, and "basic research" 17 percent.

Thus, the latter half of Hypothesis 1 is supported in a sense, since 60 percent of the companies that were satisfied with their R&D centers in China responded that the positioning of R&D centers was "for local market." However, the positioning for "for local market" was most important for all the categories. The difference between satisfied companies and unsatisfied companies is that satisfied companies think that their secondary important positioning reason of their R&D centers was "for Japanese market" unlike unsatisfied companies whose secondary important positioning reason of their R&D centers was "for global market." As Vernon's Product Cycle Theory in [15] suggests, production sites move to less developed countries as products mature. It seems that product development function for home markets also moves to those less developed countries where production takes place.

2. Investment

In order to measure the investment to an R&D center, the R&D resource inputs and capital were asked.

To measure the size of R&D resource inputs to R&D centers in China, the number of non-Japanese researchers/engineers in the largest R&D center in China and the ratio of R&D expenditure of the largest R&D center in China against total R&D expenditure of a parent company were asked.

With regard to the number of non-Japanese researchers/engineers in the largest R&D center in China, for all the companies that had R&D centers in China, the average was 28.2 persons. For the categories of different satisfaction levels, the results were as follows. For the category of companies that responded "satisfied," the average was 15.7 persons; for the category of companies that responded "satisfied to some extent," the average was 65.5 persons; and for the category of companies that responded "yes and no" or "unsatisfied," the average was 3.7 persons.

With regard to the ratio of R&D expenditure of the largest R&D center in China against total R&D expenditure of a parent company, for all the companies that had R&D centers in China, the average was 4.9 percent. For the category of companies that responded "satisfied," the ratio was 7.4 percent; for the category of companies that responded "satisfied to some exten," the ratio was 3.3 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 3.0 percent.

For the size of capital investment, no significant differences were found among the three categories of satisfaction levels. More than half of R&D centers had the capital of less than 100 million yen (about 1.07 million US dollars[9]).

Thus, Hypothesis 2 is supported in a weak sense. The category of companies that responded "yes and no" or "unsatisfied" have the smallest number of non-Japanese researchers/engineers on average and the lowest ratio of the R&D expenditure in China over total R&D expenditure of a parent company.

3. Overseas R&D management experiences

In order to measure the overseas R&D management experiences, the year of R&D center establishment in China (the length of operation in China) was asked.

With regard to the year of R&D center establishment in China, no significant differences were found among the three categories of satisfaction levels. Nearly 60 percent of them were established in the early 2000s.

Thus, Hypothesis 3 is not supported.

4. Localization

In order to measure the level of localization, three questions were asked. Those questions were "whether a top manager was a local person or not," "whether research theme could be determined locally or not" and "whether local core human resources existed or not."

Regarding the localization of top management, for all the companies that had R&D centers in China, the share of R&D centers whose top management was localized was 19 percent. For the category of companies that responded "satisfied," the ratio was 14 percent; for the category of companies that responded "satisfied to some extent," the ratio was 40 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 0 percent.

Regarding the localization of research theme decision, for all the companies that had R&D centers in China, the share of R&D centers where research theme decision was localized was 35 percent. For the category of companies that responded "satisfied," the ratio was 43 percent; for the category of companies that responded "satisfied to some extent," the ratio was 20 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 33 percent.

Regarding the existence of local core human resources,

[9] The annual average rate of 93.52 yen/dollar in 20009 was used.

for all the companies that had R&D centers in China, the share of R&D centers where local core human resources existed was 80 percent. For the category of companies that responded "satisfied," the ratio was 83 percent; for the category of companies that responded "satisfied to some extent," the ratio was 80 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 75 percent.

Thus, Hypothesis 4 is supported in a sense. The localization of top management was not realized for unsatisfied companies; the decision of R&D themes was rather localized for satisfied companies; and more local core human resources existed for satisfied companies.

5. Research activities

In order to investigate research activities, research contents and collaboration with universities and public research institutes were examined.

The results were as follows. For all the companies that had R&D centers in China, the shares of companies by research contents were as follows: "practical R&D" 45 percent, "early stage R&D of overseas products" 29 percent, "own basic research" 14 percent, and "joint basic research with universities and public research institutes" 11 percent.

For the category of companies that responded "satisfied," the shares of companies by research contents were as follows: "practical R&D" 54 percent, "early stage R&D of overseas products" 26 percent, "own basic research" 10 percent, and "joint basic research with universities and public research institutes" 10 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by research contents were as follows: "early stage R&D of overseas products" 45 percent, "practical R&D" 43 percent, and "joint basic research with universities and public research institutes" 13 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by research contents were as follows: "own basic research" 43 percent, "practical R&D" 27 percent, "early stage R&D of overseas products" 17 percent, and "joint basic research with universities and public research institutes" 13 percent.

