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Summary of Research Papers-05



# Study on Women's Jobs at a Time of Digital Transformation ( II ): Career development and social protection system

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Korean Women's Development Institute

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Digital Transformation (II):  
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# Contents

<b>I . Introduction</b> .....	<b>1</b>
1. Purpose of the Study .....	1
2. Research Question .....	3
3. Research Design .....	4
<b>II . Literature Review</b> .....	<b>6</b>
1. The meaning of Digital Transformation and the Situation in Korea .....	6
2. The Impact of Digital Transformation on the Labor Market .....	8
3. Impacts on Women’s Works and Career Development .....	11
4. Social Protection of Women Workers .....	13
<b>III . Changes in Women’s Jobs</b> .....	<b>13</b>
1. Polarization of Women’s Jobs .....	13
2. Shifts in Women’s Jobs in the Businesses that Develop and Utilize Digital Transformation Technology .....	14
3. Shifts in Women’s Jobs in Science & Technology .....	15

<b>IV. Shifts in Women’s Jobs in Manufacturing SMEs and Policy Support</b> .....	<b>18</b>
1. Research Design .....	18
2. The Women Workers’ Participation in Digital Technology Application .....	20
3. The Impacts of Digital Transformation on Women Human Resources .....	20
4. Educational Training and Career Development for Digital Transformation .....	21
5. Experiences in Policy Support for Women and Policy Demands .....	22
6. Policy Suggestions .....	24
<b>V. Shifts in Nursing Jobs with Nursing Information System and Policy Support</b> .....	<b>27</b>
1. Research Design .....	27
2. Nursing Information System and Working Environment .....	28
3. Participation of Nurses in Medical Digitalization .....	30
4. Digital Competency of Nurses and Experience of Vocational Education .....	32
5. Policy Suggestions .....	34

<b>VI. Working Situation of Women SW Developers in the Crisis of Career Interruption</b> .....	<b>36</b>
1. Research Design .....	36
2. Work Characteristics of Women SW Developers .....	37
3. Adaptation to AI Industry and Policy Support .....	39
4. Policy Suggestions .....	42
<b>VII. Working Situation of Crowd Workers</b> .....	<b>44</b>
1. Research Design .....	44
2. The Job Characteristics of Crowd Workers and Working Conditions .....	46
3. Career Development and Social Protection of Crowd Workers .....	49
4 Policy Suggestions .....	54
<b>VIII. Situation of Women Job Seekers' Response to Digital Transformation</b> .....	<b>56</b>
1. Research Design .....	56
2. The Competency of Information Search and Job Searching Activities of Women .....	57
3. The Impact of Digital Technology on Women's Jobs and Career Development .....	59

4. Policy Suggestions ..... 61

References ..... 64

## Tables

〈Table 1〉	Research Topics and Questions .....	4
〈Table 2〉	Establishment rate of SMEs' information system(2000, %) .....	8
〈Table 3〉	Percentage of Women Workers in Businesses that develop and utilize Digital Transformation Technologies (2017 vs 2019) .....	15
〈Table 4〉	Women's Job Situation in Science & Technology (2017-2020) .....	16
〈Table 5〉	Hourly Wage in Science and Engineering by Gender (2020) .....	17
〈Table 6〉	The Characteristics of the Businesses Surveyed .....	19
〈Table 7〉	Policy Suggestions for Small and Medium-Sized Manufacturing Businesses .....	26
〈Table 8〉	Characteristics of Survey Participants .....	28
〈Table 9〉	The proportion of using nursing information system to average working hour per day(%) .....	28
〈Table 10〉	The Impact of Nursing Information System on Medical Environment(1st choice, %) .....	29

⟨Table 11⟩ The Possibility of Shifts in Nursing Jobs due to the Improvement in Nursing Information System’s Convenience and Availability(% , Score out of 4–point Likert Scale) .....	29
⟨Table 12⟩ Existence of an information system department at the hospital & nurses’ experience of working in the department(%) .....	30
⟨Table 13⟩ The proportion of nurse–produced data in the whole medical data(%) .....	31
⟨Table 14⟩ Experience of making complaints to improve the system and its application(%) .....	31
⟨Table 15⟩ The interest and fairness in career development with medical digitalization(%) .....	32
⟨Table 16⟩ Self Evaluation Score of Digital Competency(5–point scale) .....	33
⟨Table 17⟩ Experience of Vocational Education and Training for Digitalization of Hospital and Future Interest in Participation(%) .....	34
⟨Table 18⟩ Policy Suggestions for Nursing Service .....	35
⟨Table 19⟩ Participants’ Characteristics .....	37
⟨Table 20⟩ Working Environment Changes Required to Help Women Employees Work for a Longer Period of Time in Software Programming Related Fields .....	38
⟨Table 21⟩ Benefit Plans and Experience of Utilization .....	38

