THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Present Conditions and Problems in Employment and Promotion of Female Researchers in Japan

Mamiko Takeuchi
Associate Professor, Kyushu University, Japan

Abstract:
Japan's Ministry of Education, Culture, Sports, Science and Technology has promoted several projects supporting female researchers at Japanese universities. However, there is a large imbalance in the ratio of female to male students, especially in engineering and science departments. In addition, fewer women are entering graduate schools, of which only a small number want to be professors. This study describes the conditions of, and problems with, female researchers' support system at national universities in Japan. Based on a statistical analysis, the ratio of female to male students has hardly changed in the past 10 years, at either the departmental or overall graduate school levels in Japan; however, the ratio of female to male researchers at these universities increased during the same period. These results demonstrate that the next generation's upbringing is of key importance, as is enhancing the work-life balance of female researchers, in order to increase the number of high-quality female researchers at Japanese universities.

Keywords: *Japanese Government Project, promotion of female faculty*

1. Introduction

The ratio of female to male researchers in Japan is still low, in comparison to developed countries in Europe and the Americas. In addition, departments and institutions promote female faculty to administrative positions less often. For these reasons, it is necessary to increase the number of female faculty and to improve their potential for seeking a variety of viewpoints and ideas regarding academic research. To address this need, the Japanese government made a serious commitment of support for female faculty in 2006, implementing a project that now involves 56 of 82 national Japanese universities. This project provides institutions with funding of up to 20 million yen per year over three years, to maintain and improve the research environment for women—with particular consideration for work-life balance. In addition, a five-year project to support the active recruitment of female researchers began in 2009. This project involves funding institutions at up to 80 million yen per year over five years, to employ and foster superior female faculty in the fields of engineering, science, and agriculture, which have especially small percentages of female researchers. Thus, the five-year project aims to construct a total system comprising a diversity of human resources, to reenergize research, and to achieve a sense of gender equality. Twelve national universities were accepted for this project in 2009 and 2010. In 2013, the ratio of female researchers to total researchers reached its highest ever percentage at approximately 14.4%, while approximately 61% of the total 128,000 female researchers in Japan belong to universities.

Five of the seven Japanese Imperial Universities (Nagoya, Tokyo, Kyushu, Tohoku, and Hokkaido) were accepted for this second project; all seven of these institutions are also involved in the first project. This means that the top tier of national universities, which had previously been dominated by male researchers, is now employing or recruiting female faculty members and utilizing their advantages. This paper uses statistical analysis to focus on the effects of these projects on the number of female faculty and students, and considers the conditions and problems of promoting female faculty in Japan.

2. Previous Literature

Most previous studies of female faculty have commented on special conditions associated with their activities, such as in discretionary work, the tenure-track system, the accumulation of research, and academic conditions and promotions. Gurney (1985) argued that female researchers are likely to face dilemmas in male-dominated settings, as in being treated as inferiors, being subjected to sexist comments, and being sexually propositioned. Kahn (1993) and Ginther and Hayes (2003) found that the number of female faculty in the fields of economics and humanities was less than that of their male counterparts.

August and Waltman (2004) observed that a positive departmental climate, mentoring by the department chairperson, student relations, and collegial peer relations influenced the career satisfaction of female faculty, and that these supports seemed to affect department's retention rates. Mixon and Trevino (2005) reported discrimination against female economists unrelated to their

productivity, which affected their opportunities for promotion. Schneider (1998) noted that most female faculty are involved in teaching, and tend to publish less, which could explain why they are less likely to be promoted.
On the other hand, Gronow (1987) showed that female faculty members' use of childcare did not seem to interrupt their university careers, as maternity leave brought about only a short interruption of work, which could, however, be a problem for a research project. He also pointed out that marriage appears to function as a neutralizing factor, easing women's relationships with their male colleagues. Ransom and Megdal (1993) indicated that the gender-wage gap tended to decrease with affirmative action. Ward (2001) showed that the gender-wage gap could be explained mostly by observable heterogeneity and not by discrimination.
Many researchers focus on female faculty in the natural sciences. Katila and Merilainen (1999) argued that the biggest problems faced by female academics were the shortage of female role models and the lack of feminine impact on dominant discourse, namely patriarchal discourse, and that this was a serious problem in the sciences. Sabatier (2010) revealed that females have significantly lower hazard rates for promotion, particularly during the first half of their careers in the field of biology, and pointed out that promotion strategies are different for males. Aksnes et al. (2011) revealed that the publications of female researchers are cited less often than those of males, and that this also varies according to their scientific position, age, and discipline. Ginther and Kahn (2009) mentioned that women are less likely to receive tenure-track positions in science, but, based on empirical evidence in scientific fields overall, there is no gender difference in promotion to tenure or full professor after controlling for demographic, family, employer, and productivity covariates. Fox (2005) reported that women with preschool children have higher productivity than women without children or with school-age children, and that women who marry other scientists have higher positive productivity than women who do not.
Furthermore, some researchers considered the role model effect of female faculty on female students. Canes and Rosen (1995) found no evidence that an increase in the proportion of female faculty had a positive impact on the percentage of females studying the sciences or engineering. Dynan and Rouse (1995) reported that female faculty did not affect the probability that female students would continue to study economics. Neumark and Gardecki (1998) also showed virtually no support for the hypothesis that initial job placements for female graduate students were improved by adding female faculty members, or by having a female dissertation chair. The impact of female faculty on students is a very important issue for thinking about diversity as a key element of a whole organization. Unfortunately, data revealed that information about faculty and students is limited in Japan. In this study, we use basic statistical information to clarify the conditions and problems of female Japanese faculty.

