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Measures for Improving Women's K-Digital Training and Career Education

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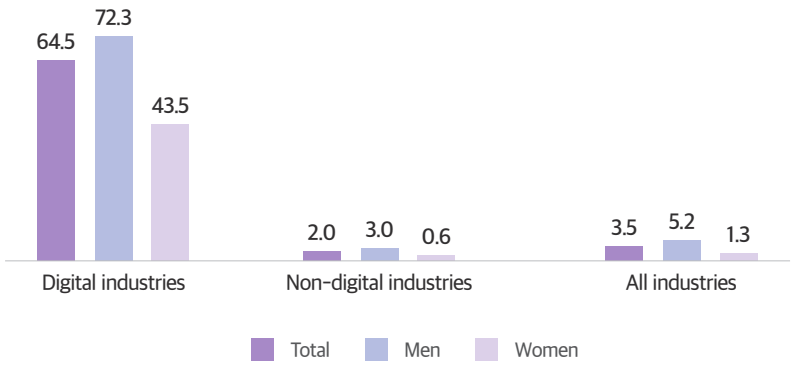
Strategies for Developing Women as Core Digital Talent to Enhance Digital Competitiveness

Abstract

- Digital technology has become a key driver of new industries and employment opportunities, exerting a profound impact across society.
- Consequently, global competition for technological leadership has intensified, and securing highly skilled technological talent has become a critical national strategy for enhancing digital competitiveness. However, South Korea is currently confronting a demographic crisis that has reduced the supply of science and engineering personnel while also limiting the available pool of human resources, making it increasingly difficult to secure talent in digital fields.
- Under these circumstances, talent development policies must be redesigned to cultivate women — who have traditionally been regarded as a potential or supporting workforce in these sectors — as core digital talent. Although women remain substantially underrepresented in digital industries, there is an urgent need to establish policies that promote women's participation in digital fields from the educational stage onward and support their transition into core talent within the labor market.
- Accordingly, this study identifies the social and structural barriers that continue to constrain women's participation in digital fields and proposes policy directions aimed at strengthening educational support across secondary education, universities, and graduate schools.

Proportion of Core Digital Talent by Industry (2023)

(Unit: %)



* This paper was produced by extracting and summarizing parts of a research report from the Korean Women's Development Institute. Please refer to the full report for further details: Lee, S., Cho, H., Jang, H., Choi, S., & Choi, J. (2024). Measures for Improving Women's K-Digital Training and Career Education. Seoul: Korean Women's Development Institute.

1 Background and Key Issues

▶ Recognizing the importance of cultivating digital talent, the Korean government included the initiative to 'foster one million digital professionals under Policy Task 15, Nurturing Future Talent through Creative Education, among the 110 national policy agenda items announced in 2022. The government also specified the scope of digital talent and outlined related implementation strategies.

- 'Digital talent' refers to individuals equipped with the knowledge and competencies required to develop, utilize, and operate emerging digital technologies. These technologies encompass eight major sectors, including software (SW) technologies such as artificial intelligence and blockchain, 5G, cybersecurity, big data, augmented reality (AR) and virtual reality (VR), the metaverse, cloud computing, and the Internet of Things (IoT).
- In August 2022, the government announced the Comprehensive Plan to Nurture Digital Talent, which presented its strategic framework for fostering one million digital professionals.

▶ The digital technology sector is widely recognized as one of the fields expected to experience substantial employment growth in the future, while simultaneously facing severe labor shortages. Nevertheless, women remain significantly underrepresented in this sector.

- According to the Korea Employment Information Service, the number of software developers is projected to increase by 66,000 by 2031, making it the occupation with the third-highest projected employment growth, following care workers and nurses.
- The Report on the Supply and Demand of Industrial Technical Personnel(산업기술인력 수급 실태조사 보고서) identifies the software sector as experiencing the most severe shortage of industrial technical personnel among the nation's twelve key industries. Over the past three years, the annual labor shortage rate in the software industry has remained at 4.0%, substantially exceeding the overall industry average of 2.2%. Despite this demand, women account for only 14.9% of technical personnel in the software industry and 28.9% in the IT business sector.

▶ Among the institutions responsible for cultivating talent in digital technology fields, universities and graduate schools occupy a central position in national policy initiatives. The primary academic disciplines supporting the establishment and expansion of digital technology-related programs are computer science and communications engineering. However, women account for less than 30% of graduates in these fields.

