Boundary Agenda between Gender Equality and Human Resource: The Establishment of Policy for Women in Science and Technology in Korea[1]

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Abstract

The policy for women in science and technology in Korea consists of the separate enactment, national planning, working bodies, and various supporting programs. The research analyses the formation of it into three phases: Rising concerns and floating solutions, in between gender and human resource, and settling down in science and technology policy. It points that women's issues in science and technology was on the boundary between gender equality and human resource development. Due to the boundary feature, the issue took the advantage of the two independent policy windows: The growing women's policy and the "avoidance of science and technology." As a result, the goals and rationale of women's policy in science and technology changed from gender equality to securing human resource.

Key words

women's policy in science and technology, recruitment target system, gender and science policy, policy window

Introduction

Gender mainstreaming in science and technology has been a policy concern in many countries. In the West, the EU studied the status of women in science and technology together with associated policies and made some interesting proposals (e.g., EC, 2000; Rees, 2002). In the USA, the National Science Foundation (NSF) has supported many programs that have endeavored to encourage more women to take up science and technology as a career. In Asia, where the number of women

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educated and employed in science and technology is much smaller than in Western countries (RESGEST, 2006), some countries such as Korea, Japan, and Taiwan began to launch similar support programs.

Among Asian countries, Korea has established a well-institutionalized policy for encouraging women into science and technology. The Framework Act on Science and Technology (2001) and the Basic Plan for Science and Technology (2002-2006) included some items on education and the participation of women. In addition, the Korean government developed a separate policy mechanism. In 2002, the Act for Fostering and Supporting Women in Science and Technology was enacted, which sets out and clarifies the following: the formation of a separate national plan, the introduction of affirmative actions like the Recruitment Target System (RTS), the establishment of a working center for women in science and technology, and the building of gender-segregated statistics. This mechanism represents a contrast with the Japanese approach that involved including support programs as part of the 3rd Basic Plan for Science and Technology (2006-2011) (Miura & Ogawa, 2007; Normile, 2006).

A number of questions arise from these observations that need to be addressed. First, how did the women's issue in science and technology become a policy agenda with the separate enactment and national 5-year plan? In other words, how did women become accepted as a policy target group in science and technology with a strong merit system? Second, who were the main actors? Third, what were their purposes and strategies? Finally, what are the results and implications arising from the Act from a gender perspective?

This research argues the formation of a policy for the participation of women in science and technology in Korea went through three phases: (1) rising concerns and possible solutions during the 1990s; (2) being located somewhere between gender equality and human resource from 2001 to the enactment in 2002; and (3) becoming firmly established as part of the science and technology policy after the enactment. It pays attention to the influence of the two factors during the process, i.e., the internal and external political context of the administration and the unexpected growth in the concern relating to the "avoidance of science and technology." The conclusion follows that the factors relating to such developments altered attitudes in policy toward women in science and

technology and eventually led to the setting of different goals and priorities.

Framework

To explain the development of the policy toward women in science and technology in Korea, this research refers to the debates on gender discrimination versus universalism in science and technology; through these debates, advocates have been furnished with the rationale and solutions required for supporting a policy for the participation of women in science and technology. This analysis therefore endeavors to understand policy formation as a result of the dynamic interaction existing between related groups and socio-political factors, especially in relation to Kingdon's policy window theory (Kingdon, 2003).

Superficially, there would seem to be no problem with gender equality in science that has traditionally been believed to be neutral in this regard. Sociologist Merton (1973, ch.3), for example, previously claimed that the ethos inherent to science has played a significant role in creating the institutional imperatives that determine scientists' way of working. He also stated the ethos is formulated in four norms: universalism, communalism, disinterestedness, and organized skepticism. Among these, universalism is especially significant, as it induces scientists to evaluate scientific achievements by way of scientific criteria alone and, not by other possible criteria such as gender bias, ethnicity, nepotism, and so on. Thanks to the peer review system based on universalism, recognition and reward in science inevitably came to be merit-based.

