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A Field-focused University education in NRI : A case of UST-KAERI

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1. Introduction

The University of Science & Technology (UST) was founded in Oct. 2003 through the approval of the former Ministry of Education & Human Resources Development to nurture R&D professionals in convergence technology, who will lead us into the 21st century, the era of information technology.

In the era of 'global talent war', every country competes to secure young scientific/technological leaders who will cope with future global and national agenda. In accordance with this need, advanced countries have diversified their higher-level education channels utilizing the representative national research institutes or laboratories in addition to the traditional graduate school. Recently, almost all the advanced countries operate a unique graduate school or university to nurture higher talents based on the national research institutes (NRIs) which lead national strategic R&D fields. They include International Max-Planck research school(IMPRS) and International Helmholtz graduate school in Germany, Watson school of the Cold Spring Harbor Lab. and Kellogg school of the Scripps Research Institute in US, Feinberg graduate school of the Weizmann Institute in Israel, SOKENDAI in Japan, and UST in Korea.

UST has enormous research facilities and special high-tech equipments, and has faculty members who have outstanding research records, which is not common in general universities. With high-tech equipments, the excellent faculty members are participating in useful field-focused R&D education. Instead of having a rigid department, UST allows flexible opening of a major for new convergence technology. By doing this, UST is responding actively to fast changes in science and technology.

UST manages 29 campuses granted as government funded research institutes in the area of science and technology with educational functions. Each campus member and faculty are joining a network related to educating each other and cooperating with different research activities, which is expanding to enhance collaboration with institutions related to diverse areas of research. In addition, to share and reflect the newest trend of research on education, collaborated lectures are operating, which have grafted the know-how each of its campus professors. The profiles of these professors are provided to students in a masters, integrative and doctorate program, who apply to enter the university. The students can determine the particular research area with the help of their expected academic advisor in advance, which allows a customized research education for the students.

2. New paradigm of fostering talent

Most of the graduate schools based on national research institutes operate most similar education system, which is quite different from the traditional graduate schools. They show new type of education system and initiate the most advanced cooperation model between universities and research institutes.

Basic traditional subjects like physics, chemistry and biology are performed at nearby neighbor universities which have the closer relationship through cooperative agreement. Each campus opens its own intensified classes in advanced areas, and several campuses co-open some convergence technology classes provided by association of experts from related majors. General education courses such as liberal arts, research ethics, technical writing, laboratory safety, writing papers are performed in university headquarters.
The collaborated lectures and team teaching classes are more preferred in national research universities, which utilize the strong points of national research institutes. Majors, classes and even cooperative R&Ds are well diversified through the role of networking hub among the participating campuses and their members.

All the UST students must participate in national R&D projects with their advisor professors in the public sector, ensuring their outstanding qualities. They are abundant in field experience and are thus able to quickly comprehend their tasks. In addition, they have a high adaptability and can be immediately deployed in various research fields, public or private suitable to their majors. UST students are also contributing to fostering the future-creative talents, by working as mentors of Daejeon Science High School and Chungnam Science High School, giving them the basic science knowledge and course advice.

UST supports all students covering all tuitions fee with a full scholarship and giving them living expenses. UST took the initial step in Korea to revoke matriculation fees and paper evaluation fees, so that the students can fully concentrate on their studies and not to suffer from financial burden. Even with UST's short history, UST students show high research performances in SCI papers and patents. Ph. D degree graduates publish more than 5 SCI papers and 1.5 patents in average. More and more students have applied to UST based on its reputation. Thus, even the short history of 6 years, UST was permitted from the government to double its student quota. This means that the new paradigm of nurturing higher R&D professionals utilizing national research institutes is successful in Korea through UST model .

3. Current status and major achievements of the KAERI campus

The KAERI campus is open to 5 majors related to nuclear science and technology and since 1 September, 2012, 108 faculty members have been guiding 39 students who are taking masters, integrative or doctor's courses. The ratio of faculty members to student at the KAERI Campus is 2.8: 1, which is 1.8 -times more than the average campus ratio of 1.6:1. Therefore, this shows that the KAERI campus is ensuring internal stability. The superiority of our nuclear techniques is also well known abroad. The number of foreign students at the KAERI Campus is 59%, which is 1.8-times more than the 32% found on the average campus (Table 1).

Table 1. Incumbent students at KAERI campus

(Unit : person, 2012.9)

Section	Master	PhD	Integrative*	Total
Korean	7	7	2	16
International	17	4	2	23**
Total	24	11	4	39

*Student completed 2 semesters in master course
(GPA:≥ 3.5, recommended by advisor)
**Rate of International student = 59% (UST average = 32%)

The KAERI campus produced 15 alumni from 2007 to 2012. The employment rate of the KAERI campus is 90% (Table 2). Nine of 15 graduated students are employed and the other 5 are continuing their studies. One unemployed person is currently at home caring for her baby. The Ph-D alumni of the KAERI campus have shown outstanding research activities. All, 5 persons, have found good jobs.

Table 2. Graduate Status of KAERI campus

(Unit : person, 2012.9)

Section	Employed	To Ph D	Total
Korean	6	3	9
International	3	2	5
Total	9	5	14

4. Mission and development strategy

UST is aiming to become the best national research university in Asia and a global leader. To achieve this long-term vision based on its mission, UST set up strategic plan until 2025. Also, it selected 3 core values – creativity as a scientist, challenge for research goal and collaboration in team project.

As a national research university, UST highly depends on its 29 national research institutes. So, the key success factor is how to fully utilize the excellent researchers, accumulated knowledge and skills, huge facilities and cutting-edge equipments in each institute.

Domestic and overseas partnership are very important to enforce global competence of UST students. There are 3 kinds of collaborations for UST to be faced considering its position and status in national innovation system.

First one is closer networking among 29 national research institutes which belong to UST.
Second, UST needs the role of bridge between universities and industry because national research institutes are focused on goal-oriented R&D from basic science and technology. UST has the feature of combination of university and research institutes in its origin. So, the cooperation among industry, university and research institute is easily realized by introducing industry.
Third, UST has stronger in global collaboration than any other institutes or organizations. Each UST campus has its own global partners in its field as a representative institutes in Korea. Some of them participate in international organizations as representatives of Korea. So, UST students can utilize global research institutes and universities which have closer relationship with UST campuses for a long time. Exchange of credits, joint/dual degrees, cooperative R&D are widely open and most preferred to UST students as well as faculties.

To distinguish itself from general universities, UST has nurtured the advantages of an educational system. UST is expanding its collaboration with other universities for exchanging credits from general major subjects to activate general major education, and is setting up specialized majors for each research institutes to have cooperative lectures and developing joint teaching materials to enforce an outstanding educational system. UST is also putting forth the effort to expand basic knowledge subjects by implementing humanities, social education, and arts fused with general education, thesis writing, analysis of patents/theses, etc.

5. Conclusion

UST-KAERI is utilizing massive nuclear research facilities and world class faculties to nurture creative professionals in R&D who can be immediately sent into industrial and research fields. The alumni of KAERI campus have a high employment rate of 90%, in approval of their excellent capacity in terms of research and field experience. It is expected UST-KAERI will become a leading national research school in the nuclear field in the near future.

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