Thus, the former half of Hypothesis 5 is supported. That is, "practical R&D" is widely conducted for satisfied companies; and "own basic research" is widely conducted for unsatisfied companies.

The latter half of Hypothesis 5 is not really supported. However, the collaboration with universities and public research institutes in basic research was conducted to some extent for all categories of companies.

6. Organizational structure

Nearly 90 percent of R&D centers on Japanese companies in China were wholly owned. Thus, the analysis by the three categories was not meaningful. Although the number of samples was limited, joint venture R&D centers were interestingly all satisfactory. For the wholly owned R&D centers, only one third was satisfactory. It seemed that the objective and management practices were adjusted to the structure of organization from the beginning.

7. Challenges

For all the companies that had R&D centers in China, the shares of companies by challenges were as follows: "recruiting qualified personnel" 17 percent, "leakage of IPRs and know-hows" 14 percent, "difficulty of communication" 14%, and "division of roles with Japanese R&D centers" 14 percent.

For the category of companies that responded "satisfied," the shares of companies by challenges were as follows: "recruiting qualified personnel" 22 percent, "leakage of IPRs and know-hows" 17 percent, and "division of roles with Japanese R&D centers" 17 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by challenges were as follows: "difficulty of communication" 21 percent, "recruiting qualified personnel" 14 percent, "heavy load of localization" 14 percent and "division of roles with Japanese R&D centers" 14 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by challenges were as follows: "personnel drains" 20 percent, "leakage of IPRs and know-hows" 20 percent, "recruiting qualified personnel" 10 percent, "difficulties of overseas R&D evaluation" 10 percent and "cost-effectiveness" 10 percent.

Thus, Hypothesis 7 is supported in a weak sense. "Leakage of IPRs and know-hows" was one of the two most significant problems for unsatisfied companies and the second most significant problem for satisfied companies as well.

A marked difference that distinguish satisfied companies from unsatisfied companies was that unsatisfied companies had the problems of "personnel drain", "difficulties of overseas R&D evaluation" and "cost-effectiveness."

C. Satisfaction Levels of Japanese R&D Centers in the United States

A large part of companies thought that their R&D centers in the United States were satisfactory in the light of the purposes of establishment. The companies that responded "satisfied" occupied 47 percent; those that responded "satisfied to some extent" occupied 31 percent; and those that responded "yes and no" or "unsatisfied " occupied 22 percent. The average score was 1.3 points when the average score was calculated by allocating 2 points to "satisfied," 1 point to "satisfied to some extent," 0 points to "yes and no" and -2 points to "unsatisfied." This average score, 1.3, is a little higher than that in the case of China, 1.1.

Henceforth, the analyses will be conducted by the three categories of companies: the companies that responded "satisfied," the companies that responded "satisfied to some extent" and the companies that responded "yes and no" or

"unsatisfied."

D. Success Factors of Japanese R&D Center in the United States

1. Objectives and positioning of R&D centers

For all the companies that had R&D centers in the United States, the shares of companies by the objectives of establishing R&D centers were as follows: "technology information collection" 24 percent, "supporting local needs" 18 percent, "qualified human resources" 16 percent, and "research collaboration" 15 percent.

For the category of companies that responded "satisfied," the shares of companies by the objectives of establishing R&D centers were as follows: "technology information collection" 26 percent, "supporting local needs" 19 percent, "qualified human resources" 19 percent, and "research collaboration" 16 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by the objectives of establishing R&D centers were as follows: "technology information collection" 22 percent, "supporting local needs" 19 percent, and "qualified human resources" 15 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by the objectives of establishing R&D centers were as follows: "technology information collection" 21 percent, and "supporting local needs" 21 percent.

Although all the companies thought that "technology information collection" and "supporting local needs" were important objectives, only the companies that were satisfied with their R&D centers in the United States tended to respond that one of important objectives of establishing R&D centers in the United States was "qualified human resources."

For the positioning of R&D centers in the United States, the results are as follows.

For all the companies that had R&D centers in the United States, the shares of companies by the positioning of R&D centers were as follows: "for local market" 39 percent, "for global market" 27 percent, "basic research" 20 percent, and "for Japanese market" 7 percent.

For the category of companies that responded "satisfied," the shares of companies by the positioning of R&D centers were as follows: "for global market" 39 percent, "for local market" 30 percent, and "basic research" 17 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by the positioning of R&D centers were as follows: "for local market" 36 percent, "basic research" 29 percent, and "for global market" 21 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by the positioning of R&D centers were as follows: "for local market" 71 percent, and "basic research" 14 percent.