〈Table 22〉 The Degree of Anxiety over Career Break .....	39
〈Table 23〉 Intention to Work at a Similar Job in case of Reemployment .....	39
〈Table 24〉 Opinions on AI Jobs .....	40
〈Table 25〉 Ways for Acquiring New Technology Related to Jobs (1st Choice) .....	41
〈Table 26〉 Policy Support Needed to Increase AI-Related Job Competency .....	41
〈Table 27〉 Policy Suggestions for AI Industry and Women Software Developers .....	43
〈Table 28〉 FGI Participants Profile for Platform Work .....	45
〈Table 29〉 Personal Backgrounds of the Survey Respondents for the Survey on Working Situation of Crowd Workers .....	45
〈Table 30〉 Response results on the question “I am working only as a crowd worker” .....	46
〈Table 31〉 Distribution of Marital Status and Gender of Crowd Workers(%) .....	47
〈Table 32〉 Employment Status of Other Jobs except Crowdworker .....	47
〈Table 33〉 The Proportion of Income made by Crowd Work ...	48
〈Table 34〉 The Average Number of Platforms in Transaction with Crowd Workers .....	48

⟨Table 35⟩ Working Hour and Income of Crowd Workers on a Weekly Average .....	49
⟨Table 36⟩ Percentage of the Uninsured regarding Social Insurance(%) .....	50
⟨Table 37⟩ Intention for Taking up the Social Insurance(%) .....	51
⟨Table 38⟩ The Reason for Not Taking up the Social Insurance(%) .....	52
⟨Table 39⟩ The Score of Perception on the Skill Level for the Task .....	53
⟨Table 40⟩ The Score of Perceptions on the Needs for New Certificates or License .....	54
⟨Table 41⟩ Policy Suggestions on the Platform Industry for Crowd Work and Crowd Workers .....	55
⟨Table 42⟩ Personal Backgrounds of the Respondents .....	56
⟨Table 43⟩ Policy Suggestions for Women .....	63

# Figures

[Figure 1] Change of Employment Rate by Gender, Depending on the Levels of Skills (2000 vs 2020) ..... 14



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# Study on Women's Jobs at a Time of Digital Transformation (II): Career development and social protection system

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## I . Introduction

### 1. Purpose of the Study

This research aims to investigate the impact of digital transformation on the work and career of women, and suggest policies in response to the change. Specifically, the fields of investigation are 1) small and medium-sized manufacturing businesses, 2) health and medical care service focusing on nursing service, 3) AI industry, 4) crowd work platform. Also, the researchers tried to focus on the career development and social protection for the workers in terms of policy suggestions. Male workers hold a majority in manufacturing SMEs and female workers are

majority in nursing service. AI industry and crowd work platform were chosen because they are the two emerging fields for job creation with digital transformation.

Digital technologies have been converged with diverse technologies in various fields and the convergence led innovation. That kind of convergence brought about a broad ripple effect to the related industries and businesses, and it also shifted the daily life and social norm.

Digital technology has been used for overcoming challenges such as aging, population shift, climate change, economic recession, and Covid-19 pandemic all over the world. Specifically, Korea is the country experiencing rapid aging and population decrease, therefore, it is essential for the country to improve the labor productivity. However, there is another perspective suggesting negative impact when technology replaces human labor. It can be more serious for those who are vulnerable to technological innovation as well as those who are working in the field with a high possibility of labor substitution. Korean Economic, Social, and Labor Council(2019:43)<sup>1)</sup> pointed out that most of the labor policies are focusing on the establishment of infrastructure and support for companies, but there are limits in dealing with the declining number of decent jobs, quality control of jobs, and the issues in education and training without reflecting the opinions of civil society. Florito, Aneja, and De Sanfeliu(2018:4) suggested that the policy makers are interested in the impact of technological change on the future jobs, but the gender-blinded policy makers could increase the gender gap in labor market.