Since Rossi's monumental address on gender discrimination in science and technology at MIT in 1964 (Rossi, 1965), however, there has been a lot of debates on the issue. For example, Long, Allson *et al*. (1979) showed that scientists with degrees from prestigious universities were more likely to get a job at universities with high academic status. Others have claimed that gender disparity exists in job availability, job status, income, promotion, and research grants and have explained that women scientists published articles 60% of men's in terms of quantity due to the gender disparity (e.g., Cole, 1979; Zuckerman, 1988).

The year 1997 represented a turning point for policy toward women in

science and technology in Europe. Tangible evidence of gender discrimination was given for the first time by the investigation of the research grant allotment by the Swedish Medical Research Council (MRC) (Wennerås & Wold, 1997). The investigation showed that women applicants had to be about 2.2 times more productive than their male competitors to win the grant from MRC. Galvanized by this result, an intense debate followed over a period of six weeks, from September 9 to October 14, 1999, in an online debate in *Nature,* one of the most renowned scientific journals.[2] European Communities began to examine the status of women in science and technology in relation to gender bias both in the peer review system and in funding programs (Lane, 1999; EC, 2000; Rees, 2002). Based on these studies, many new measures and programs to promote women in science and technology were suggested and some of them were adopted in several countries.

With regard to agenda setting, the policy window theory can be useful in analyzing the influence of social issues on policies toward the participation of women in science and technology. Kingdon (2003, p. 3 , p. 165) defined the policy agenda as the list of subjects or problems to which governmental officials associated individuals paying serious attention and whereby the policy window serves as an opportunity for advocates to put forth their most favored solutions as well as to highlight any special problems. Only if advocates successfully interact with policy makers during a period when the policy window remains open, such problems will become a part of a governmental agenda and favored solutions or alternatives implemented. Otherwise, it will be necessary to await the opening of the next available window.

Usually, what leads to a policy window becoming available is a change in political outlook (e.g., a change of administration or shift in the national sentiment). It is, therefore, quite predictable as to when a policy window is likely open. However, unexpected events might cause a window to open for advocates with proposals associated to such events. For example, a sudden rapid rise in oil price will open a window for those advocating initiatives in renewable energy.

The policy window theory helps to explain why some social problems

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2. Visit http://www.nature.com/nature/debates/women/women_frameset.html for the complete debate.

might be perceived as urgent and can be solved through government action whereas others may not. It is also useful in understanding the role of advocates during policy formation. Sometimes, however, advocates may even try to exploit another's window of policy for their own purposes through presenting alternative arguments and solutions.

Phase I: Rising Concerns and Floating Proposals

Gender Gap in Education and Work in Science and Technology in Korea

Despite the increase in women educated at the tertiary level since 1960s, qualitative analyses demonstrated that there was still a deep-rooted traditional gender segregation in various disciplines. It is typified by the following statement, "while *natural sciences, engineering and medicine* were traditionally men's field of study, teacher education, humanities, and arts/physical education programs were considered to be women's fields (italics are original)" (Oh, 2006, p. 36). Table 1. shows that the same is also true for higher level degrees. It also shows that there is a "leaky pipeline" in science and technology whereby a higher degree level leads to fewer women.

Table 1. Distribution of Graduates in Science and Engineering* by Gender and Degrees: 1980-2000

No. of Graduates(%)

		1980	1985	1990	1995	2000
BA	Total	16,046	36,026	40,901	57,205	72,845
	Female	3,061	7,687	6,947	12,487	20,176
	(%)	19%	21%	17%	22%	28%
MA	Total	1,109	3,920	5,361	8,675	15,754
	Female	101	505	515	1,157	2,143
	(%)	9%	13%	10%	13%	14%
PhD	Total	132	409	696	1,264	2,175
	Female	16	30	37	92	209
	(%)	12%	7%	5%	7%	10%

Sources: the Ministry of Education, *Statistical Yearbook of Education*, 1980, 1985, 1990, 1995, 2000

If we break down the data in Table 1, a big gap between the number of women in natural science and technology emerges as illustrated in Table 2. In natural sciences, barriers seemed to exist at the graduate level and in the job market, whereas there were great social and cultural barriers at every level in engineering. Even the rapid increase of women in engineering colleges during the late 1990s was mainly due to the growth in the IT industry that is regarded as "softer" than traditional engineering fields.

