

Analysis of Collaborations between Small-Medium Companies and Universities Based on Joint Research Projects

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Abstract. The university-industry collaborations have been recognized as an important factor for the creation of innovation. Although the university-industry collaborations have been mainly conducted by large companies so far in Japan, the small-medium companies rather than large companies are accumulated in regional areas. However, there are a lot of problems in the university-industry collaborations of the small-medium companies. In this paper, the collaborations between small-medium companies and universities are analyzed based on joint research projects. The results show that the joint research projects of small-medium companies for collaboration partners are not conducted enough comparing with those of large companies. Moreover, the results also show that the average budget per project of small-medium companies is rather lower than that of large companies according to the detailed data of Niigata University. Based on these results, the problems of the university-industry collaborations of small-medium companies for collaboration partners are extracted. Moreover, the stage map that proceeds to commercialization for the collaborations between small-medium companies and universities is made and discussed.

Keywords: university-industry collaboration, innovation, joint research project, small-medium company.

1. Introduction

University-industry collaborations (called UICs in short) have been recognized as an important factor for the creation of innovation. Moreover, The UICs have been encouraged in recent years in Japan from the view point of new industry and job creation [1]. The UICs have become more active and changed to the period of the quality from the quantity. Many results from UICs have been reported recently focusing on the geographical distance between university and industry, on the size of collaboration partner companies, and on the number of projects by technology [2-10].

On the other hand, although the UICs have been mainly conducted by large companies so far in Japan, the small-medium companies rather than large companies are accumulated in regional areas [6, 7]. However, there are a lot of problems in the UICs of such small-medium companies. It is difficult to activate the UICs of small-medium companies by themselves because the small-medium companies are lacking in funds, technologies, and organizations. Therefore, the intensity and extent of the UICs are important for the support of small-medium companies and the activities of economy.

In the previous paper [11], the UICs were analyzed based on the case study of joint research projects in order to clarify the structure of the UICs in regional areas of Japan. In this paper, the collaborations between small-medium companies and universities are analyzed based on public and detailed data of joint research projects. The detailed data is obtained by Niigata University. Based on the analyzed results, the problems of the UICs of small-medium companies for collaboration partners are extracted. Moreover, the stage map that proceeds to commercialization for the collaborations between small-medium companies and universities is made and discussed. Niigata area is one of the areas in which small-medium companies are almost

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accumulated in Japan. These results are applicable to many other areas because there are many areas in which small-medium companies are almost accumulated.

2. Joint Research Projects between Small-Medium Companies and Universities

The UICs are used as a very wide meaning. This paper is focused on joint research projects for the analysis. The reason is that the joint research projects are essential for university-industry collaborations because the contract content including the ownership of the intellectual property is clearly defined and private companies are the main partners. The execution situation issued by Ministry of Education, Culture, Sports, Science and Technology in Japan every year is used in order to know the record of the projects [12]. The public data of the joint research projects are limited to national universities for this analysis due to the difference of the systems by private and national universities.

2.1. Analysis based on public data

Figure 1 shows the trend in the number of joint research projects in national universities in Japan dividing collaboration partners into large, small-medium companies and others by time series in the period from 2001 fy (fiscal year) to 2008 fy. A small-medium company is considered as one with a total capital of less than 300 million yen (3,226 thousand US dollar) or a total number of employees less than 300. The number of joint research projects has been increasing steadily and is in a total of 14,303 in 2008 fy. This means that the UICs have been encouraged steadily. Figure 2 shows each rate of the divided joint research projects in national universities by time series. Both the number and rate of large companies for collaboration partners have increased. The number of large companies in 2008 fy is about 3.5 times than that in 2001 fy. On the other hand, although the number of joint research projects of small-medium companies has increased slightly, the rate of these projects has decreased since 2002 fy. The number of joint research projects of small-medium companies in 2008 fy is slightly 2.0 times than that in 2001 fy. The rate is only 16.4 percent in

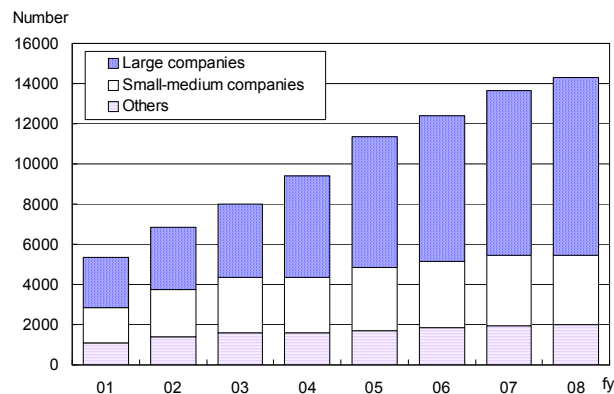


Fig. 1: Number of joint research projects divided by company scale in national universities by time series.

