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Small Group Support: Attracting and Retaining Women in SET in Korea

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ABSTRACT
The "small group support" program was implemented to ensure the visibility and empowerment of women in science, engineering and technology (SET) primarily in the Busan, Ulsan and Gyeongnam region of Korea. The realization of this program was based on studies showing that the contingent type of employment is significantly higher in women in this southeastern region. Moreover, underrepresentation of women in the science and technology sectors has been shown to be more serious in areas further away from the national capital. The major outcomes of this project in 2010 include the formation of two new legal associations of women in SET in the region. In 2011, ten additional "small groups" were funded, resulting in better networking opportunities that contributed to the uplifting of the morale of the participants.

KEYWORDS
small group; SET; BIS-WIST; Korea; women's networks

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INTRODUCTION

The enactment of the law on "fostering and supporting women in science and technology" in the year 2002 has significantly advanced the status of women scientists[1] and engineers in the Republic of Korea (Lee et al., 2007). Since then, the role of women scientists and engineers in boosting national competitiveness has been better recognized through the various government-supported programs (Lee, 2010). Gender mainstreaming policies were introduced in Korea in the mid 1990's, and "since its implementation in 2001 the WISE" program has focused on "the mentoring, by renowned, women in science, engineering and technology"(SET) of female students from elementary school through to college, resulting in a significant increase in the average female/male student ratio in science-related departments (Lee, 2010). However, according to the report on the status of women in SET by MEST and WISET (2012), only 61.4% of women who graduated in science and/or engineering fields were in the paid workforce, compared with 91.4% of their male counterparts. In 2004 the National Institute for Supporting Women in Science and Technology (NIS-WIST) was established, followed by four regional institutes in the Gwangju/Jeonnam (GJIS-WIST), Daejeon/Chungnam (DCIS-WIST) Busan/Ulsan/Gyeongnam (BIS-WIST),and Daegu/Gyeongbuk (DGIS-WIST) areas from 2006. From 2004 to 2010, WIST centers have provided women scientists with education and training programs as well as career services, professional development programs, networking opportunities and research for policy making, with the aims of attracting, supporting and retaining women in SET careers.
In January 2011, NIS-WIST and the four regional institutes were integrated with other related government-supported centers to establish WISET (Center for Women in Science, Engineering and Technology), through which the Korean government is likely to further strengthen the national support system for women scientists and engineers in the country.

The establishment of the WIST centers (which are now WISET programs) has provided opportunities for women from various fields to form networks that could open new doors for possible research collaborations and information sharing. However, as in the case of the technological development trends in Korea, data and policies for women in SET also seem to be centralized to those in the national capital, Seoul (Shapiro et al. 2011).

Moreover, various studies today argue that women need better informal networks throughout their training and careers to ensure their success as scientists (Feeny & Bernal, 2010). This is because the informal science network is critical to the structure and advancement of careers through the process of "…information sharing; this is the distribution of resources and power by group leaders to the community (Etzkowitz et al., 2000; Tierney & Bensimon, 1996). The underrepresentation of women in SET careers is more profound in the Busan, Ulsan and Gyeongnam region (the southeastern region of Korea), as shown in the reports by NIS-WIST (2009). There is also a clear difference in both the

distribution and the type of employment by region. We therefore report on one of the initiatives of BIS-WIST, to retain and increase the representation of women in SET in the southeastern region by encouraging the setting-up of informal professional networks. Herein we report on the activities of the "small group support" policy from 2009 to 2011.

WHY "SMALL GROUP SUPPORT"?

Economic Activity of Women Scientists and Engineers in the Southeastern Region of Korea

The percentage of women in the graduating class of science and engineering bachelor courses increased from 28.0% in the year 2002 to 31.9% in the year 2006 (WISET, Korea) (see Table 1). In the case of MS and Ph.D. holders, the increase was 17.8% in 2002 to 22.6% in 2006 for MS and 11.3% to 18.5% for Ph.D. graduates, respectively (WISET, Korea). However, when evaluating these numbers in terms of science and engineering programs separately, one can see that the percentage of women enrolled (data is shown in number of graduates) had already exceeded 50% in the natural sciences in 2006.