3. Case Study and Statistical Consequences of these Projects

3.1 Case Study of the Projects

The universities that were accepted for the governmental projects promote a variety of attempts to employ and support female faculty members. Table 1 below summarizes examples of each effort by the accepted universities. Their efforts are divided into support of research, allowing women to fulfill family needs, and other responsibilities. These attempts are mainly directed toward female faculty members, allowing them to accumulate a body of research and give lectures while retaining a work-life balance.
Many of the accepted universities planned to provide useful research information, some funding, and some human resources, and most of the accepted universities have continued with some of these attempts after finishing their three-year projects. A consciousness of female empowerment dispersed throughout the female faculty network, but contrary to countries in Europe or American countries, a formal mentoring system and support for dual-career couples has been delayed in Japan.[1] The former is difficult to blend into the Japanese academic environment, and the latter is not popular in Japan. It is for these reasons that we need to require that our original systems match these supports in our academic environment. Also, we need to offer more support for promoting recruited female faculty to senior positions.[2]

Kinds of Support		
Support for Research	**Life Support**	**Other Support**
・Provide research assistant ・Flexible class schedule ・Provide travel funds for conferences ・Provide seminars on research methods	・Inform childcare resources ・Enhance flexible worktime ・Enhance men's childcare leave	・Network of female faculty ・Host cross university meetings ・Offer leadership program ・Offer training as PI (Principal Investigator)

Table 1: Case Studies of the Kinds of Support Available for Female Faculty Members in Universities

3.2 Statistical Consequences of the Project

3.2.1. Statistical Trends in Female Faculty Members

Figures 1 to 4 show the average ratios of female to male faculty members in each position at the top seven universities, and all national universities, from 2005 to 2007.[3] These Figures are drawn from a survey conducted by the Japan Association of National Universities. We see from Figure 1, that is very difficult for women to become professors in one of the top seven universities and that all seven universities are below the average for all national universities. However, from Figures 2 and 3, we also see that the Nagoya and Kyushu Universities have excellent records in employing female faculty at the associate or lecture professor positions,

respectively.[4] These two universities were accepted for the government's second project, which signaled the importance of affirmative action in the fields of engineering, science, and agriculture. With regard to the assistant professor position, we know that the gap in the ratio of female faculty among national universities is not wide. Based on these statistical results, we can say that female associate professors wishing to advance in their careers are confronted by a daunting glass ceiling.