- In 2002, graduates in computer science and communications-related disciplines included 35,744 men and 25,643 women, with women accounting for 41.8% of all graduates. By 2022, the number had declined to 27,209 male graduates and 11,157 female graduates, reducing the proportion of women to 29.1%.
- Although not all professionals working in digital fields necessarily major in computer science and communications-related disciplines, the persistent underrepresentation of women in these core academic fields remains a significant issue requiring policy attention.

▶ As emerging digital technologies continue to evolve and expand across industries, greater policy attention must also be directed toward Gendered Innovations, which integrate sex and gender analysis into research and technology design, in order to prevent gender bias and enhance the reliability and excellence of digital convergence technologies.

- Article 14 of the Framework Act on Science and Technology stipulates that technology impact assessments concerning emerging future technologies and technologies with substantial technological and economic impacts must examine their effects according to characteristics such as gender. Similarly, Article 3 of the Act on the Performance Evaluation and Management of National Research and Development Programs requires that performance evaluations consider whether gender and other characteristics have been appropriately reflected in accordance with the nature of the research and development project.
- In other words, all members of society should participate in the process of digital technology development, and gender diversity within the field must be fundamentally ensured. The current underrepresentation of women in digital fields may hinder Gendered Innovations, whereas increasing women's participation can contribute to preventing and addressing gender bias while enhancing gender diversity within the sector.

2 Major Findings

Review of Previous Studies on Women's Educational Participation and Career Paths in STEM Fields, Including the Digital Sector

▶ This study reviewed recent studies conducted in Korea on women's participation in education, career development, and employment in STEM fields, including digital sectors, and derived three major policy implications.

- First, policy support is needed to strengthen female students' positive perceptions of and self-efficacy in digital fields during their school years. The low participation rates of female students in STEM disciplines and their relatively negative attitudes toward these fields cannot be explained solely by differences in academic achievement. Nevertheless, previous studies consistently report lower levels of scientific self-efficacy among female students. These findings highlight the need for educational policies and support systems that foster positive perceptions of digital fields and enhance female students' confidence in their abilities.
- Second, the availability of role models and the expansion of mentoring support are particularly important for encouraging female students to pursue STEM education. Unlike male students, female students' participation in STEM fields is significantly influenced by factors such as support from teachers and professors, parental encouragement, and the presence of role models. Accordingly, the findings confirm the necessity of expanding mentoring programs and developing visible role models for female students in STEM disciplines.
- Third, cultivating women as core digital talent requires not only gender-sensitive educational environments but also gender-sensitive labor market structures. Female students in STEM fields tend to have relatively low expectations regarding employment opportunities, promotion prospects, and long-term career success within their fields of study. These perceptions stem from the structural barriers that women have historically encountered in STEM fields, including gender stereotypes and discrimination in promotion opportunities and wages within both educational institutions and the labor market. Therefore, expanding women's participation as core digital talent requires the development of both educational and labor environments grounded in gender-sensitive perspectives.

Review of Current Policies for Cultivating Digital Talent

This study also examined the legal foundations, related legislation, and policy implementation measures concerning digital talent cultivation in order to assess whether current policies incorporate mechanisms for improving gender equity. The review found that, at the philosophical level reflected in the Framework Act on Education and related legislation, values such as the development of women's human resources, gender equality awareness, and gender balance are formally recognized. However, legislation related to fostering talent in advanced technology fields primarily emphasizes the cultivation of specialized professional talent, placing greater priority on expertise and excellence than on gender diversity and inclusiveness. As a result, the study identified a significant limitation in current policies and major government initiatives: the lack of sufficient awareness and consideration of gender diversity and gender balance in the process of cultivating digital talent.