Table 1. Percentage of women enrolled in degrees in science and engineering from 2002 to 2006 in Korea.(BS Bachelor of Science, MS Master of Science)

Degree and Major		Year 2002 %	Year 2006 %
BS	Science & Engineering	28.0	31.9
	Science only		55.4
	Engineering only		19.4
MS	Science & Engineering	17.8	22.6
	Science only		43.7
	Engineering only		12.6
Ph.D.	Science & Engineering	11.3	18.5
	Science only		33.4
	Engineering only		7.6

Source: Ministry of Education, Statistical Yearbook of Education (2002) & Database of WISET, ROK

The high percentage of women in the graduating classes of students in natural sciences was even more notable in the regions further away from the national capital. For example, in the Busan, Ulsan, otherwise known as the "southeastern region", the percentage of female students in the graduating class of Bachelors in Sciences was 59.9% as reported in the BIS-WIST Policy Brief in 2007 (Table 2).

However, these female science graduates did not do as well at finding employment as their male counterparts or as female engineering graduates, as shown in Tables 3 and 4. The tendency of female scientists and engineers to remain in the southeastern region was significantly higher than for men (meaning a higher proportion of men than women tend to leave their hometown to find better employment). Of all the female graduates, 83.9% tend to stay in the southeastern

region rather than move to other places such as the national capital to find employment. In general, employment opportunities for women scientists are less favorable than for their male, and their female engineering, counterparts.

Table 2. Percentage of female students graduating in Science and Engineering in the Busan, Ulsan and Gyeongnam ("southeastern") region of Korea

Degree	%Females in Science (number)	%Females in Engineering (number)
BS	59.9 (2,920)	18.1 (2,109)
MS	51.3 (264)	13.1 (135)
Ph.D.	36.8 (67)	10.1 (24)
Total	58.3 (3,251)	17.5 (2,268)

Source: BIS-WIST Regional Policy Brief (2009)

Table 3. Employment of Scientists in the Southeastern Region of Korea

Type of Employment	Female Scientists (%)	Male Scientists (%)
Large Enterprise Employment	22.1	26.5
Small & Medium-sized Enterprise Employment	62.8	62.3
Remaining in Region for Economic Activity	83.9	56.5

Source: BIS-WIST Regional Policy Brief (2009)

Table 4. Employment of Engineers in the Southeastern Region of Korea

Type of Employment	Female Engineers (%)	Male Engineers (%)
Large Enterprise Employment	26.1	37.6
Small & Medium-sized Enterprise Employment	64.2	55.5
Remaining in Region for Economic Activity	74.3	69.9

Source: BIS-WIST Regional Policy Brief (2009)

The Busan-Ulsan-Gyeongnam Institute for Supporting Women in Science and Technology (BIS-WIST) was established in 2006 in accordance with Section 2,

Article 14 of the "Act on Fostering and Supporting Women in Science and Technology" as a regional institute commissioned by the Ministry of Education, Science and Technology (MEST) of the Republic of Korea. BIS-WIST was located in, and supported and run by, Dongseo University with the objective of providing support for women scientists and engineers in the southeastern region of Korea. Figure 1 shows the WIST network until 2011; from 2012, WIST centers have been integrated into a larger WISET network.