Table 2. Distribution of Graduates at Tertiary Education by Gender, Fields, and Degree: 1980-2000

No. of Students(%)

Year			1980	1985	1990	1995	2000
BA	Natural Sciences	Total	4,735	12,578	10,387	21,173	21,172
		Female	2,911	7,137	4,898	9,765	11,000
		(%)	61%	57%	47%	46%	52%
	Engineering	Total	11,311	23,448	30,514	36,032	51,673
		Female	150	550	2,049	2,722	9,176
		(%)	1%	2%	7%	8%	18%
MA	Natural Sciences	Total	417	1,613	1,489	2,487	3,241
		Female	87	471	365	793	1,119
		(%)	21%	29%	25%	32%	35%
	Engineering	Total	692	2,307	3,872	6,188	12,513
		Female	14	34	150	364	1,024
		(%)	2%	1%	4%	6%	8%
PhD	Natural Sciences	Total	91	212	240	414	637
		Female	16	23	29	69	141
		(%)	18%	0%	12%	17%	22%
	Engineering	Total	41	197	456	850	1,538
		Female	0	7	8	23	68
		(%)	0%	4%	2%	3%	4%

Sources: Ministry of Education, *Statistical Yearbook of Education*, 1980, 1985, 1990, 1995, and 2000.

Unlike education, it is difficult to form a complete picture as to the

numbers of women workers in science and technology due to insufficient statistics. The statistics on research and development (R&D) compiled by the Ministry of Science and Technology (MOST)[3] had only seven sex-disaggregated items and gave very restricted information about women researchers (KISTEP, 2000).[4] According to this data, women researchers were as few as 10% of total R&D personnel in 2000 and of a lower status than men. About 55% of women researchers working in universities seemed to be graduate students or non-regular researchers because women faculties were only 3.4% in natural sciences and engineering (Roh *et al*., 2000). In all public research institutes, women researchers amounted to 11.4% as of December 2000 (Lee, 2001, p. 20). Moreover, only about 33% of the total women researchers were employed in private R&D institutes, but no information is available for the 1990s except for a survey in 1999 showing that about 60% of women were in their 20s but in subordinate positions (Han, 1999).

Advocates of policies encouraging greater involvement of women in science and technology should consider three points from the statistical analysis. First, girls at secondary schools should be encouraged to choose science and engineering. Second, supporting action should be taken that helps women overcome the barriers in the job market. Third, additional programs need to address the discrimination in access to research resources (Lee, 2001).

Growth of Women's Policy

During the 1990s, gender equality became a government priority. After a long period of military government, a new civilian one was established in 1993. Leaders of women's movement took part in pro-democracy movements and had contributed to the establishment of the new government. They required the government to institutionalize policies for gender equality. In addition, the Beijing Declaration of the

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[3] In 2008, MOST and the Ministry of Education merged to form the Ministry of Education, Science, and Technology.

[4] Generally, science and technology include medicine and agriculture, so the statistics reflect this. But, for reasons connected to administration, medicine and agriculture were considered not to be part of the policy of MOST. From this point onwards, the discussion will therefore proceed with reference only to natural sciences and engineering.

4th World Conference on Women in 1995 also helped the enactment of the Framework Act on Women's Development in the same year. The Act included articles on the introduction of interim preferential treatment for women, planning for women's policy, a fund for women's development, participation of women in governmental committees, and so forth.

Policies toward women became more institutionalized and were extended during the Dae-Jung Kim administration (1998 - 2002). The first lady had been one of the leaders of the women's movement and the president himself took a progressive position toward policies concerning women. The Presidential Commission on Women's Affairs created in 1998 replaced the 2nd Minister of State for Political Affairs as the main office dealing with women's issues. When the Commission was raised to the Ministry of Gender Equality (MOGE) in 2001, MOGE was able to demand that other ministries implement gender mainstreaming into their policies.

Women's policy put a low priority on discrimination in science and technology partly due to the convention of value neutrality and meritocracy prevailing in such disciplines. The 1st Basic Plan for Women's Policy therefore contained only two science-related initiatives: the two-year pilot program of girl-friendly science education and the scholarship for female students in science and technology. However, the Government Recruitment Target System based on the Act and the participation of women in government committees would also eventually come to have an influence on policies toward women in science and technology.