<Table 1> Legal Foundations Related to the Development of Female Talent in Digital Fields

Legislation	Classification	Key Contents
Act on Fostering and Supporting Women Scientists and Technicians	Article 8. Maintenance of Appropriate Ratio of Female Students in Science and Technology Universities, etc.	① Where the ratio of female students among those attending science and technology universities, etc. is very low, the State and local governments may encourage the science and technology universities, etc. to maintain an appropriate proportion of female students who enter each year. ② The State and local governments shall devise and promote preferential policies in their assistance of research expenses, etc. for science and technology universities, etc. that maintain an adequate ratio of female students who enter under paragraph (1).
Framework Act on the Development of Human Resources	Article 7. National Human Resources Committee	• The National Human Resources Committee shall deliberate on the matters concerning the planning, coordination or evaluation of plans and policies on the development of female human resources
Special Act on High-Tech Industry Talent Innovation	Article 23. Training and Utilization of Youth and Female Talent in High-Tech Industries	• The State and the heads of local governments may provide the following support in order to promote the training and utilization of youth and female talent: - Promoting preferential treatment for youth and female talent in the course of high-tech industry talent innovation activities conducted by the industrial community - Administrative and financial support for facilitating the training and utilization of youth and female talent in high-tech industries
Industrial Technology Innovation Promotion Act	Article 20. Training of Human Resources in Industrial Technology	• Training of women and disabled persons as technical experts and promoting their participation in industrial technology fields
Framework Act on Education	Article 17-2. Enhancement of Gender Equality Awareness	• The State and local governments shall formulate and implement policies, including the following matters, to promote gender equality awareness more proactively: - Educational measures to focus on nurturing areas where women's activities are weak, such as physical education and science and technology - Selection of careers that depart from gender stereotypes and educational plans providing priority support therefor - Plans for creating educational and convenience facilities and an educational environment in consideration of gender characteristics

Source: Reconstructed by the authors based on the major provisions of relevant legislation provided by the National Law Information Center.

- The legal foundations for cultivating digital talent are primarily embedded in legislation related to advanced industries, national strategic technologies, and science and technology sectors, all of which are regarded as critical to strengthening national competitiveness. These laws generally emphasize the cultivation of highly specialised professional talent, while giving limited consideration to the value of equity in the talent development process.

- However, the Framework Act on Education stipulates that the national and local governments must establish and implement policies to promote gender equality awareness, including educational measures for fields in which women's participation has traditionally been limited and the creation of educational environments that take gender characteristics into account. In contrast, legislation related to advanced technology fields — which constitutes the primary legal basis for digital talent cultivation — focuses predominantly on fostering specialized professional talent and contains little consideration of gender diversity.
- Laws governing industries that serve as the foundation for utilizing digital talent do incorporate certain considerations related to gender equity by emphasizing the training of female personal and promoting women's participation in industrial sectors. In other words, a coherent policy philosophy regarding gender diversity is lacking across related legislation. Therefore, legal provisions that explicitly ensure gender balance and gender diversity in talent cultivation should be systematically incorporated across the various legal frameworks governing professional workforce development.
- Major policies and flagship initiatives for cultivating digital talent also fail to adequately consider gender diversity. Existing policies and programs primarily emphasize professional expertise in talent development, with limited awareness of gender balance and inclusiveness. Moreover, major initiatives generally do not incorporate gender equity-related criteria into project selection procedures or performance evaluation systems. Consequently, meaningful improvements in related policies and programs will require prior reforms to the underlying legal and institutional framework.

Analysis of the Current Status and Characteristics of Women as Core Digital Talent

▶ This study analyzed the current labor market status and characteristics of women as core digital talent and examined the present state of talent cultivation in related fields. The findings confirm that women remain significantly underrepresented among core digital professionals currently active in the labor market. In addition, female students majoring in digital or STEM-related disciplines continue to be substantially underrepresented, and the number of women obtaining relevant professional certifications remains extremely limited. Accordingly, the study suggests that women's underrepresentation in digital fields is likely to persist.

<Table 2> Distribution of Core Digital Talent (2023)

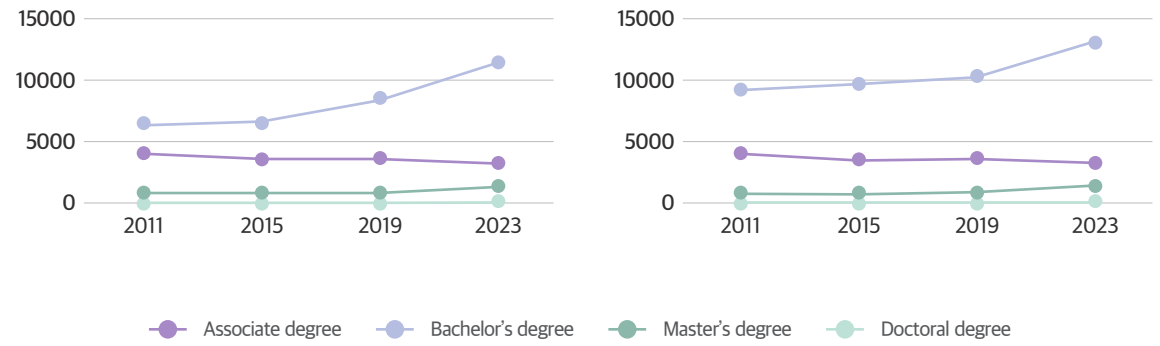
(Unit: persons, %)

