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A Joint Effort between Academia and Industry in the Eastern Part of Kagawa Prefecture in Japan

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ABSTRACT

The Regional Cooperative Development Center (RCDC) at Tokushima Bunri University was established in 2005. The role of the RCDC is to make a social contribution and to assist in the development of human resources. The RCDC has made contributions to society by organizing meetings to facilitate the exchange of technology, holding public lectures, supporting joint research projects, providing technical assistance for manufacturers, making available the free use of equipment owned by the university and so on. Additionally, the RCDC has put much effort into giving undergraduate students internship opportunities at industries in the eastern part of Kagawa Prefecture (the TOSAN area) in Japan. The RCDC also trained a contracted researcher from a small company about the creation of intellectual property, including how to conduct a patent prior art search, how to prepare a patent specification, etc. The RCDC has worked in partnership with industry, Sanuki City Society of Commerce and Industry and Higashi-Kagawa City Society of Commerce and Industry in order to revitalize local communities.

Keywords: Engineering education, Industrial-academic-government collaboration, Human resource development, Regional contribution

I. Introduction

The RCDC was established in 2005 by a group of teachers at Tokushima Bunri University's Faculty of Science and Technology. The RCDC was placed under the control of the Center for Advanced Science and Engineering (CASE). The RCDC is an organization that promotes projects conducted by CASE, and its mission is to promote research and development (R&D) to overcome various regional problems related to R&D and the growth of industries, to strengthen students' interest in manufacturing, to contribute to the revitalization of local communities and to promote business growth through exchanges with the real world. The RCDC is composed of three sections as shown in Fig. 1 and each section carries out the following 3 projects jointly and severally.

Project for the promotion of technology exchange: This section promotes technology exchange meetings, joint research, etc.

Program for the promotion of active student learning. This section promotes cultural and exchanges of technology between industry and students.

Project for the promotion of information networks. This section promotes the PR of the above activities in cooperation and collaboration with the university's public relations arm.

In the past 6 years, we have organized various activities including technology exchange meetings, public lectures, joint research projects, technical assistance for manufacturers, providing free use of some instruments owned the university, undergraduate student internships, educating a contracted researcher from a company about the creation of intellectual property, etc. When we look at these activities from a different perspective, they can be divided into social activity work and human resource development, as shown in Fig. 2. Here we report on the particular activities which were carried out in the Department of Science and Technology. These included educating a contracted researcher about the creation of intellectual property based

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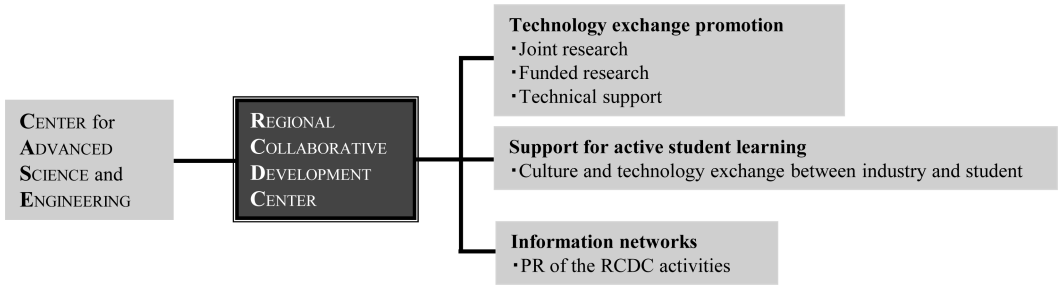

Fig. 1 Organization chart of the RCDC and the mission

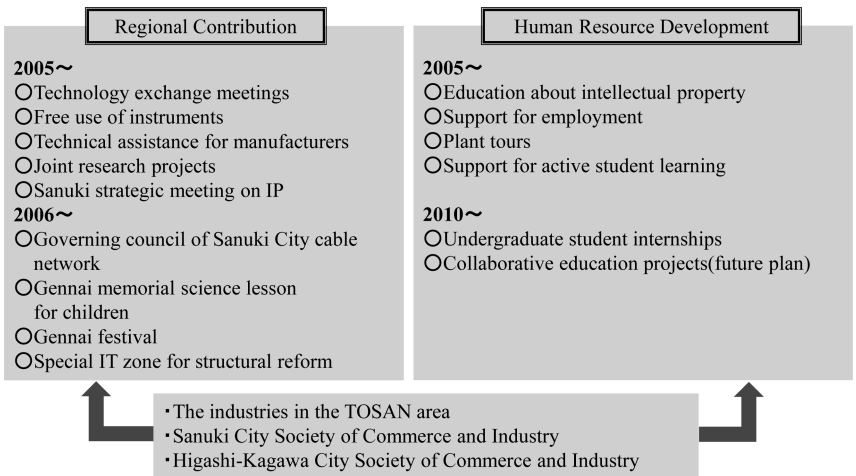

Fig. 2 The avtivities of the RCDC

on research by members of our group, organizing technology exchange meetings, providing opportunities for undergraduate students to take up internships at industries in the TOSAN area and having The 2011 Autumn Meeting of The Society of Fiber Science and Technology, Japan.