Rise of Advocates

During the 1990s, some women scientists became concerned with the status and discrimination of women in science and technology. They were motivated by the development of women's policy during the 1990s and by discussions on the issue. Eventually, in 1993, the Association of Korean Women Scientists and Engineers (KWSE) was founded, which was the first organization of women in science and technology. From the beginning, KWSE placed emphasis on expanding "the female population in science and engineering" and protecting "the rights of women scientists and engineers."[5] Senior women scientists at Government-supported

Research Institutes (GRIs) played a central role in the foundation and activities of KWSE due to the fact that GRIs were located in a district named "Daeduck Research Park" in a local city, Daejon. For 12 years after its foundation, three presidents of KWSE came from GRIs.

To the benefit of all women scientists and engineers, KWSE carried out many activities. In addition to meeting with the 2nd Minister of State for Political Affairs in 1994, it organized many workshops and seminars on the employment of women scientists and engineers (KWSE, 1994, 1995). It also began collecting gender discrimination cases against women scientists and engineers in 1995. Though these collective activities did not produce any tangible results, KWSE at least contributed to raising the issue amongst both science policy makers and women scientists and engineers.

Apart from these collective activities, women scientists carried out many policy researches on the issue (e.g., Kim *et al*., 1995; Moh *et al*., 1995; Kim *et al*., 1997). They examined foreign policies and specific issues that could potentially become proposals leading to policy solutions in Korea. Among these, there were affirmative action in employment and promotion, career development programs, mentoring, scholarship and research grants, training and retraining programs, and participation in policy making processes.

The proposals and solutions, however, received little positive response from the Presidential Commission on Women's Affairs except for the pilot education program. MOST launched only one grant program to raise the research capabilities of several women's universities in 1997. In fact, this did not do much for women scientists because there were large proportions of male professors among the beneficiaries.

In summary, during the 1990s, women scientists who received encouragement from the rapid growth of women's policy issues came to raise the issue of gender equality in science and technology. KWSE, the only women scientists' organization at that time, and some established women scientists who became advocates for initiatives dealing with the difficulties of women in science and technology. However, their pet solutions failed to be adopted by government officials.

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[5] See http://www.kwse.or.kr

Phase II: In Between Gender equality and Human Resource

The First Policy Window

The first policy window that became available for those advocating policies toward women in science and technology came with Dae-Jung Kim administration's emphasis on gender mainstreaming from 1998. The announcement concerning the establishment of MOGE at the New Year's presidential address in 2000 was therefore a symbolic event (Park, 2000). MOGE strongly recommended other ministries to adopt gender awareness into their policies. It also required governmental committees to have at least 30% of women members.

In response to this policy, MOST placed article no.24 concerning "the fostering of women scientists and engineers" in the Framework Act on Science and Technology in 2001. In addition, MOST invited women scientists with experience of policy researches to sit on its committees and asked eminent women scientists to find proposals dealing with what to do in this regard (e.g., Roh *et al*., 2000; Jhon & Lee, 2002; Lee *et al*., 2003). Finally, MOST launched the Women Scientists Program[6] which is a research grant program only for women researchers

The opportunity for further positive action came unexpectedly and in an informal way, at first by way of media release, and then, later, in an institutional context. On May 11, 2001, the new Minister of Science and Technology, who was appointed on March 25, 2001, announced at a forum[7] organized by women scientists that MOST was planning a series of action programs for women in science and technology. He mentioned "WISE program[8] and RTS (quota) with 20% by 2010 applicable to

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[6] It consists of two subprograms for research. One is for outstanding female scientists at regular research positions, and the other is for prospective female scientists who are doctorates but not full-time employees with doctorates. For more information, see http://www.krf.or.kr.

[7] The forum was held to celebrate the 50th anniversary of the chemistry department of Ewha Women's University.