Category		All Majors			
		Total	Men	Women	Percentage of Women
Digital industries	Employed in digital occupations	436,008	355,745	80,264	18.4
	Employed in non-digital occupations	240,351	136,045	104,306	43.4
	Proportion employed in digital occupations	64.5	72.3	43.5	
Non-digital industries	Employed in digital occupations	547,906	468,556	79,350	**14.5**
	Employed in non-digital occupations	27,207,803	14,982,140	12,225,664	44.9
	Proportion employed in digital occupations	2.0	3.0	0.6	
All industries	Employed in digital occupations	**983,914**	**824,301**	**159,614**	**16.2**
	Proportion employed in digital occupations	3.5	5.2	1.3	

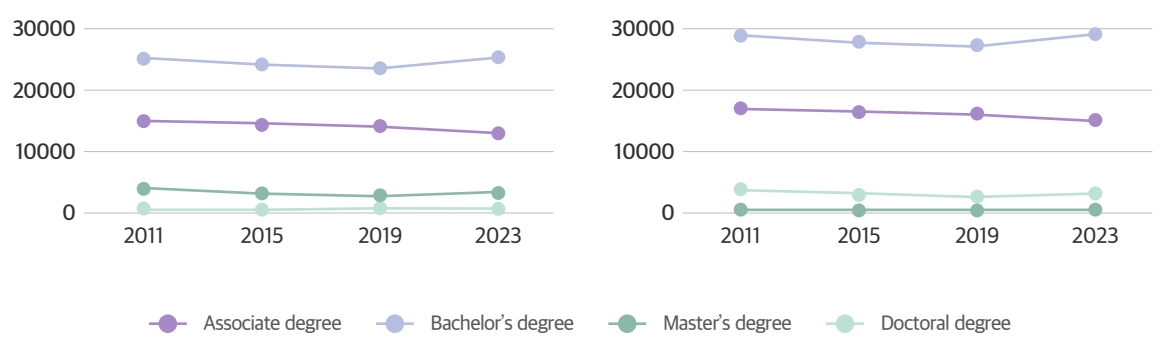
Source: Prepared by the authors using data from the Report on the Local Area Labour Force Survey (first half of 2023), Statistics Korea (now the Ministry of Data and Statistics) (2023).

- South Korea currently has approximately one million core digital talent, of whom only about 160,000 are women, accounting for just 16% of the total workforce in this sector. Core digital talent is concentrated primarily within digital industries, and most majored in STEM fields, including digital-related disciplines. In particular, majoring in a STEM field is a prerequisite for women to become core digital talent.
- Core digital talent is predominantly composed of men in their 30s and 40s, whereas women in the field are concentrated mainly in their 20s and 30s, and women generally do not remain in this field from their 40s onward. Notably, women holding at least a bachelor's degree account for only approximately 2% of all core digital talent, indicating that highly educated women are not being fully utilized.
- In major digital industries, women account for approximately 20% of the workforce. These industries make relatively active use of highly educated women and are continuing to grow, indicating the need for continued monitoring.
- Although the number of female graduates in STEM fields, including digital-related majors, increased between 2011 and 2023, the total number remains less than half that of male graduates. Nevertheless, the number of women completing master's and doctoral degrees has shown a slight increase.

Number of Graduates in Digital Degree Programs (Women) (Unit: persons)



Number of Graduates in Digital Degree Programs (Men) (Unit: persons)



Source: Prepared by the authors using data from the Basic Statistics Survey on Education, Korean Educational Development Institute (2011-2023).

- Women account for less than 25% of all holders of certifications in digital fields, and for some certifications there are no female certificate holders at all. Women are more highly represented among holders of certifications related to publishing, broadcasting, and digital content.