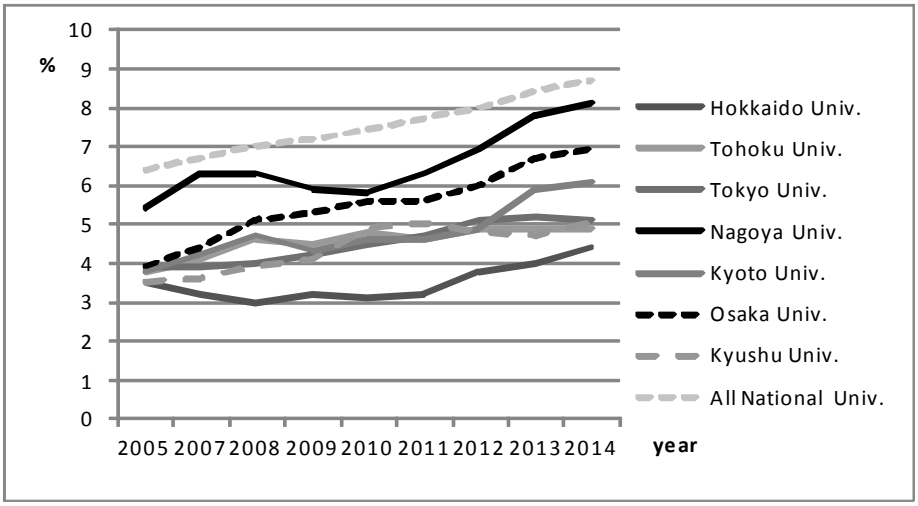

Figure 1: Percentages of Female Professors

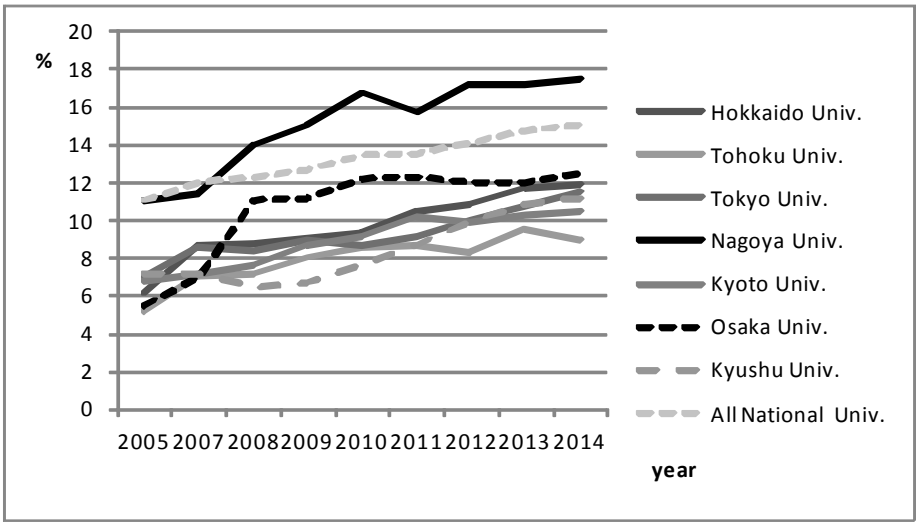

Figure 2: Percentages of Female Associate Professors

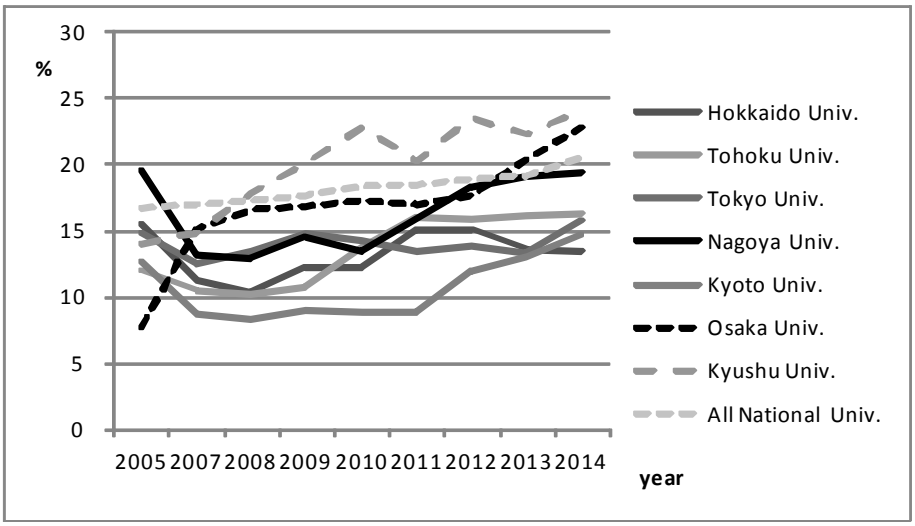

Figure 3: Percentages of Female Lecture Professors

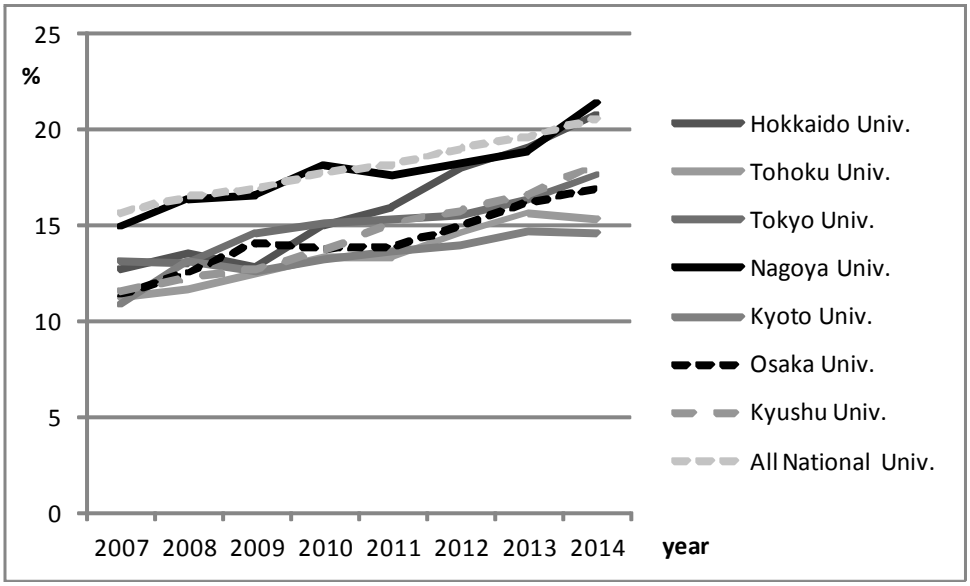

Figure 4: Percentages of Female Assistant Professors

3.2.2. Influence on Female Students

What kind of influence does an increase in female researchers have on students at Japanese universities? Studies in Europe have generally shown that female researchers serve as role models for female students, and that when their numbers increase, the proportion of female students entering graduate schools also increases. However, are these programs actually working? If so, we might expect to see increases in the proportion of female students entering graduate schools in national Japanese universities, helping to improve the quality of female researchers in the future.

Figures 5 and 7 are based on a survey conducted by "The basic survey of schools 2005-2014" (Ministry of Education, Culture, Sports, Science and Technology, 2014). They show that the ratio of female to male undergraduate and master's students at national universities remained at almost the same level from 2005 to 2014. Exceptionally, the ratio of females in the fields of agriculture and engineering in undergraduate courses has slightly increased. This seems to reflect the effect of another government project that has supported female junior and high school students in choosing natural science courses from 2009 onward. All 24 national universities have been accepted by this project, but it has been pointed out that the effects are limited by the low annual budget by these universities.