II. Regional Contribution and Human Resource Development

1. Education on the Creation of Intellectual Property

The university teachers with engineering backgrounds who come from private companies probably account for 45% of all teachers in the department of science and technology. They were previously employed by different businesses, such as Asahi Kasei Corporation, Fujitsu Ltd., Hitachi Ltd., Mitsubishi Electric Corporation, Mitsui Engineering & Shipbuilding Co., Ltd., Teijin Ltd, etc. Integrating their knowledge of intellectual property rights into the university courses is one possible way to make a social contribution and to assist the development of human resources, because the teachers have considerable knowledge about intellectual property rights from their corporate R&D activities. There are many small companies which have superior technologies and human resources, but don't necessarily have the manpower or someone in charge who has enough time to train employees. However, it is important to develop human resources regardless of the scale of the company, and so some small companies are faced with a dilemma.

In view of these circumstances, for 3 years from 2006, we conducted our usual intellectual property educational courses, which contain essential basic knowledge, for the benefit of the company the students work for, and we also worked with the contracted researcher in the materials science and technology group. The following material outlines a view of invention which is necessary for contributing to sustainable development for the growth of industries,

and the basic knowledge required for preparing a Japanese patent specification. Corporate researchers should always keep in mind ways of bringing about the creation of a technology that can be used by almost everybody and how that technology might be used.

A. What is a Patent?

A patent is a set of exclusive rights granted to an inventor or their assignee for a limited period of time in exchange for the public disclosure of an invention. A patent is intended for an invention which is industrially applicable [1]. Within the Japanese Patent Act, "invention" means the creation of technical ideas utilizing the laws of nature and with workable specificity. In other words, the followings are not inventions within the meaning of this Act - discovery of principles, something that already exists in nature, secrets which are difficult to duplicate, derivation of formulae, etc. A patent is also distinguished from a device as defined by the Utility Model Act. In many cases, an invention usually makes people think of an actual product which is invented, but it is also found in situations as shown in Fig. 3. There are not many inventions discovered in day-to-day work, but researchers need to develop an awareness of inventions as part of their way of thinking.

- A new method of making a product
- A new method of using a product
- A new method of utilizing characteristic properties of substances
- When an inventor has solved a problem
- When an inventor has discovered a means of solving problems
- When an inventor has produced a large benefit
- When an inventor has discovered an advantageous effect which was previously unknown

Fig. 3 How to recognized inventions

【A patent is granted on an application】
- Existence of novelty
- Existence of inventive step
- Industrially applicable

【 Fails to mature into a patent】
- Is the same as another invention
- Is an invention easily discovered from known things
- Industrially not applicable

Fig. 4 Conditions required for an invention to mature into a patent

B. Conditions for Patentability

The conditions for patentability [2] are shown in Fig. 4. Specifically, if the prior art has novelty and usefulness and is an inventive step, it's a patentable invention. Therefore, it is necessary to train an inventor to assess the patentability of inventions based on the following points.

C. Novelty

A patentable invention is one that other people are not aware of and which does not exist in prior art documents. A new invention which contains publicly known material may have a chance of being patented, and therefore it is important to make correct assessments based on what is publicly known. So the inventor must conduct a novelty search to determine whether or not an application is able to be filed, and must take into account the novelty of his or her own invention.

D. Assessment of Inventive Steps

An inventor must compare his or her own invention to its closest related prior art, and consider which categories from the following list apply.

- There is no existence of prior art
- It is a combination of publicly known prior arts
- There is an interchange of parts of publicly known prior arts
- There is a numerical limitation of some parts of publicly known prior arts
- It is a prior art with more limited concepts in contrast to a patent containing generic concepts

Apart from the first inventive step above, an invention having a striking effect and a significant level of unforeseen effects, are important criteria for an evaluation of patentability. So, it is necessary to make a comparative review of prior arts with respect to each condition for the prior art.

E. Whether or Not it is Industrially Applicable

Since the patent system is designed as a tool to provide

an incentive to industrial progress, inventions which are only useful academically or experimentally are eliminated.