Analysis of Career Pathways and Career Development Characteristics of Core Digital Talent

This study conducted a case study based on in-depth interviews to examine the career pathways and career development characteristics of core digital talent. The case study explored three major areas from the elementary school stage onward: educational experiences, career-related activities, and occupational experiences. Through this approach, the study identified key characteristics and gender differences among core digital professionals. Based on participants' academic majors and educational backgrounds, in-depth interviews were conducted with 31 core digital professionals across six groups. Their firsthand experiences revealed both the current position of women in digital fields and the structural limitations they continue to face, while also identifying policy demands specific to each group.

- Graduate school graduates × Digital-related majors: Education up to the undergraduate level should focus on strengthening foundational academic competencies, while government support beginning at the master's level is needed to enhance research capabilities at an internationally competitive level. Universities should also provide diverse opportunities for changing majors, including interdepartmental transfers at the undergraduate level, enabling students to identify their aptitudes and establish career pathways while at university.
- Graduate school graduates × Non-digital majors: If the government seeks to systematically cultivate digital talent, support is needed to ensure the effective management and utilisation of such talent. In addition, policies aimed at improving digital literacy should be provided regardless of individuals' academic majors or occupational fields.
- University graduates × Digital-related majors: University curricula should be continuously updated to reflect emerging technological developments and industry trends, while opportunities for career-related activities for female students within universities should be expanded. Furthermore, workplace cultures should be improved to support broader access to and more flexible utilization of parental leave systems.
- University graduates × Non-digital majors: The quality of government-funded training programs, such as digital boot camps, should be enhanced. Moreover, there is a need to further expand domain-specific digital workforce development policies so that digital talent can be cultivated across a wide range of industries.
- High school graduates × Digital-related majors: Greater financial support and additional specialized educational personnel are needed for Meister high schools. In particular, there is a strong need to secure highly qualified instructors capable of teaching rapidly evolving digital technologies.
- Current high school students × Digital-related majors: Voucher-based financial support for specialized digital high schools should be expanded. In addition, policies promoting the recruitment of high school graduates in digital fields — as well as preferential hiring systems for graduates of Meister and specialized vocational high schools — should be introduced.

3 Policy Recommendations

Policy Directions

Improving Public Awareness and Social Culture as a Foundation for Cultivating Women as Digital Talent

- In order to increase the number of women entering and advancing in core digital roles, priority should be given to policies and support measures aimed at increasing women's interest in digital fields and improving awareness of women's participation in those fields.

Strengthening and Expanding Digital Education in Schools

- Beginning at the earliest stages of schooling, opportunities for exposure to and experiential learning in digital-related fields — such as data science, software (SW), and artificial intelligence (AI) — should be expanded.

Identifying Female Role Models in Digital Fields and Strengthening Mentoring Programs

- By identifying female role models in digital fields and strengthening mentoring initiatives, it is possible to introduce the diverse roles and activities of female digital talent while broadening awareness that digital competencies can be applied across a wide range of industries and occupational contexts.
- It is also important to continuously increase the visibility of female role models in both educational institutions and industry settings in order to demonstrate the growth potential of women within digital sectors where they continue to be underrepresented.

Strengthening Digital Literacy Education

- Digital literacy education should be continuously reinforced within foundational university curricula. After students acquire basic digital competencies, universities and graduate schools should provide advanced curricula designed to strengthen digital application capabilities in ways that reflect the characteristics of specific academic disciplines and domain areas.
- In addition, universities should systematically provide programmes designed to attract students from relevant domain disciplines, while also expanding support programs for educators equipped with digital competencies.

Detailed Policy Recommendations

<Table 3> Detailed Policy Recommendations for Expanding the Cultivation of Women as Core Digital Talent

Category		Detailed Policy Recommendations
Policy Improvement and Supplementation Measures	Policy Design and Planning Stage (Ministry of Education, Ministry of Trade, Industry and Resources)	① Establish legal foundations for evaluating and monitoring women's participation in advanced technology fields - Present concrete policy targets through the analysis of sex-disaggregated data during the planning and formulation of digital talent development policies. ② Establish a governance system for fostering women digital talent - Prepare legislative revisions that clarify provisions related to women's human resource development within the National Human Resources Committee framework while strengthening their policy priority. ③ Promote an interministerial coordination system for cultivating women digital talent - Strengthen the role of the Human Resources Strategy Meeting in relation to women digital talent development.
	Policy Implementation and Performance Management Stage (Ministry of Education)	④ Establish a gender equity-based performance management system for evaluating the effectiveness of digital talent development policies - Mandate the management of sex-disaggregated data for policy beneficiaries and improve evaluation systems by incorporating gender equity indicators into policy performance assessments.