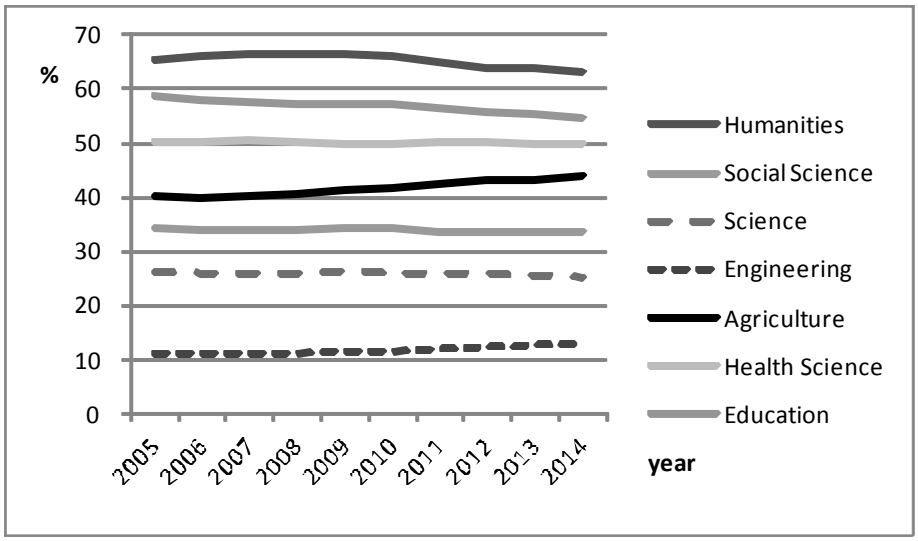

Figure 5: Percentages of Female Students in Undergraduate Courses

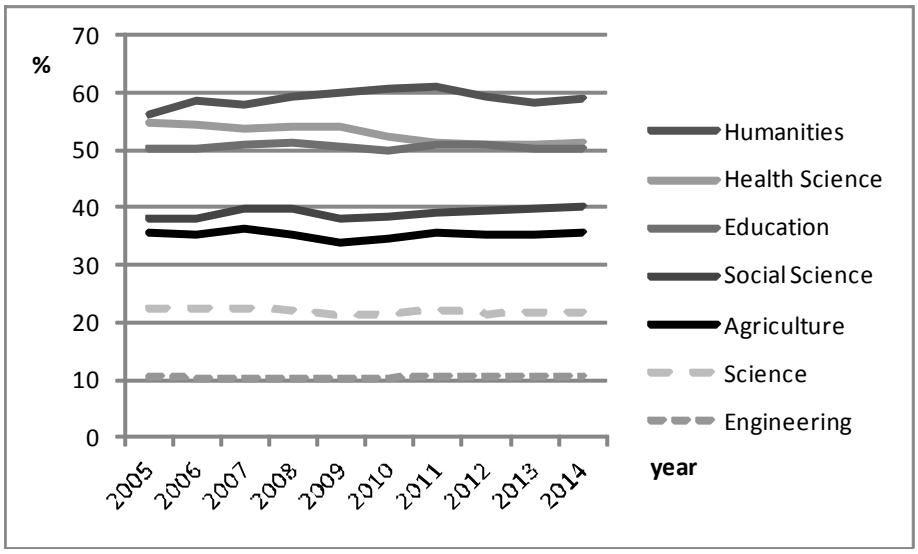

Figure 6: Percentages of Female Students in Master's Courses

On the other hand, the percentage of female students in doctoral courses rose slightly over the past 10 years, as shown in Figure 7. Why is this upward trend only apparent in doctoral studies? One likely explanation is the admission of female students from other countries into Japanese doctoral programs, as pointed out by the government (Ministry of Education, Culture, Sports, Science and Technology, 2012),[5] and another is the possibility that there has been a slight growth in the number of female master's students that go on to doctoral studies.[6]

Compared to another trend evident in these three figures, the differences between the highest and lowest percentages in departments tend to narrow at the upper levels. This reflects the overall low percentage of female students that go on to master's and doctoral studies.

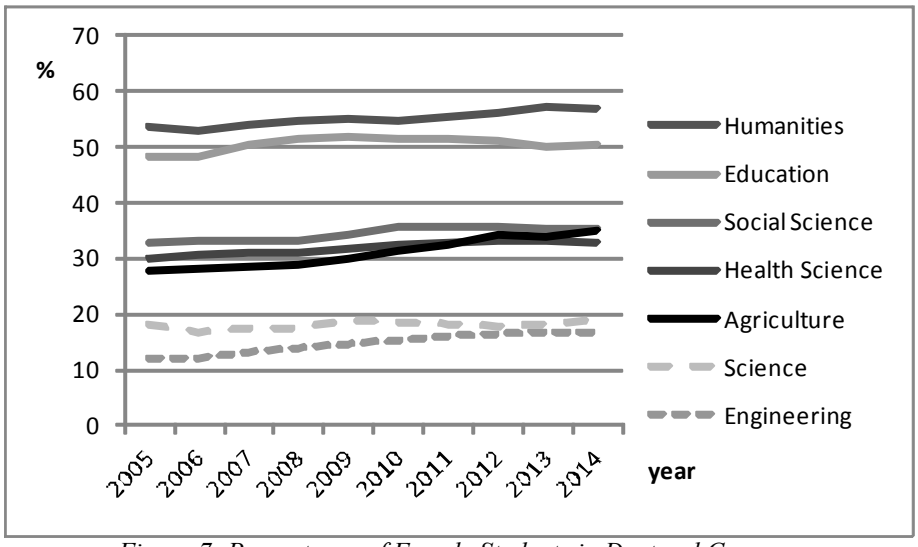

Figure 7: Percentages of Female Students in Doctoral Courses

4. Consideration of Structural Problems

4.1. Structural-problem Features in Engineering, Science, and Agriculture

From "The basic survey of schools 2014" (Ministry of Education, Culture, Sports, Science and Technology, 2014) and "The survey of scientific and technological research 2013" (Ministry of Internal Affairs and Communications, 2013), we identified main departments. In Figures 8 and 11, we present the number of students and faculty in national universities by department or specialization and sex.[7]