Region-specific Program of BIS-WIST

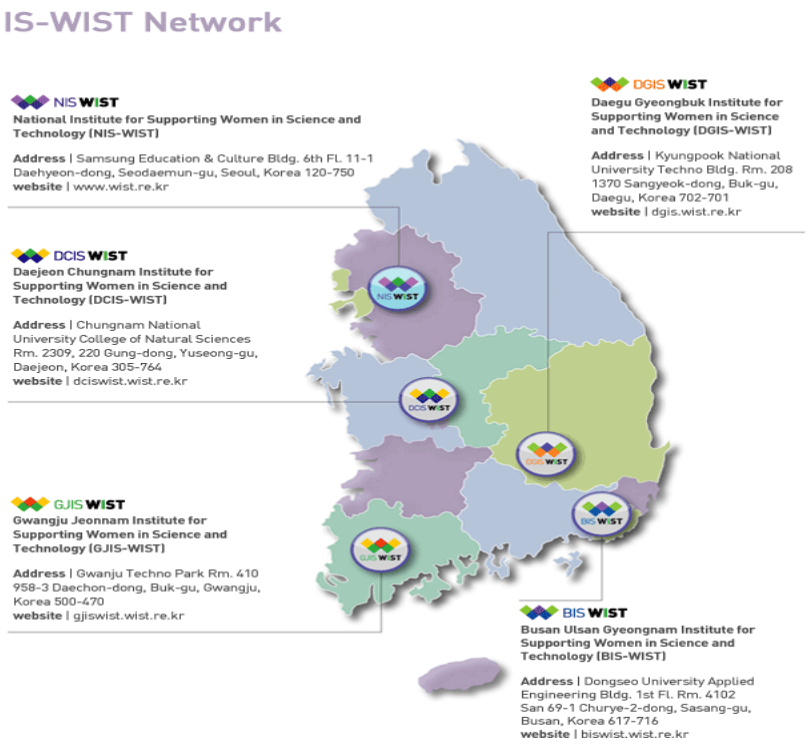

Figure 1. The WIST network from 2004 to 2011

Even though overall educational attainment falls within the range of the national average (Tables 1 and 2), the underrepresentation of women in the science and technology sectors has been more severe in the southeastern region than in the capital region (WISET Statistics). The 2009 NIS-WIST report showed that 18.7% of all the female high school graduates going into science and engineering courses in college were residing in the southeastern region, which was the second largest population next to the capital, Seoul, where 41.2% lived (Figure 2).

Therefore, after the successful completion of the Stage 1 projects (2006–2008), which included the "CEO/CTO Supporters" program for attracting science and engineering graduates into careers in science and technology, the Stage 2

projects of BIS-WIST, begun in January 2009, focused on programs that could increase the retention of women in the science and technology workforce. The initiation of "small group support" was a notable change, which was implemented to ensure the visibility and empowerment of women in science and technology (ST) primarily in the Busan, Ulsan and Gyeongnam region. Whether informal or well-established, women's networks have played a valuable role in raising the profiles of women scientists and engineers by bringing to light the problems they face.

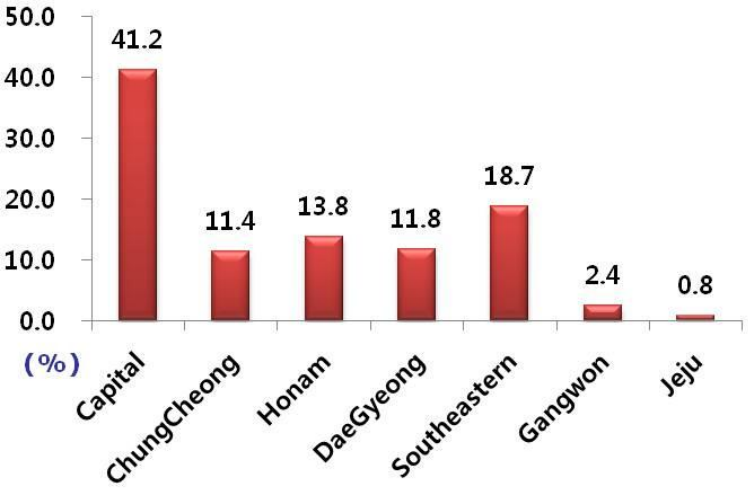

Figure 2. Distribution of Female High School Graduates going into Science and Technology by Region in Korea (2009)