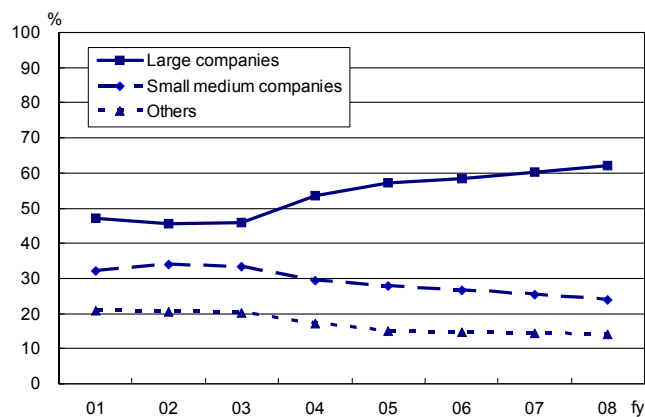


Fig. 2: Rate of joint research projects divided by company scale in national universities by time series.

2008 fy. Therefore, the joint research projects of small-medium companies for collaboration partners are not conducted enough comparing with those of large companies when the numbers of large and small-medium companies in Japan are considered, respectively.

2.2. Analysis based on detailed data

Figure 3 shows the trend in the number of joint research projects in Niigata University dividing collaboration partners into large, small-medium companies and others by time series. The number of joint research projects has been increasing steadily and is in a total of 204 in 2008 fy. The trend in Fig. 3 examining the trend regardless of the company scale is similar to that in Fig. 1. Figure 4 shows each rate of the divided joint research projects in Niigata University by time series. Although the number of large companies for collaboration partners has increased, the rate roughly has flattened in recent years. The number of large companies in 2008 fy is about 3.3 times than that in 2001 fy and this trend is similar to that in the whole of national universities. Comparing the rates of large companies in 2008 fy in the two cases, the rate is less than 50 percent in Niigata University although the rate is more than 60 percent in the whole of national universities. On the other hand, the number of joint research projects of small-medium companies for collaboration partners in 2008 fy is about 5.3 times than that in 2001 fy. This result is larger than that in the whole of national universities. The reason is that small-medium companies have been accumulated in Niigata Prefecture and the support system to these companies has been strengthened. However, the rate of small-medium companies roughly has flattened and has been about 30 percent as well as that in the whole of national universities.

On the other hand, the average budget per one joint research project roughly has flattened from 2001 fy to 2008 fy in both the whole of national universities and Niigata University. However, the average budget per project in Niigata University is about 1,314 thousand yen (about 14.1 thousand US dollar) and is rather lower than 2,386 thousand yen in the whole of national universities. In the case of Niigata University, the average budget per one project of small-medium companies is about 933 thousand yen and that of large companies is about 1,449 thousand yen. That is, the average budget per project of small-medium companies is rather lower than that of large companies. We consider that small medium companies are lacking in funds, technologies, and organizations and the characteristics of regional areas are reflected.

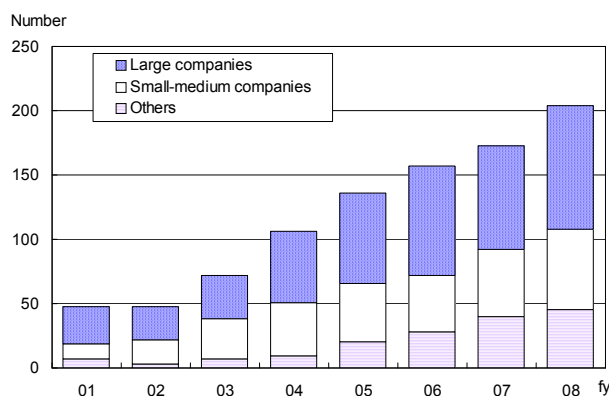


Fig. 3: Number of joint research projects divided by company scale in Niigata University by time series.