In 2014 in Japan, the total expenditure for scientific and technological research was approximately 18 trillion and 134 billion yen, respectively, which was approximately 3.75% of the total GDP. The number of researchers was approximately 840,000, of which approximately 13,000 were female. The number of researchers per population of 10,000 people was 52, which was the second highest among the OECD countries. Figures 8 and 9 show that engineering departments are the biggest departments in the national universities, and that the majority of students regard a master's degree being as essential for becoming a researcher in universities or companies. According to Figures 10 and 11, the biggest reversals can be seen in the numbers of doctoral students and faculty. In

Japan, a four-year medical doctoral program is provided on top of the six-year undergraduate programs, which many students choose to pursue after passing the national exam for medical practitioners. These doctors tend to work at university hospitals as faculty members who engage in both medical care and conduct their own research by entering doctoral programs.

When we mention female faculty empowerment in the field of engineering, we should point out that structural problems have occurred in this field. That is, the field of engineering has been traditionally male-dominated, and researchers working at large Japanese companies (for example, Matushita, Sony, Toshiba, NEC, and Toyota) are required to have a master's degree. That is, the students in master's courses are attractive human resources for both universities and leading technological companies. In fact, whereas there are approximately 130,000 students majoring in engineering at the undergraduate level, only 10,000 students enter doctoral programs and 75% of students gain employment with companies after completing their master's degrees. With regard to the top seven national universities, a huge amount of research funds have been invested by the government into these universities, and the scale of their engineering departments is bigger than in other national universities. The same tendency can be confirmed in the fields of science and agriculture, with over 60% of students who have master's degrees in the humanities and social sciences entering doctoral programs, while only 45%, approximately, of students with science and agriculture degrees enter doctoral programs. Permanent status as researchers in large companies is attractive for master's students. In such an environment, we must obtain and foster competent female researchers in these three fields.