[8] WISE stands for Women into Science and Engineering. In order to provide female students with role models and career information, WISE program organizes mentoring between female students and established scientists and engineers. For more information, see http://www.wise.or.kr.

national/public universities and GRIs (NIS-WIST, 2006). According to the advisor of the minister of MOST, the decision seemed to be made by the minister himself without previous in-depth discussion with staff officials in charge" (S. S. Kim, personal communication, December 18, 2008). However, once the news about the RTS was reported in seven major daily newspapers (e.g., Yoon, 2001), follow-up measures became inevitable. By the end of 2001, MOST launched several measures including the Woman Scientist of the Year Award (2001), Pilot WISE Program (2001-2002), and building a database listing of all women scientists and engineers by KWSE.

Recruitment Target System on the Boundary

Unlike the other measures, RTS was late to be implemented because legal basis should be provided in order to make public research institutes adopt it. RTS for women in civil service started as early as in 1996 but it was possible only after the Civil Service Examination Regulation had been amended by the Framework Act on Women's Development. For RTS in science and technology, relevant laws such as the Public Educational Officials Act or the Framework Act on Establishment, Operation, and Fostering of GRIs should be amended in this regard. This possibly explains why the Minister stated at the forum that "reference to RTS will be put in the Framework Act on Science and Technology" (Yoon, 2001).

Two months later, on July 18, the National Science and Technology Council (NSTC) finally decided to acknowledge women's programs with the exception of RTS, which was deemed in need of further consideration due to the legal problems. Because the Council chaired by the President is the nation's highest decision-making body for science and technology policy, RTS was, at least, not rejected out of hand. Following this, MOST was given the task of initiating and implementing RTS. In other words, MOST became a sort of advocate that attempted to persuade other ministries and opposing groups as to the justice of the cause.

In order to give some early successful examples, MOST asked the 25 GRIs in science and technology to adopt RTS. RTS was not compulsory at that time. However, the presidents of 25 GRIs which were influenced by MOST in budget and management concurred with introducing RTS

in September 2001 (Kim, 2001b).

At this stage, however, the issue of women's participation in science and technology including RTS still gravitated between gender equality and human resource. Interestingly, the report passed to NSTC (Kim, 2001a) stated that MOST was considering "enactment of a law for fostering and promotion of employment of women scientists and engineers which is similar to *the Science and Engineering Equal Opportunities Act* (1980) in the USA" (author's italics). To prepare for the enactment, MOST granted a research project titled "Analysis of a Draft Proposal for the Act on *Sexual Equality Employment* in Science and Technology Areas" (author's italics) (Yoo, 2002). A woman scientist stated during a media interview that, "Interim RTS is not inverse discrimination; *rather, it helps prevent unequal treatments*" (author's italics) (Park, 2001).

Phase III: Transition to Human Resource Agenda in Science and Technology

The Second Window: Debate on "Avoidance of Science and Technology"

In early 2002, when MOST was working for the enactment, the so-called "avoidance of science and technology" became a topic of heated debate in Korea. It was triggered by the attention directed toward the continuous decrease in the number of applicants choosing science and engineering among subjects for the Korean Scholastic Aptitude Test. The fact was interpreted as an evidence of decline in the social preference for science and technology, which might be a threat for the economic development of Korea. There were a variety of arguments as to its causes and possible solutions among scientists, engineers, and policy makers according to particular standpoints (Lee, 2006).

The debate on avoidance of science and technology was also instrumental in opening a new policy window for advocates of policies toward women in science and technology. Generally, the debate was a window for dealing with many agendas in science and technology, but not a window for women's inequality. It nevertheless allowed advocates of women in science to highlight an important point: the potential

scarcity of qualified scientists and engineers. As NSF did in 1989, they argued that if this was to occur, then the national competitiveness of science and technology might, in the future, be subject to decline (NSF, 1989).

Leading women scientists and engineers and policy makers from MOST then modified and redirected their argument. They began to argue that women scientists and engineers should be supported because they were valuable but under-utilized human resource. At the same time, they tried not to mention the discrimination against women as much as before (KWSE, 2003). For example, when a public hearing was held in April 2002, the draft proposal, originally titled "the Act on *Sexual Equality Employment* in Science and Technology Areas", (author's italics) was presented as "Act on *Fostering and Supporting* Women Scientists and Engineers" (author's italics). The title of a brochure advertizing that hearing reads "Women Scientists and Engineers are the *competitive resource* in the 21st century" (author's italics). With this rhetoric, advocates could be free from the burden of raising gender inequality issue in merit-based science and technology.