F. Review of Peripheral Prior Art

Because the target of an invention may be not only for substantive conditions, it is necessary to think more broadly about peripheral prior arts. That is, a single prior art should consider many factors, like the method of production, the equipment used, its use and application, physical properties and related matters. Therefore, when there has been an invention of substantive condition, it is necessary to review these factors to determine whether or not a new invention exists in peripheral prior arts. By considering at least 4 of the above items the accuracy of an assessment of the patentability of an invention will be heightened. It is important to develop acute observational skills on a regular basis in regard to the possibility of new inventions. It is conceivable that researchers could easily discover new inventions based on experimental facts by heightening their awareness of prior arts. There is no doubt that all inventions discovered in research make some contribution to their companies, but it's not necessarily the case that a patent is the best way to protect a prior art. Another option is to not disclose a prior art to the public. The following items are prior arts which have technical know-how, but which are very difficult to assess for their patentability.

- A prior art which is not able to be evaluated from products
- A poor prior art which has a broad effect
- A prior art which is not surpassed by the prior art of other companies because those companies choose not publicize their prior art

G. Preparation of a Detailed Patent Statement

A patent claim, stipulating the scope of an invention, is the most important part of a patent specification as well as an indication of its patentability. The wording of a claim needs careful attention. Inventors should be careful about the following items [3].

- What kind of invention (product, method, process or use) is it?
- Is it an invention of a generic concept or of a more limited concept?
- Is it a basic patent or a selective invention?

A patent specification is not a scientific paper. A scientific paper reports original empirical work, but a specification is an implementation manual for an invention. Therefore, a specification must be written with scrupulous care so that people can replicate the experiment, and so it will have similar interpretations for anyone who reads it. Because a patent is protected by exclusionary law, the conditions that must be met to merit a patent are prescribed by law. Accordingly, an inventor must provide a "detailed description of the invention", clearly and logically, in the specification. A "detailed description of the invention" in the specification is divided into various parts [3], such as the "technical field to which the invention pertains", "conventional art", "problems to be solved by the invention", "means for solving the problem", "best mode for carrying out the invention", "working example", "advantageous effect of the invention" and so on.

We have not carried out our usual research guidance as part of our intellectual property education course but have concentrated on the above items under a special educational program, and have conducted on-the-job education under general graduate mentoring. As a result, the contracted researcher previously mentioned filed 1 application of the 4 patents we filed during his contract time. To sum up one's findings and file an application is an excellent method for researchers at a university or a company to identify the direction of R&D during their research process. Furthermore, when we accepted the contract researcher in 2006, he was a new employee who had just finished his master's degree at a national university in Japan. His new job had little relevance to his major field of study at his university. The company he is working for now in Japan undertook a joint study with our research group before we accepted the researcher, and we are currently continuing with the joint study.

2. Technology Exchange Meetings

A technology exchange meeting, such as the one shown

Fig. 5 A snapshot of the technology exchange meeting

in Fig. 5, has been held once a year at the university since its inception 6 years ago. The RCDC has organized the lectures (by business people or by professors) and the exhibition of company's products around a theme decided upon each year. (In recent years, the programs relating to collegiate job-hunting have been added to meetings elsewhere). The following lectures and poster presentations took place at the most recent technology exchange meeting [4].

1. "Analysis of ice water by the thermally stimulated depolarized current (TSDC) method", Tokushima Bunri University Science and Technology, 2. "The structure of water induced by specific ceramics treatment and effects of treated water in view of some biological aspects" Nihon Jisui Co., Ltd., 3. "An electric vehicle designed and built by the university students", Tokushima Bunri University Science and Technology, 4. "Preparation toward the application of supercritical drying technology in the process line", Rexxam Co., Ltd., 5. "Glucolipids as bio-functional component", MACROPHI Inc. 6. "DNA and forensic science", Tokushima Bunri University Human Life Sciences, 7. "Technology of a new business development", Softbank Mobile Corporation, 8. "A case report of support for industry-university cooperation in an effort to revitalize East Shikoku", JST Innovation Satellite Tokushima 9. "The effectiveness of closed cycle breeding and system development", The Fisheries Research Agency 10. "Who are the students corporations are looking for?", Shigoto Plaza Takamatsu, etc.

Some of the companies in the TOSAN area, and other companies and organizations which participated in the past at the meetings are as follows: Asahi Kasei Corporation, Asahi Seisakusyo CO., Ltd., Asahi Techno-Research CO., Ltd., Awa Paper Mfg. CO., Ltd., Aoyama Trading CO., Ltd., Fuji Dan-ball CO., Ltd., Fukumoto Body Corporation, Kamacho Scale CO., Ltd., Kao Corporation, Kasco CO., Ltd., Mitsuboshi Belting Ltd., Nichiei Steel CO., Ltd., Nihon Kogyo CO., Ltd., Nihon Jisui CO., Ltd., Nissei Chemical CO., Ltd., Purex CO., Ltd., Sanuki Wine Co., Ltd., Shikoku Co., Ltd., Shikoku Cable Co., Ltd., Shikoku Chemicals Corporation, Shikoku Instrumentation Co., Ltd., Shinko Electric Wire Co., Ltd., Tadano Ltd., Tokutake Sangyo Co., Ltd., The Hyakujushi Bank Ltd., Yamanishi shop Ltd., Yoshinogawa Electric Wire & Cable Co., Ltd., Kagawa Industry Support Foundation, Sanuki City Society of Commerce and Industry, Shikoku Bureau of Economy, Trade & Industry, Shikoku Technology Licensing Organization, The City Office of Sanuki, AIST Shikoku, Kagawa University, The University of Tokushima, etc.