Thus, Hypothesis 1 is not supported for the United States unlike in China. On one hand, nearly 40 percent of satisfied companies responded that the positioning of R&D centers was "for global market." On the other hand, more than 70 percent of unsatisfied companies responded that the positioning of R&D centers was "for local market".

2. Investment

In order to measure the investment to an R&D center, the R&D resource inputs and capital were asked.

To measure the size of R&D resource inputs to an R&D center in the United States, the number of non-Japanese researchers/engineers in the largest R&D center in the United States and the ratio of R&D expenditure of the largest R&D center in the United States against total R&D expenditure of a parent company were asked.

With regard to the number of non-Japanese researchers/engineers in the largest R&D center in the United States, for all the companies that had R&D centers in the United States, the average was 23.6 persons. This average size was a little smaller than that in China. For the categories of different satisfaction levels, the results are as follows. For the category of companies that responded "satisfied," the average was 35.0 persons; for the category of companies that responded "satisfied to some extent," the average was 15.4 persons; and for the category of companies that responded "yes and no" or "unsatisfied," the average was 7.7 persons.

With regard to the ratio of R&D expenditure of the largest R&D center in the United States against total R&D expenditure of a parent company, for all the companies that had R&D centers in the United States, the average was 6.4 percent. This ratio was a little higher than the ratio in the case of China, 4.9 percent. For the category of companies that responded "satisfied," the ratio was 6.8 percent; for the category of companies that responded "satisfied to some extent," the ratio was 4.6 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 7.8 percent.

For the size of capital investment, more satisfied companies seemed to have a larger investment. Sixty percent of R&D centers had the capital of less than 100 million yen (about 1.07 million US dollars[10]).

Thus, Hypothesis 2 is supported in a sense. The more satisfied, the larger the size of the investment to an R&D center was, except the ratio of R&D expenditure of the largest R&D center in the United States against total R&D expenditure of a parent company.

3. Overseas R&D management experiences

In order to measure the overseas R&D management experiences, the year of R&D center establishment in the United States (the length of operation in the United States) was asked.

For the year of R&D center establishment in in the United States, clear differences were not found except that no "satisfied" companies established their R&D centers in the United States in 2005 or after 2005.

[10] The annual average rate of 93.52 yen/dollar in 20009 was used.

Thus, Hypothesis 3 is not supported for the United States, either.

4. Localization

In order to measure the level of localization, three questions were asked. Those questions were "whether a top manager was a local person or not," "whether research theme could be determined locally or not" and "whether local core human resources existed or not".

Regarding the localization of top management, for all the companies that had R&D centers in the United States, the share of R&D centers whose top management was localized was 56 percent. For the category of companies that responded "satisfied," the ratio was 40 percent; for the category of companies that responded "satisfied to some extent," the ratio was 67 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 71 percent. The more satisfied, the lower the ratio of the localization of top management in the United States was.

Regarding the localization of research theme decision, for all the companies that had R&D centers in the United States, the share of R&D centers where research theme decision was localized was 25 percent. For the category of companies that responded "satisfied," the ratio was 20 percent; for the category of companies that responded "satisfied to some extent," the ratio was 0 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 63 percent. The unsatisfied companies showed the highest ratio of the localization of research theme decision in the United States.

Regarding the existence of local core human resources, for all the companies that had R&D centers in the United States, the share of R&D centers where local core human resources existed was 84 percent. For the category of companies that responded "satisfied," the ratio was 100 percent; for the category of companies that responded "satisfied to some extent," the ratio was 67 percent; and for the category of companies that responded "yes and no" or "unsatisfied," the ratio was 71 percent. On one hand, the satisfied companies showed the highest ratio of the existence of local core human resources. On the other hand, the unsatisfied companies showed the second highest ratio.

Thus, Hypothesis 4 is not supported for the United States unlike in China.

5. Research activities

In order to investigate research activities, research contents and collaboration with universities and public research institutes were examined.

The results were as follows. For all the companies that had R&D centers in the United States, the shares of companies by research contents were as follows: "practical R&D" 43 percent, "early stage R&D of overseas products" 16 percent, "joint basic research with universities and public research institutes" 15 percent, and "own basic research" 13 percent.

For the category of companies that responded "satisfied," the shares of companies by research contents were as follows: "practical R&D" 38 percent, "own basic research" 21 percent, "early stage R&D of overseas products" 18 percent, and "joint basic research with universities and public research institutes" 15 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by research contents were as follows: "practical R&D" 40 percent, "joint basic research with universities and public research institutes" 25 percent, "early stage R&D of overseas products" 14 percent, and "own basic research" 7 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by research contents were as follows: "practical R&D" 58 percent, "early stage R&D of overseas products" 14 percent, "own basic research" 2 percent, and "joint basic research with universities and public research institutes" 1 percent.

