A New Challenge to Create Future through Industry-Academia Collaboration

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Abstract

Innovation, an important factor in capitalist economies, often occurs as a chemical reaction between different knowledge systems of different fields. However, employees of many companies share similar information and values specific to their industry, and have little contact with different knowledge systems of different fields.

Therefore, we felt that we needed to have a place to support dialogue among people who seek diverse common sense ways of thinking and values. We then established a joint research course at a university. We linked the ideas generated from this program to our research and development themes. This program served as a catalyst for solving social issues and making them useful for our business. This catalyst enabled us to broaden our knowledge base to create new value, such case as producing R & D themes that were unfamiliar to our company.

1 Preface

The capitalist economy, which was born in the 18th century, has since developed significantly and is now adopted in many countries and supports the world economy. Innovation is an important element in the capitalist economy, and the economy and social environment grow and progress through the invention of new business models and technologies. One of the important factors for innovation is the “chemical reaction of knowledge”. This is born when people with different values, ways of thinking, and knowledge respect each other, and work together on a shared goal. Innovation born from the “chemical reaction of knowledge” includes ideas for creating new technologies, new business models, and new ways of using existing technologies. In this paper, we introduce the Joint Research Course as a place for the “chemical reaction of knowledge”.

2 Joint Research Course as Place to Promote Chemical Reactions of Knowledge

Employees of many companies share similar information and values that exist in each industry and department, and their ways of thinking are similar, even if there are some differences. In such an environment, even if ideas for improvements come up, it is difficult to come up with innovative ideas. Conversely, a “place” where people from different backgrounds can communicate while maintaining diversity is an environment where ideas that lead to innovation are more likely to develop.

In order to create a “place” that promotes such innovative thinking, we established a joint research course (course name: “Meiden Innovation Creation Fundamental Research Course”) at Tokyo University of Agriculture and Technology.

A joint research course is a research organization established within a university by providing funds to a university from companies and other organizations. Traditional joint research is often a one-to-one relationship in which a specific laboratory (usually one laboratory) responds to a specific issue. On the other hand, a joint research course is a research organization where many university professors can share information and solve problems and generate ideas, making it easy to create a multiple-to-multiple relationship. Fig. 1 shows the difference between conventional joint research program and joint research course this time.

In addition, specially appointed teachers are dispatched from companies to the joint research course. Since specially appointed teachers are also university faculty members, they can have close

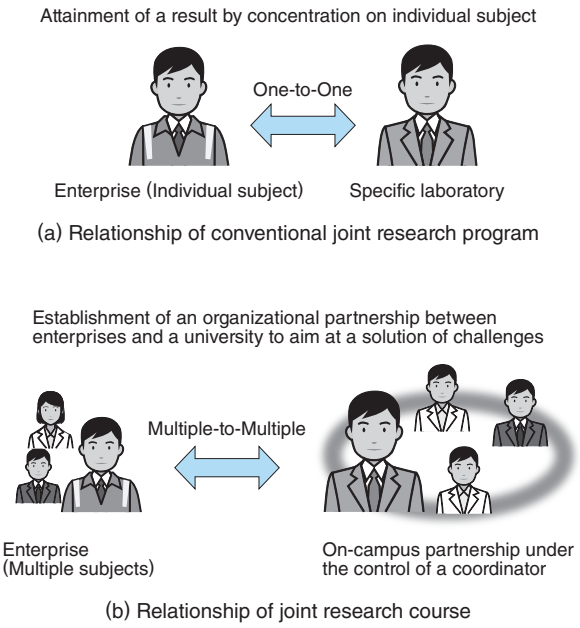

Fig. 1 **Difference between Conventional Joint Research Program and Joint Research Course this Time**

For a single subject, actions are taken with a diversity (multiple-to-multiple).

exchanges of views and exchange of information with the university. Furthermore, by ensuring diversity at one university, even in a multiple-to-multiple relationship, the adjustment of confidentiality agreements and intellectual property rights can be simplified as it becomes a relationship between one company and one university.