Facing the digital transformation, it needs to maximize the positive

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1) 경제사회노동위원회(2019).

effect of digital transformation for resolving the social-economic challenges in the Korean society. Also, the policy making needs to focus on the competency development of general members of the society. Policies are needed to support key technology development and foster promising businesses. Lastly, the policy makers need to focus on backing up the SMEs to overcome the challenges in digital transformation and the vulnerable population such as women, youths, local talents, aging workers, and the groups in need.

## 2. Research Question

This study consists with 9 chapters. Chapter 1 and 2 are mainly about the introduction of this study and review of the literature. Chapter 3 analyzed national statistical data to discuss the features of women's jobs specifically in the field using or developing digital technology, and the employment situation of women engaging in science and engineering professions. Chapter 4 investigated manufacturing SMEs, Chapter 5 for health and medical care service industry focusing on nursing service, chapter 6 for AI industry, and Chapter 7 discussed crowd work platform to discuss the shifts in women's jobs and needs for policy making. Chapter 8 explored the impact of digital technology development on women's career, specifically the unemployed women who visit Saeil center for help(which means career support center for women in Korea). Lastly, chapter 9 proposes policy suggestions for each area.

<Table 1> shows the main research topic and research questions in each chapter.

**<Table 1> Research Topics and Questions**

<b>Research Topic</b>	<b>Research Question</b>
Women's Career Shifts with Digital Transformation (Chapter 3)	<ol style="list-style-type: none"> <li>1) Is there a polarization in women's jobs depending on the level of skills?</li> <li>2) Is there a shift in the size of women's employment in the field that uses and develops technologies for digital transformation?</li> <li>3) Is there a gender difference in the working conditions and employment situation among science and engineering professionals?</li> </ol>
Shifts in Women's Jobs and Policy Demand in each Field of Study (Chapter 4 to 7))	<ol style="list-style-type: none"> <li>1) How do the workers perceive the shifts in the labor market, such as the quantitative and qualitative (shifts in career development and working conditions) changes?</li> <li>2) How do the managerial employers perceive the shifts in womens' jobs, HRM, and working conditions?</li> <li>3) What kind of policy demand do the women workers and managerial employers have for career development and social protection of women workers?</li> </ol>
The Impact of Digital Technology Development on Women Jobseekers (Chapter 8)	<ol style="list-style-type: none"> <li>1) Do the women jobseekers feel the necessity of computer skills and education about digitalization?</li> <li>2) How many women jobseekers experience the jobs that use digital technologies? How do they perceive their level of adaptation to the skills required to meet the demand of labor market?</li> <li>3) What kind of expectations do the women jobseekers have for career development and job opportunity?</li> </ol>

### 3. Research Design

First, review of the literature was used for understanding the definition of digital transformation and the impact of digital transformation on women's career. Next, survey questionnaire was invited to confirm the shifts in women's jobs due to digital transformation. Also, surveys were conducted to identify demands for women's career development and social protection policy. Each chapter used strategic approach to determine the research target and range because of the small scale of investigation.

Third, an in-depth interview has been made for developing survey questionnaire and analysis of the survey results. The number of

interviewees is 38, including HR personnel in SMEs, nurses(the team leader, chief nurse, and general-duty nurses), women software developers (currently employed), career-disrupted women software developers, and crowd workers.

The national statistical data was analyzed to discuss the features of women's jobs in science and engineering field, women's human resource situation in the businesses using digital transformation technologies, and the job characteristics of women in science and engineering field. The data used for analysis are Economically Active Population Survey (2000, 2014- 2020), the Business Activity Survey (2019, 2020), and the Regional Employment Survey (2020).

A conference forum was also held to discuss aspects of policy-making. The participants included personnels from IT businesses, female-owned businesses operating a smart factory. experts on medical digitalization, and managers for vocational education and training for women on big data and AI technology.

Lastly, experts' consultation was made for this study. In the early stage of research, the consultation helped the authors choose the direction and range of the research. Also, the experts examined five types of survey questionnaire for each chapter, participated in the workshop for policy suggestions, and reviewed the research proposal.

## II . Literature Review

### 1. The meaning of Digital Transformation and the Situation in Korea

OECD(2019c) has made a clear definition and abundant explanation on the meaning of digital transformation. OECD(2019c) categorized digitization, digitalization, and digital transformation as follows: 1) digitization means converting analog data and process to the format that machines can read, 2) digitalization mainly refers to the utilization of digital technology and data, as well as the interconnection for changing traditional activities, and 3) digital transformation is the general social and economic effects due to the digitization and digitalization. (OECD, 2019c:18).