3. Undergraduate Student Internships at Some Industries in the TOSAN Area

A system of cooperation between some industries in the TOSAN area and the university has been organized and is ready to be put into effect. This will be done through joint research projects, technical assistance for manufacturers, free use of some instruments owned by the university and a technology exchange meeting. These have all been part of the program for the promotion of the RCDC from 2005.

Undergraduate student internships at some industries in the TOSAN area were commenced in 2010. Staff members of the RCDC have played a central role in the internship program. The program was held during the undergraduate summer at certain companies, for about a one-week period in 2010. These industries were Teikoku Seiyaku Co., Ltd., Nissei Chemical Co., Ltd., Shikoku Co., Ltd., Kasco Co., Ltd., Fuji Dan-ball Co., Ltd., Dynax Takamatsu Co., Ltd. and Sohgo Security Service Co., Ltd. Each company was willing to accept a maximum of 3 students. The internship program is not open to everyone. Students wanting to take

Fig. 6 A snapshot of the briefing session

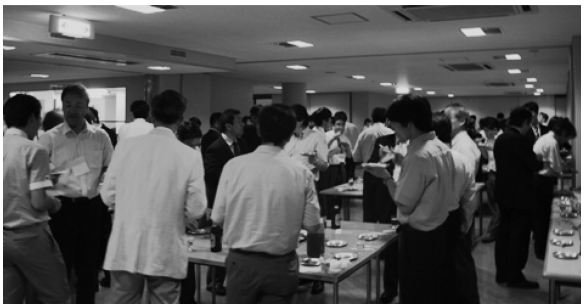

Fig. 7 The Autumn Meeting Banquet attended by many teachers, business people, and students

part in this program must study the internship system in detail in advance, and when the students have completed the program they must present the results of their internship work at a briefing session organized by the support division for active student learning as shown in Fig. 6. There were 7 such presentations in 2010.

4. The 2011 Autumn Meeting of The Society of Fiber Science and Technology, Japan

The Society of Fiber Science and Technology, Japan had its first autumn meeting on September 8-9, 2011, at Tokushima Bunri University's Kagawa Campus in Shikoku. The TOSAN area, including Higashi-Kagawa City, is a place where the glove industry, which is part of Japan's textile industry, is strong, and it has been a glove-production area for approximately 120 years. Higashi-Kagawa City benefited from high economic growth in the 1940s-1950s, when the city surpassed the United States and became the world's top glove-production area [5]. Although many business operations are based on OEM production and the TOSAN area is now little known as a place of production, almost all the gloves used by players in sports that require gloves are made in the TOSAN area. These include gloves used by major leaguers Suzuki Ichiro and Matsui Hideki and professional golfers Ishikawa Ryo and Miyazato Ai. Thus, in addition to having varied product lines and a high level of quality, the TOSAN area is the top place for synthetic glove production in the world based on the area density of production at the current time[6]. We have been advertising nationwide the specific local industry, which uses high technology and has not been well known to the general public, and we have planned a special lecture on this area[6]. The mayor of Sanuki, Sanuki City Society of Commerce and Industry, Higashi-Kagawa City Society of Commerce and Industry, industries in the TOSAN area, Kagawa Industry Support Foundation, and our students, in addition to the executive committee members, collaborated on this gathering, making the Autumn Meeting an unusually fruitful convention [7], as shown in Fig. 7.

III. Conclusion

The authors introduced here some of the various activities we have organized in the past 6 years. We feel that through such activities, we have overcome a wide gap between university instructors, students, companies, and local communities. Our hopes, resulting from these initiatives and activities, are to develop human resources, to contribute to the revitalization of local business, to enable students to gain a great understanding of the industries in the TOSAN area and to prevent the outflow of students from Kagawa Prefecture.

The above industry-university collaboration initiatives and activities have been conducted by a group of teachers at the Faculty of Science and Technology since 2005. This work is partially supported by a Grant from Tokushima Bunri University for Educational Reform and Collaborative Research (No. TBU2011-1-1).

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