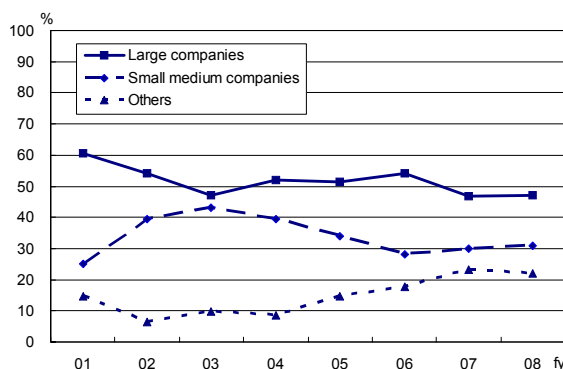


Fig. 4: Rate of joint research projects divided by company scale in Niigata University by time series.

3. Stages of Collaborations between Small-Medium Companies and Universities

There are a lot of problems in the UICs of the small-medium companies as mentioned above and the number of successful cases where proceed to commercialization is limited. It is important to understand that the joint research projects are conducted at which stage from the basis to the commercialization in order to develop the joint research projects to the commercialization. Therefore, the problem in the UICs of the small-medium companies is made clear and the factors of successful cases where proceed to commercialization are discussed.

In the previous paper [11], the specific subject of the joint research projects was roughly divided into the three cases (1) needs oriented joint research project, (2) knowledge development joint research project, and (3) evaluation type joint research project. Although both the cases (1) and (3) were applicable to small-medium companies, the case (2) were not almost applicable to these companies. In addition, the disagreement of active areas between small-medium companies and universities was made clear and the cause of the disagreement was mentioned.

The stage map from the basis to the commercialization for the collaborations between small-medium companies and universities was made based on these results in addition to the case studies and experiences of the author. Figure 5 shows the made stage map. In the case of the collaborations between small-medium companies and universities, the needs are almost brought into the university from the industrial world and the specific subject is almost clear. The management is important. The following management is required in order to develop the joint research project to the commercialization: The target is made clear and is shared at development stage as shown in Fig. 3. In addition, each role is recognized and the management from bird's-eye view is properly conducted. The concrete items of the management are the target in the whole project, the setting of time, the milestone of each subject, the secure and distribution of fund, the grasp and adjustment of progress, and the treatment of outbreak thing etc. The result of research is applicable to practical use and is excavated at research stage. The university researchers can tackle without discomfort at this stage. We believe that the UICs are conducted smoothly at this stage. On the other hand, the style at development stage is different from radical style in universities. In addition, the results are required in the restriction of short time relatively. Therefore, university researchers are not familiar with this stage and the conflict is apt to occur between the companies and universities. For this reason, it is important to overcome this development stage through the collaborations between small-medium companies and universities in order to develop the joint research projects to the commercialization.