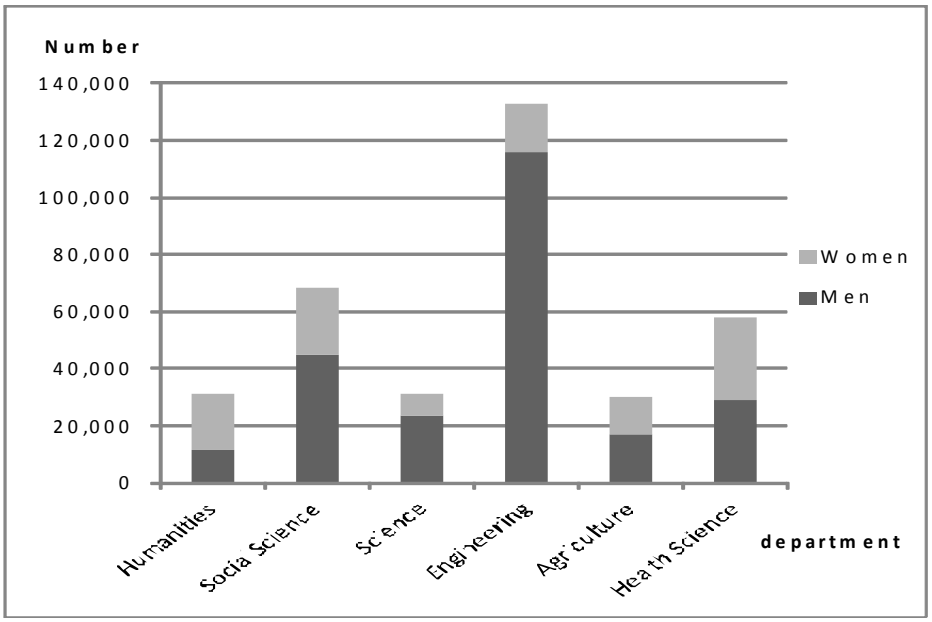

Figure 8: Number of Undergraduate Students by Department and Sex in 2014

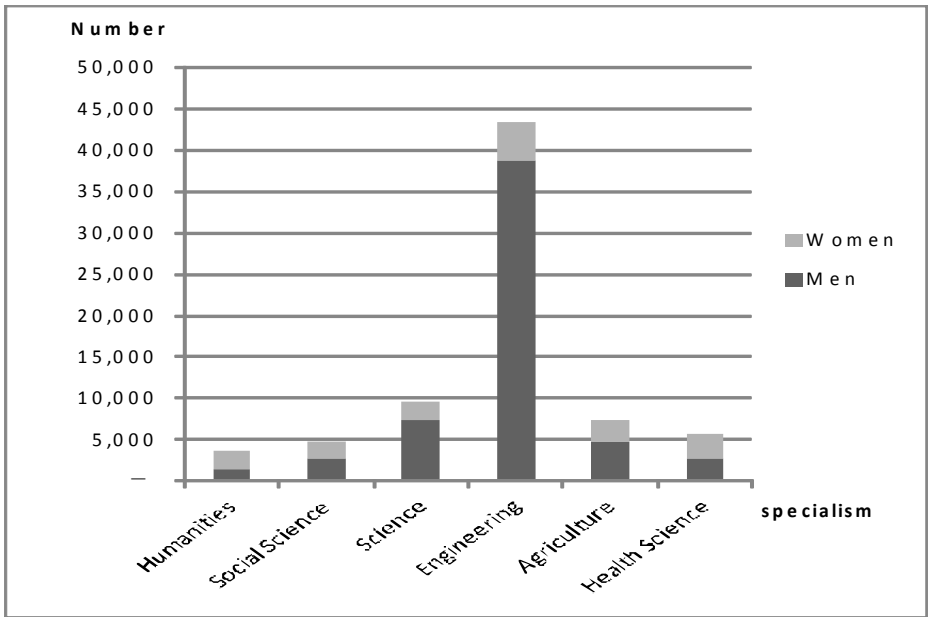

Figure 9: Number of Master's Students by Specialization and Sex in 2014

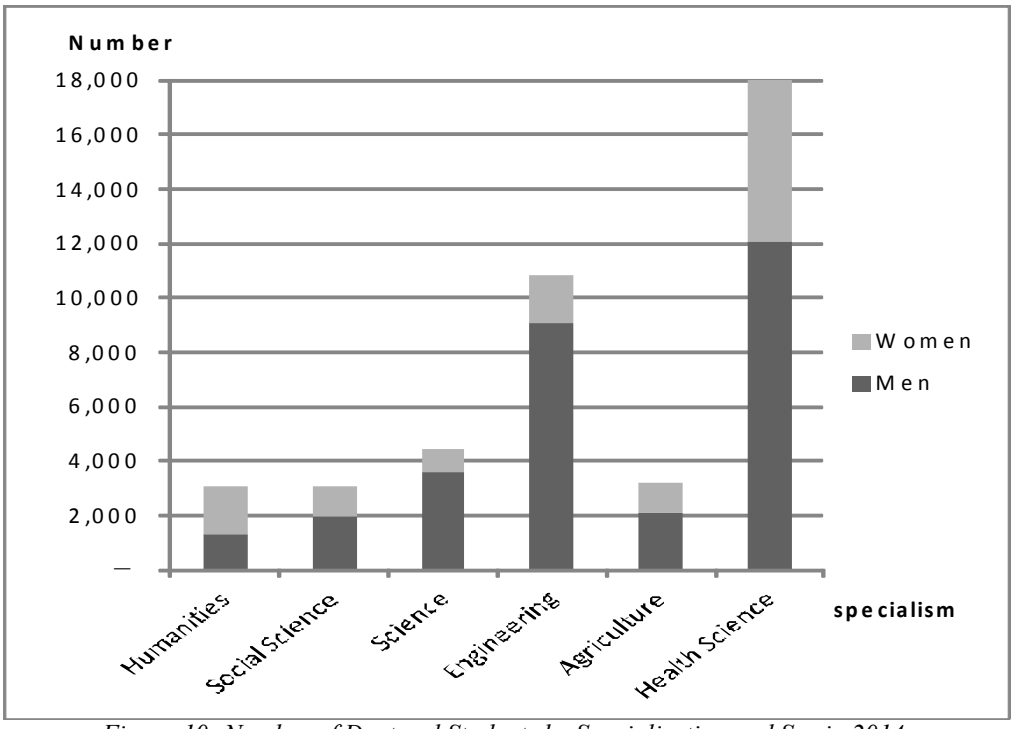

Figure 10: Number of Doctoral Students by Specialization and Sex in 2014

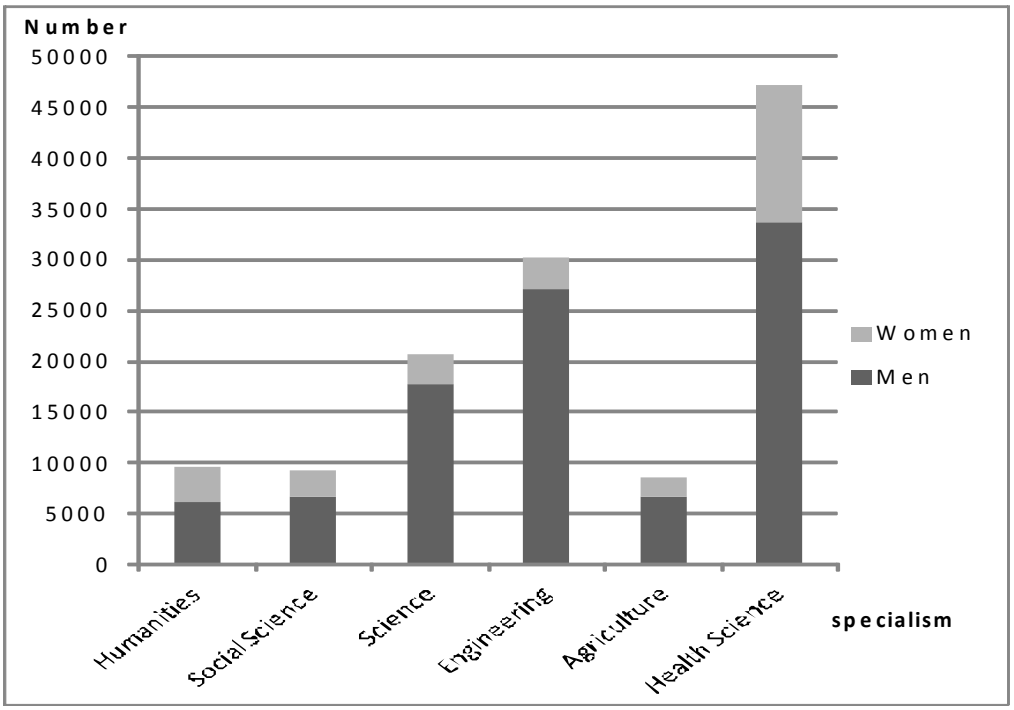

Figure 11: Number of Faculty by Specialization and Sex in 2013

4.2. Structural Problem: Age Composition of Researchers in National Universities

Another structural problem is the age composition of researchers. Figures 12 and 13 show the age composition of researchers at national universities. These figures are based on "The statistical survey of school teachers 2014" (Ministry of Education, Culture, Sports, Science and Technology 2014).