Institutionalization of Policies toward Women in Science and Technology

The Act on Fostering and Supporting of Women Scientists and Engineers enacted in December, 2002 was a turning point for the development of policy for women in science and technology. With the Act, the policy for women in science and technology gained a legal and more secure basis: Without it, supporting programs might have been unexpectedly abolished or reduced when the window on women's policy issues eventually closed once more. For example, RTS was applicable to seventy-four national/public research institutes in 2003 and ninety-nine in 2007, whereas it was applicable to only twenty-five GRIs before the enactment (Kim, 2008).

The Act contains many fundamental principles that place policy issues of women in science and technology on an institutionalized footing. It clarifies the positive measures in promotion as well as in employment (article 3), the establishment and operation of separate planning (article 5), the designation of a staff officer of women scientists and engineers for

promotion of employment and status (article 12), the investigation of actual status of women scientists and engineers (article 6), and the launching of the Working Center for Women in Science and Technology concerning the investigation and research in women's policy, education, training, and so forth. (article 14).

According to the Act, policy toward women in science and technology should, in principle, apply to every step of career paths for a woman scientist or an engineer. Apart from the above five articles, there are also some points relating to secondary and tertiary education for female students, support for research, employment and promotion, as well as career path development. Therefore, the range of solutions and alternatives could have been extended to include most of the proposals advocated by women scientists before (Park, 2003).

In reality, implemented programs were limited to traditional affairs of MOST, i.e. research and development, informal science education, and human resource development (HRD) at graduate levels (Kim *et al*., 2005). Many support programs were for qualified women researchers with MA or PhD degrees, and promotion programs were centered on the mentoring and informal science education for K12 by WISE centers; whereas policy for formal education at schools belongs to the Ministry of Education. In fact, RTS turned out to fall short of conventional expectations concerning affirmative action because it was applicable only to national/public institutes, and not to private sectors and private universities - the two biggest employing sectors of scientists and engineers (Oh, 2004). These problems might have resulted from the transition of policy issues regarding women in science and technology from gender equality to a workforce agenda during the formation period.

Concluding Remarks

The development of issues relating to women in science and technology has been divided into three phases. For each phase, different social and political changes exerted an influence upon the ideas and actions of the advocates concerned. The issue of women in science and technology can also be regarded as part of either the debate on gender equality where the focus has been on discrimination over the long-term or, alternatively,

as part of the HRD agenda of science and technology. With regard to the boundary feature surrounding this issue, when the window to adopt a gender perspective was open and to which the government was favorably disposed, the issue of women in science and technology was taken up by MOST. In phase III, when the second window became available concerning the avoidance of science and technology debate, things became more evenly balanced in the context of science policy whereby the problem of gender equality was replaced by concern to do with the potential feature workforce. With the passing of the Act, the policy toward women in science and technology in Korea was finally legitimated and placed on a systematized footing especially in connection with its operation and scope. The attitude to women in science and technology, however, initially pioneered in Asian countries but it was in Japan and Taiwan that this received official endorsement (e.g., Miura & Ogawa, 2007).

The implications of this series of events are two-fold. First, policy toward women in science and technology became an established part of the discipline of science, where, previously, the merit system had ignored the need for gender equality. Second, the policy toward women in science and technology came under the influence of MOST. In other words, women came to be regarded as a means of contributing to national competitiveness and no longer suffered from deep-rooted discrimination.

Although this result seems to be somewhat obvious given present circumstances, more effort still needs to be directed toward discrimination in employment in the private sector, life-work balance, and life-cycle career path development in order to further enhance gender equality. Evaluation and expansion of ongoing programs will, of course, continue to be important in terms of achieving yet more improvements to the present scheme. Finally, one of the implications of this research is that the means by which a goal might be achieved is not necessarily fixed but can potentially be attained by the active participation and interaction on the part of both women scientists and policy makers.

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