3 Functions Expected from Joint Research Course

The functional aspects can be divided into the following three:

(1) A function to promote human resource development and exchange by utilizing a multiple-to-multiple network;

(2) A function to link cutting-edge research (seeds) from universities with the requests and issues of companies from (1) to generate ideas, and after social implementation verification, to link them to the acquisition of new core technologies and the creation of new businesses;

(3) A function to maintain and develop basic research and fundamental techniques inside the university so that continued development is attained for (2).

At present, efforts are centered on (1) and (2), and have not yet reached (3).

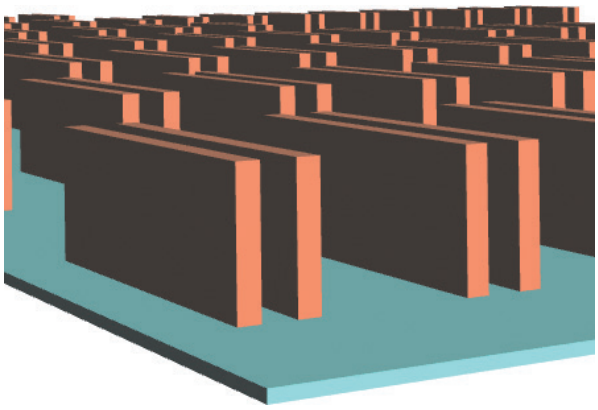

Fig. 2 **Image of Metasurface Sensor Structure**

Meta-molecules in nanosize are placed over the board surface.

4 Case Study and Progress

Here is an example of idea creation. We introduced the seeds of the university obtained through the joint research course to employees and also solicited ideas for their use. In an example of soliciting ideas on the subject of electromagnetic metasurfaces or metasurfaces※1, there was a proposal for using them in a small antenna to detect partial discharge in generators. Partial discharges occur due to deterioration of the insulation system of the generator. Therefore, their detection is an important issue for our company's products, which aim for long-term reliability.

Based on this idea, we considered whether it could be used as a research and development theme or a new business. The study was carried out intermittently over a period of about six months. The employee who proposed the idea, a professor researching metasurfaces, and a professor, who specializes in fluid dynamics, joined us to proceed with the study.

While the initial idea of applying metasurfaces to an antenna for detecting partial discharge electromagnetic waves ended in failure, the employees deepened their knowledge of metasurfaces, and the university professors deepened their knowledge of the mechanism of partial discharge generation in generators. As a result, we realized that metasurfaces could be used as sensors to detect ozone and ammonia gases that are generated due to partial discharges. We determined from the results of simulation studies that this was theoretically feasible and began to consider the research topic and business. Fig. 2 shows an image of the metasurface sensor structure.

It is highly likely that the conventional technical consultation with universities would have concluded that metasurfaces are not suitable as antennas for partial discharges.

Another example is our work on mobile robots. Since our company is primarily focused on electricity, robots tend to be associated with ideas that utilize electrical energy such as motors and inverters. By adding the idea of using mechanical energy such as springs, we are now considering mechanisms and effects that were not previously available at our company. In addition to generating ideas, we are also seeing an increase in PR opportunities through the publication of papers, patent applications, and external funding.

5 Postscript

In a business environment that is rapidly changing on a global scale, companies need to continue and develop their businesses. To do this, it is essential to maintain and develop existing core technologies and core businesses while at the same time we need to develop new businesses and acquire new core technologies.

Our company is also working on both knowledge exploration and exploitation as dual approach. Here, we have introduced our efforts regarding “exploration”. Through these activities, we will actively link new ideas to solving social issues and strive to contribute to society and increase our corporate business value.

・All product and company names mentioned in this paper are the trademarks and/or service marks of their respective owners.

(Note)

※1. A surface structure where a microstructure relevant to the wavelength is formed on a board to express its characteristics.