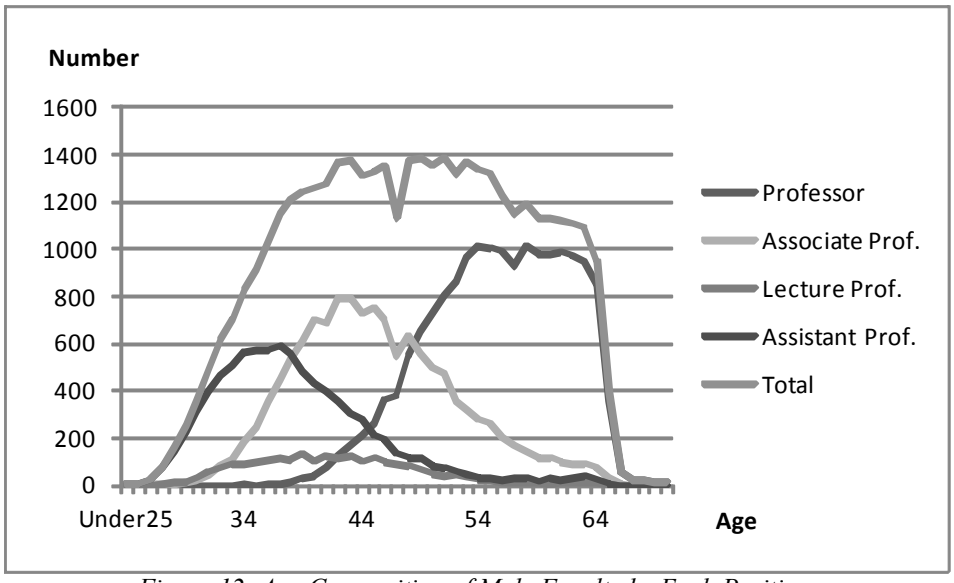

Figure 12: Age Composition of Male Faculty by Each Position

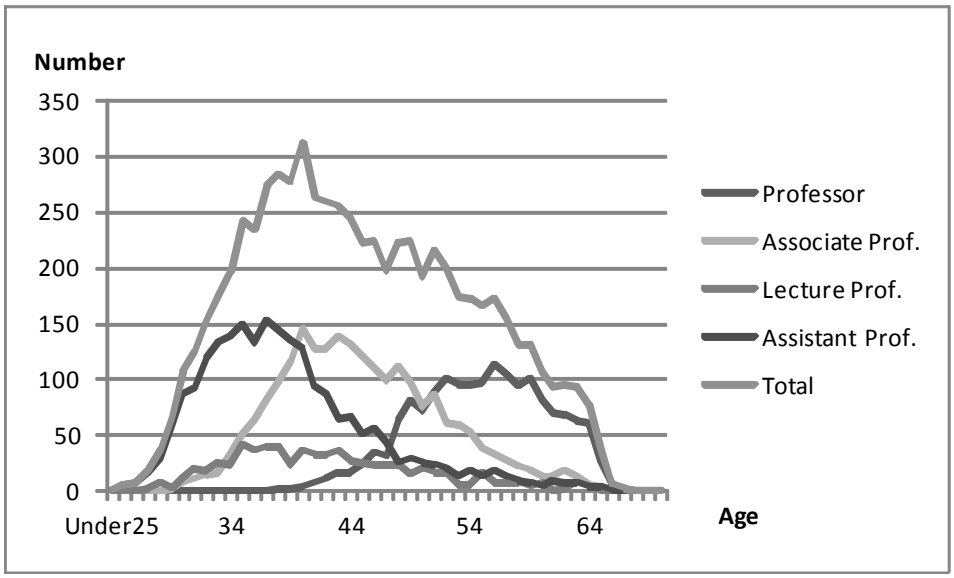

Figure 13: Age Composition of Female Faculty by Each Position

As for the three main positions—professor, associate professor, and assistant professor—we can confirm that the percentage of each position amongst the total faculty differs by sex. With regard to male faculty, professors dominate, and the number of male professors remains relatively static and high across the age range of 36 to 65 in national universities, whereas the total number of female faculty decreases after reaching a peak at age 40. Since the age of retirement in national universities is 65, the retirement of all male faculty in the trapezoidal shape is predicted to take 10 years. In the younger members of this generation in Japan, the university attendance rate of females was less than 20% and shifted to rise sharply approximately after the mid-90s. With the retirement of male professors, the national universities are predicted to have sufficient capacity for employing and fostering the next generation of post-mid-90s university goers. In regard to pace of promotion, we can see that female faculty are behind by only approximately two years, judging by the age at which the two lines intersect in these figures. The facts derived from these two figures mean that the imbalance between men and women in each academic position can be mostly explained by the female university-attendance rate lagging behind that of males in their 40s to 60s, and partly explained by the slow pace of female promotion. From these facts, we can say that supporting suitably educated women in the next generation would be an efficient way of increasing the number of high-quality female researchers.