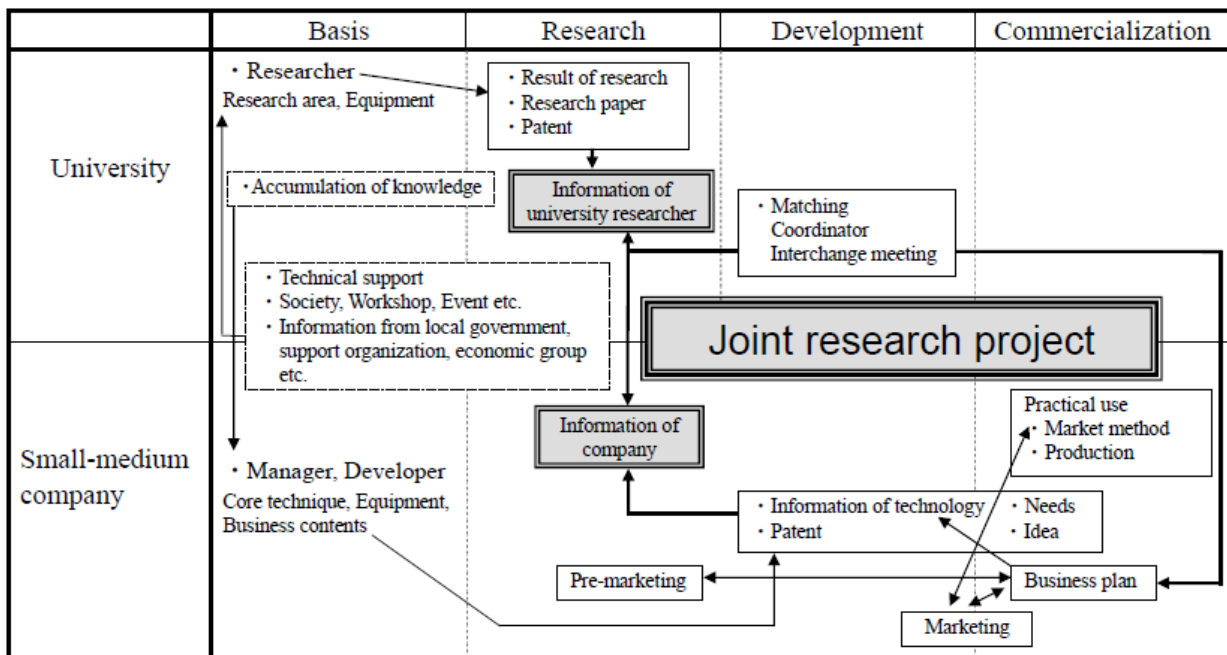


Fig. 5: Stage map for collaboration between small-medium company and university.

We consider that the role and target are enough recognized, and the self-sufficient function is needed in the case of the collaborations between companies and universities, namely, the collaborations between

different sectors. The researchers and developers in companies and universities can confirm the flow and position of the whole joint research project, and the direction of this project from bird 's-eye view. This aspect is shown in Fig. 5. The managers and developers of small-medium companies, university researchers, and coordinators between companies and universities etc. can grasp the basis, research, development, and commercialization. This map is expected to use for stage map confirming the present position and the direction to proceed next. Hereafter, we will modify and improve this stage map supporting the UICs and investigating successful cases through the collaborations between small-medium companies and universities. Therefore, we believe that the collaborations between small-medium companies and universities are systematized and the economics are promoted when the successful cases are increased and accumulated.

4. Conclusions

In this paper, the collaborations between small-medium companies and universities were analyzed based on joint research projects. The results showed that the joint research projects of small-medium companies for collaboration partners comparing with those of large companies were not conducted enough considering the numbers of large and small-medium companies in Japan, respectively. Moreover, the results also showed that the average budget per project of small-medium companies was rather lower than that of large companies. Based on these results, the problems of the university-industry collaborations of small-medium companies for collaboration partners were extracted. Moreover, the stage map that proceeds to commercialization for the collaborations between small-medium companies and universities was made and discussed.

5. References

- [1] D. Rahm, J. Kirkland, and B. Bozeman. University-Industry R&D Collaboration in the United States, the United Kingdom, and Japan, *Kluwer Academic Publishers*, 2000, pp. 29-37.
- [2] Z. J. Acs, D. B. Audretsch, and M. P. Feldman. R&D Spillovers and Recipient Firm Size, *The Review of Economics and Statistics*, Vol. 76, No. 2, 1994, pp. 336-340.
- [3] E. Mansfield. Academic research underlying industrial innovations: Sources, characteristics, and financing, *The Review of Economics and Statistics*, Vol. 77, No. 1, 1995, pp. 55-65.
- [4] Y. S. Lee. Technology Transfer and the Research University: a Search for the Boundaries of University-Industry Collaboration, *Research Policy*, Vol. 25, 1996, pp. 843-863.
- [5] C. Vedovello. Science Parks and University-Industry Interaction: Geographical Proximity between the Agents as a Driving Force, *Technovation*, Vol. 17, No. 9, 1997, pp. 491-502.
- [6] D. Audretsch. Small Firms and Efficiency, in *Are Small Firms Important ?, Their Role and Impact*, Z. J. Acs ed, *Kluwer Academic Publication*, 1999.
- [7] M. D. Santoro and A. K. Chakrabarti. Firm Size and Technology Centrality in Industry-University Interactions, *Research Policy*, Vol. 31, 2002, pp. 1163-1180.
- [8] K. Motohashi. Quantitative Analysis of Industry University Collaborative Research: - Their Implications on Japan's Innovation System, *RIETI Discussion Papers*, Series 03-J-015, 2003 (in Japanese).
- [9] W. M. Cohen, R. R. Nelson and J. P. Walsh. Links and Impacts: The Influence of Public Research on Industrial R&D, *Management Science*, Vol. 48, No. 1, 2002, pp. 1-23.
- [10] Y. Saitoh, Y. Nakayama, M. Hosono, N. Fukugawa, and S. Kobayashi. University-Industry Research Cooperation: A Status Report, 1983-2001, 2001 (in Japanese).
- [11] K. Kawasaki. Analysis of University-Industry Collaborations in Regional Area of Japan Based on Case Study of Joint Research Projects, *Proc. of 2010 International Conference on Innovation, Management and Service*, Singapore, 2010, pp. 197-201.
- [12] http://www.mext.go.jp/a_menu/shinkou/sangaku/sangakub.htm.