Need for Professional Networking in the Region

In their recent publication, Goldberger and Crowe (2010) have shown professional networking to be a form of social capital. Social networks can connect individuals, organizations and communities for information transfer that can help them achieve their goals. Moreover, the exchange of ideas, whether formal or informal, could be crucial for a scientist, especially since most scientific work today is performed by teams. As is the case in most countries, women tend to be excluded from the most important science-related meetings as they are deprived of essential information (Jon & Chung, 2013). This is true in Korea as well, and the case is even more serious in the southeastern region of the country, one of the most conservative and male-dominant cultural regions.

Studies have shown that networking with colleagues helps women in science not only to increase their research support, exchange of information, visibility and prestige but also to enhance their income (Busch & Lacy, 1983; Emmerick et al., 2006). In the UK, the impact of online networking on the career development of professional women has been explored by Donelan et al. (2011). The fact that the employment of women scientists and engineers in certain regions is low could therefore be attributable to the lack of networking opportunities. This is the reason why "small group support" needed to be initiated in the Busan, Ulsan and

Gyeongnam region of Korea. It was believed that difficulties in starting up a formal organization might delay the opportunities for some of the ardent seekers. Moreover, bringing together women of different backgrounds, major fields and interests could hinder the setting-up of a professional network. Thus support was initiated among small groups of women scientists and engineers who could share a common goals. A small amount of seed money was intended only to serve as an impetus for these responsible women.

THE SMALL GROUP SUPPORT: 2009–2011

Small Groups in 2009

Figure 3. Photographs showing various activities of the members of "Small Groups"

With the beginning of the Stage 2 Projects in 2009, six teams of women scientists and engineers received the "Small Group Support." A minimum of five persons were needed to be members of a group and each group (depending on its proposals) was funded up to 3,000,000 KRWon (about 2,500 USD) for a period of six months. As shown in Figure 3, various activities were carried out and their outcomes were presented at the end of the year and evaluated by reviewers designated by BIS-WIST. The results of the evaluation were to be used to determine whether additional support would be possible in the following year.

Table 5 shows the names and activities of the six "small groups" together with their major outcomes. What was noteworthy was the establishment of a formal (legal) organization of contingent employed women scientists and engineers, named "NAWSE." The "small group support" had created a "bigger group" since it had grown into a national organization of an NGO type with more than 70

members. All members are Ph.D.s in science or engineering who are seeking permanent research or teaching positions. NAWSE members can now obtain government support through WISET as an organization registered with the Ministry of Education, Science and Technology (now Ministry of Science, ICT and Future Planning). Another significant achievement was the women's group in one of the local pharmaceutical companies, BINEX. The executive officers of this company had decided to provide these women scientists with space to be used as a "women's lounge." This was crucial for the retention of women in this company.

Table 5. Recipients of the 2009 "Small Group Support" and their Activities

Name of Group	***Members***	***Major Activities***	***Major Outcome***
NAWSE	Contingent-employed women Ph.D.s in S&T	-Support group for contingent employees -Preparation for a legal NGO establishment -Information exchange and empowerment	Established a legal NGO
Busan Women Professors in Science and Technology	Science and engineering female faculty members in Busan City	-Information exchange by monthly seminars -Invited seminars for empowerment -Mentoring contingent employed women scientists and engineers -open website	Professional networking on a monthly basis
BINEX Women Scientists	Female scientists in "BINEX"	-Study groups on current research topics -Lunchtime peer mentoring -Discussion groups and information exchange	Women's lounge approved by the company executive board
Professional Mathemat-icians	Female faculty and graduate students in Math	-Weekly seminars -Collaboration on scientific paper	International publication
Science Communi-cators (SC)	After-school science teachers	-Seminars for program development -Discussion groups on teaching skills	Teachers manual - new experimental contents developed