4. Conclusion

The number of female researchers must be increased, and the potential for seeking a variety of viewpoints and ideas regarding academic research must be improved. The Japanese government launched two projects with the objective of promoting and supporting female faculty in universities, and based on our findings, these projects have obviously been successful from the standpoint of increasing the number of female faculty members. However, sustaining these trends and maintaining the quality of female faculty

members is not immediately guaranteed. The almost unchanging ratios of female to male students in undergraduate and master's programs and the low percentage of females in engineering and the sciences demonstrate the need to foster a new generation of researchers.

As for structural problems, it seems that it will be hard to achieve a better gender balance at universities and graduate schools. We need to persevere in our efforts to support the hiring and promotion of women, particularly in the fields of engineering, science, and agriculture. These female role models are needed to encourage female high school students to choose studies in these fields. Particularly in the next 10 years, a large proportion of male professors are scheduled to retire, and this means that many national universities have come to be financially comfortable with hiring young, new faculty members while balancing the ratio between men and women. Furthermore, providing substantial education and direction for female students is also of key importance in maintaining the quality of researchers in the national universities.

Unfortunately, I cannot acquire sufficient data for each university and individual data of each faculty to investigate the impact of marriage and childcare on the careers of female faculty in Japan. Many female Japanese faculty members face the dilemma of reducing incompatibility between work and life. This is another serious problem for the total well-being of female faculty. This type of research is our future task.

5. References

i. Aksnes, D., Rorstad, K., Piro, F., & Sivertsen G. (2011). Are female researchers less cited? A large-scale study of Norwegian scientists. Journal of the American Society for Information Science and Technology, 62(4), 628–636.
ii. August, L., & Waltman, J. (2004). Culture, climate, and contribution: Career satisfaction among female faculty. Research in Higher Education, 45(2), 177–192.
iii. Canes, B. J., & Rosen, H. S. (1995). Following in her footsteps? Faculty gender composition and women's choices of college majors. Industrial and Labor Relations Review, 48(3), 486–504.
iv. Dynan, K. E., & Rouse, C. E. (1997). The underrepresentation of women in economics: A study of undergraduate economics students. Journal of Economic Education, 28(4), 350–368.
v. Fox, M. F. (2005). Gender, family characteristics, and publication productivity among scientists. Social Studies of Science, 35(1), 131–150.
vi. Ginther, D. K., & Hayes, K. (2003). Gender differences in salary and promotion for faculty in the humanities 1977–1995. Journal of Human Resources, 38(1), 34–73.
vii. Ginther, D. K., & Kahn, S. (2009). Does science promote women? Evidence from academia 1973-2001. In R. B. Freeman & D. F. Goroff (Eds.), Science and Engineering Careers in the United States. Chicago, IL: University of Chicago Press for NBER.
viii. Gronow, T. L. (1987). University Career Opportunities for Women in Finland in the 1980s. Acta Sociologica, 30(2), 193–206.
ix. Gurney, J. N. (1985). Not one of the guys, the female researcher in a male-dominated setting. Qualitative Sociology, 8(1), Spring, 42–62.
x. Kahn, S. (1993). Gender differences in academic career paths of economists. American Economic Review Papers and Proceedings of the Hundred and Fifth Annual Meeting of the American Economic Association, 83(2), 52–56.
xi. Katila, S., & Merilainen, S. (1999). A serious researcher or just another nice girl? Doing gender in a male-dominated scientific community. Gender, Work & Organization, 6(3), 163–173.
xii. Ministry of Education, Culture, Sports, Science and Technology. (2012). [Analysis of the ratio of female faculty in Japanese universities].
xiii. Ministry of Education, Culture, Sports, Science and Technology. (2014). [The statistical survey of school teachers 2014].
xiv. Ministry of Education, Culture, Sports, Science and Technology. (2014). [The basic survey of schools 2014].
xv. Ministry of Internal Affairs and Communications. (2013). [The survey of scientific and technological research 2013].
xvi. Mixon, F., & Trevino, L. (2005). Is there gender discrimination in named professorships? An econometric analysis of economics departments in the US South. Applied Economics, 37, 849–854.
xvii. Neumark, D., & Gardecki, R. (1998). Women helping women? Role model and mentoring effects on female Ph.D. students in economics. Journal of Human Resources, 33(1), 220–246.
xviii. Ransom, M., & Megdal, S. (1993). Sex differences in the academic labor market in the affirmative action era. Economics of Education Review, 12, 21–43.
xix. Sabatier, M. (2010). Do female researchers face a glass ceiling in France? A hazard model of promotions. Applied Economics, 42(16), 2053–2062.
xx. Schneider, A. (1998). Why don't women publish as much as men? Chronicle of Higher Education, 45, 14–16.
xxi. Ward, M. (2001). The gender salary gap in British academia. Applied Economics, 33, 1669–1681.

[1] The so-called "two-body problems" refer to academic couples that live apart from each other after being employed by different universities in different areas.
[2] The Japanese government encouraged organizations to increase their recruitment of female faculty by at least 30% by 2020.
[3] This survey was not conducted in 2006, and an assistant professorship, called "Jyokyo" in Japanese, was introduced to Japan in 2007.
[4] Osaka University was not accepted for the second governmental project, but integration with the Osaka University of Foreign Studies contributed to increasing the number of female faculty members.
[5] This investigation also pointed out that half of the female students in doctoral studies in the field of engineering were foreign students.
[6] Overall, the ratio of female to male students in doctoral course has also increased slightly from 28% to 31%; in the meantime, the overall percentage of female students in undergraduate and master's programs has remained almost unchanged. These percentages are 35% and 26%, respectively.
[7] "The Basic Survey of School" and "The Survey of Scientific and Technological Research" divide undergraduate students into departments and others into specialization.