Thus, the former half of Hypothesis 5 is not really supported. "Practical R&D" was conducted more for unsatisfied companies.

The latter half of Hypothesis 5 is supported in a weak sense. The collaboration with universities and public research institutes in basic research was rather strong for satisfied companies.

6. Organizational structure

More than 90 percent of R&D centers of Japanese companies in the United States were wholly owned. Thus, the analysis by the three categories was not meaningful.

7. Challenges

For all the companies that had R&D centers in the United States, the shares of companies by challenges were as follows: "recruiting qualified personnel" 22 percent, "cost-effectiveness" 20 percent, "division of roles with Japanese R&D centers" 16 percent, and "difficulty of communication" 15 percent.

For the category of companies that responded "satisfied," the shares of companies by challenges were as follows: "recruiting qualified personnel" 20 percent, "personnel drains" 17 percent, and "cost-effectiveness" 17 percent.

For the category of companies that responded "satisfied to some extent," the shares of companies by challenges were as follows: "division of roles with Japanese R&D centers" 21 percent, "recruiting qualified personnel" 18 percent, "difficulty of communication" 18 percent, and "cost-effectiveness" 18 percent.

For the category of companies that responded "yes and no" or "unsatisfied," the shares of companies by challenges were as follows: "recruiting qualified personnel" 31 percent, "cost-effectiveness" 31 percent, "division of roles with Japanese R&D centers" 19 percent, and "difficulty of communication" 13 percent.

The unsatisfied companies and semi-satisfied ones tended to point out that "division of roles with Japanese R&D

centers" was an issue.

Thus, Hypothesis 7 is not supported well. "Leakage of IPRs and know-hows" was not a significant problem for all the categories of companies.

E. Comparison of Success Factors of Japanese R&D Centers in China and those in the United States

In some issues such as investment, the success factors of Japanese R&D centers in China were the same as those in the United States: in other issues such as the level of localization and research contents and challenges, they were different.

For the objectives of establishment, for satisfied companies, "integration of research, production and marketing" was a popular objective in China, while "qualified human resources" was a popular one in the United States. For all companies, the most popular objective was "supporting local needs" in China, while "technology information collection" was the most popular objective in the United States and "supporting local needs" was the second most popular objective in the United States.

For the positioning of R&D centers, for satisfied companies, "for Japanese market" was popular in China, while "for global market" was popular in the United States. For all companies, the most popular objective was "for local market" both in China and in the United States.

For the size of R&D personnel, it was small in terms of the number of non-Japanese researchers/engineers for unsatisfied companies both in China and in the United States.

For localization, the localization of top management and decision of R&D themes was realized for satisfied companies in China but for unsatisfied companies in the United States. However, local core human resources tended to exist for satisfied companies both in China and in the United States.

For research contents, "own basic research" was widely conducted for satisfied companies in the United States, while it was moat widely conducted for unsatisfied companies in China. "Practical R&D" was most widely conducted for satisfied companies in China, while it was popular among all the categories of companies in the United States.

For challenges, for unsatisfied companies, "personnel drains," "difficulties of overseas R&D evaluation" and "cost-effectiveness" were problems in China, while "division of roles with Japanese R&D centers" and "difficulty of communication" were problems in the United States. "Recruiting qualified personnel" was the most important problem for satisfied companies both in China and in the United States.

V. CONCLUDING REMARKS

As a whole, Japanese companies were satisfied with their R&D centers in China and in the United States in the light of their purposes of establishment at least to some extent.

In China, for satisfied companies, one of major objectives was "integration of research, production and marketing" after "supporting local needs"; one of major positioning reasons was "for Japanese market" in addition to "local market"; R&D resource input was relatively large; localization was progressed; "practical R&D" was widely conducted; and one of major problems was "recruiting qualified personnel".

In the United States, for satisfied companies, one of major objectives was "qualified human resources" in addition to "technology information collection"; one of major positioning reasons was "for global market"; R&D resource input was large; localization was not progressed except the existence of core local human resources; "own basic research" was conducted in addition to "practical R&D"; and one of major problems was "personnel drains" in addition to "recruiting qualified personnel."

Thus, success factors to manage overseas R&D centers of Japanese companies were different between China and the United States in some issues. These differences could occur depending on the kind of technologies, the stages of R&D, the sectors of the industry and so on.

For further research, along with the continuing search for the success factors of managing overseas R&D centers, the author intends to analyze the outputs of overseas R&D centers using patent data in the near future.

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