Small Groups in 2010

Table 6. Recipients of the 2010 "Small Group Support" and their Activities

Name of Group	***Members***	***Major Activities***	***Major Outcome***
KORDI-South Sea Women's Group	Women scientists and engineers within the research institute	-Research collaboration -Information exchange and empowerment programs -Career development programs	International publication Retention of women scientists
Busan Women Professors in Science and Technology	Science and Engineering female faculty members in Busan City	-Information exchange by monthly seminars -Invited seminars for empowerment -Mentoring contingent employed women scientists and engineers	Professional networking on a monthly basis Service as mentors
BINEX Women Scientists	Female scientists in "BINEX"	-Study groups on current research topics -Lunchtime peer mentoring -Discussion groups and information exchange -Managing the Women's Lounge	Increase in morale Recognition of women as important asset to company
Professional Mathemati-cians	Female faculty and Math grad students	-Weekly seminars -Collaboration on scientific paper	International publication
Science Communi-cators (SC)[2]	After-school science teachers	-Seminars for program development -Discussion groups on teaching skills	Legal NGO established
Women in Government-Funded Research Institute	Women scientists and engineers in the research institute	-Regular seminars -Peer mentoring -International networking	International conference presentation
IT Women's Group	Women IT specialists	-Regular seminars -Information exchange -Research collaboration meetings	Academia–industry cooperative research initiated
Women Contact Lens Specialists	Women optical specialists	-Collaborative meetings between women scientists in academia and industry -Information exchange	MOU signed
Traditional Korean Rice Cake Specialists	Women scientists in food science & technology	-Research meetings -Exhibition of novel rice cake recipes -Information exchange	Exhibition
Gyeongsang National University Female Professors	Women professors in science and engineering	-Meeting for convergence technology -Invited seminars -Mentoring	Mentoring

The success of the 2009 project led to an increase in the funding allocation for "Small Group Support" in 2010. Four groups from 2009 continued with their activities with increased support and eight additional groups were chosen as recipients. Table 6 outlines their activities, among which The Science Communicators group was able to establish a formal association of the NGO type. Members of this SC group were "returners" who had been away from the workforce until they were provided with retraining by BIS-WIST.

Another significant outcome of the 2010 program was that women scientists in two major research institutions became involved. Their participation in the "small group support" provided them with an opportunity to meet with fellow women scientists for information exchange. Thus one of the major outcomes of the KORDI group was an internationally peer-reviewed publication of the scientific work of the members who had participated in this "small group support." The KORDI group continues to meet regularly for mutual support. In the case of the BINEX company group, the women employees could maintain their women's lounge and, based on interviews with both the "small group" participants and management, it seems that the women were happier (they described a boost to their morale as the major outcome) and, because of this, management were also happier and had begun to recognize women as important assets to the company.

Small Groups in 2011

By the year 2011, "Small Group Support" was quite well established within BIS-WIST. Ten groups were supported in a similar manner to the 2010 program. The participants were as confident as ever and producing more outcomes such as scientific publications, exhibitions and government and private grants, which are needed to maintain and expand their professional network. Despite the downsizing of the WIST programs in 2012 when WIST was integrated into WISET, "small group support" continues. In 2012 and 2013, 12 and 11 groups respectively were supported.[3]

CONCLUSIONS

The implementation of "Small Group Support" since 2009 has resulted in better networking opportunities that have contributed to the uplifting of the morale of women scientists and engineers in the southeastern region of Korea. However, in order to maintain and further develop the two new formal associations and the ten new informal professional networks, continuous government support is still needed. Further studies are under way to show how these programs for women's networks could help with the retention of women in the science and technology sectors.

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ENDNOTES

[1] In this paper, "scientist" means natural and applied natural scientists while "science" means natural and applied natural sciences. Social science and scientists have not been included.

[2] Two groups were supported with additional funding obtained from the Namgu district.

[3] Information has been provided by the WISET Regional Agency of Dongnam.

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