Measures for Improving School Education	Secondary Education Improvement Measures (Ministry of Education)	⑤ Provide customized support programs for female students according to school level - In middle schools, prioritize improving social awareness and perceptions of digital fields; in high schools, focus on expanding opportunities for exposure to and experiences in diverse digital fields. ⑥ Strengthen digital competency classes and project-based learning experiences for first-year female high school students through common curriculum subjects - Develop educational content and improve educational infrastructure so that diverse media-based instruction can enhance female students' interest and engagement in digital fields. ⑦ Integrate digital competencies and convergence education into existing curricula and elective subjects - Develop educational content that strengthens digital competencies within existing curricula and interdisciplinary subjects. ⑧ Strengthen digital competencies among cross-curricular high school teachers - Develop diverse teacher training programs that enhance digital competencies without restrictions related to time or location. ⑨ Strengthen support for vocational high schools and industry collaboration to cultivate a workforce with diverse skill levels responsive to industrial demand - Reinforce practical skills education in vocational high schools, including specialized high schools, Meister high schools, and comprehensive high schools, while strengthening employment linkage support following graduation.
Measures for Improving School Education	Measures for Improving University and Graduate School Education (Ministry of Education, Ministry of Science and ICT)	⑩ Reform university education to reflect the characteristics of digital industries - Establish measures to make full use of field experts in university education according to the characteristics of individual academic disciplines. - In response to rapidly changing market conditions, educational systems should shift toward creative and problem-solving-oriented approaches. ⑪ Expand support for strengthening technical competencies among female students in digital fields - Strengthen career guidance and career planning support while expanding programs such as boot camps and hackathons targeting female students. - Provide various government incentives to encourage greater corporate participation in technical skills training. - Strengthen school-industry connections by expanding channels for communication and collaboration. ⑫ Enhance the social skills of women digital talent - Expand field-based learning and corporate internship opportunities through liberal arts and interdisciplinary courses within digital-related departments. - Provide career education and vocational guidance in digital fields specifically designed for female students. - Strengthen professional competencies and networking opportunities within digital sectors. ⑬ Improve digital accessibility through greater flexibility in university curricula, including expanded opportunities for selecting diverse majors - Strengthen career guidance support to help students establish specialized academic and career pathways aligned with their aptitudes and interests. - Increase entry into digital fields through more flexible academic systems and interdisciplinary integration of digital coursework. - Expand the provision of education in key digital technologies within first-year university curricula. ⑭ Expand opportunities for digital job competency education for non-majors - Implement systematic and professional educational programs providing digital literacy education, practical digital skills training, and digital convergence education for students majoring outside STEM disciplines. - Strengthen vocational training and expand short-term educational opportunities through the establishment and expansion of digital-related certification systems.
	Collaborative Measures for Expanding the Utilization of Female Workforce (Ministry of Employment and Labor, Ministry of Education, Ministry of Trade, Industry and Resources, Local Governments)	⑮ Strengthen the utilization of the female workforce in response to regional labor demand - Support the utilization of digital talent at various skill levels, including women returning to work after career interruptions. - Strengthen the cultivation and utilization of female workforce through enhanced collaboration among schools, local communities, industries, and universities. ⑯ Strengthen support for preventing career interruptions and facilitating workforce reentry in digital fields - Provide flexible career maintenance options for individuals at risk of career interruption and accompany these measures with policy support for companies. - Expand educational opportunities, including both school-based and private-sector programs, and establish certification systems to support reemployment in digital occupations for individuals returning after career interruptions. ⑰ Identifying more female role models and mentoring support within industries - Improve organizational culture and personnel management systems within companies to support the retention of women workers. - Promote active exchanges of ideas, role model development, and mentoring support at the corporate level.

Lead Government Agencies	Digital Education Planning Division, Ministry of Education
	Human Resources Development Policy Division, Ministry of Education
	Gender Equality Policy Division, Ministry of Education
Related Government Agencies	Software Policy Division, Ministry of Science and ICT
	Vocational Skills Policy Bureau, Ministry of Employment and Labor
	Industrial Technology Policy Division, Ministry of Trade, Industry and Resources