There are some different perspectives on what the key technology for digital transformation is, according to the researcher, research institute, or the timing of research. OECD(2019c:18) suggested Internet of things, 5G networks, cloud computing, big data, artificial intelligence, blockchain, and computing power as the key technologies for digital transformation. WEF(2020:27) investigated which technology would be most frequently used, and cloud computing, big data analysis, internet of things and connectivity devices, encryption and cyber security, and AI were in the lead. Jang & Kim et al.(2017:56)<sup>2)</sup> chose internet of things, cloud computing, big data analysis, AI, and robot technology for the 5 key technologies in the 4<sup>th</sup> Industrial Revolution. Jang & Kim et al.(2017) also suggested virtual/augmented reality, drone technology, blockchain, 3D printing, nano/new material as the key peripheral technologies. Therefore, it can be concluded that each researcher or

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2) 장윤종·김석관 외(2017).

organization has different criteria to emphasize as key technologies in digital transformation.

What is the situation of Korean business companies for development and application of the key technologies for digital transformation? Statistics Korea makes a survey on the situation of the development and utilization of the technologies for the 4<sup>th</sup> Industrial Revolution, and the Internet of things, cloud computing, big data, mobile 5G, AI, Blockchain, 3D printing, robot engineering, virtual and augmented reality are the 9 areas for survey(Statistics Korea, 2020)<sup>3</sup>). According to the Survey of Business Activities in 2020, 1,711 companies(12.9%) among 13,255 incorporated companies with 50 or more regular employees and with capital of KRW 3 million or more responded that they are developing or using the technologies related to the 4<sup>th</sup> Industrial Revolution (Statistics Korea, 2020:10). The number of the technology used in 1,711 companies is 3,395 and cloud technology took up 22.4%, followed by big data(18.6%), AI(12.0%), and mobile 5G (10.5%). In terms of the types of businesses, the key technologies are mostly in practical use in manufacturing(40.4%), information and communication(29.2%), other services(9.6%), wholesale and retail(8.9%).

The Korean government started to implement the policy for supporting digitalization of SMEs from early 2000s. The Act on the promotion of technology innovation of small and medium enterprises was designated in 2001, and numbers of projects have been implemented to support the digitalization of SMEs based on the Act<sup>4</sup>). According to the Survey on the Digitalization Level of Korean SMEs in 2000, SMEs have been

3) 통계청(2020).

4) Korean Law Information Center, Act on the promotion of technology innovation of small and medium enterprises, <https://www.law.go.kr/법령/중소기업기술혁신촉진법> (검색일 : 2021.11.2.).

digitalized 90.6%, compared to large enterprises, and 90.5% in manufacturing industry(Ministry of SMEs and Startups & Korea Smart Manufacturing Office, 2021:106)<sup>5)</sup>. Also, it has been revealed that the establishment rate of SMEs' information system in 2000 consists of homepage development(42.6%), groupware system(18.3%), electronic bidding system(12.8%), Customer Relationship Management(CRM, 3.1%), and Enterprise Resource Planning(ERP, 48.9%) as seen in <Table 2>.

<Table 2> Establishment rate of SMEs' information system(2000, %)

Homepage Development	Groupware System	Supply Chain Management (SCM)	Manufacturing Execution System (MES)	Point of Production (POP)	Electronic Bidding System	Customer Relationship Management (CRM)	Enterprise Resource Planning (ERP)
42.6	18.3	2	4.5	1.7	12.8	3.1	48.9

Resource: Ministry of SMEs and Startups & Korea Smart Manufacturing Office(2021:55).

## 2. The Impact of Digital Transformation on the Labor Market

The representative studies on the impact of digital transformation on the labor market are made by World Economic Forum(WEF) in 2016, 2018, and 2020. It has been anticipated that the number of job would be declined due to the technological development(WEF, 2016:13), however, the projection has been changed in 2018 and 2020, as the number of new jobs would be more than the number of disappeared jobs(WEF, 2018:8; WEF, 2020:29). OECD(2019a) also predicted that the major technological revolutions gave positive effects on the labor market, and such a trend would not be shifted dramatically in a few years(OECD, 2019a:44). OECD(2019c:87) revealed that 42% of the new jobs created from 2005 to 2015 are included in the digital-intensive industries.

5) 중소벤처기업부·스마트제조혁신추진단(2021).

Kim(2015)<sup>6)</sup> and Park et al.(2016)<sup>7)</sup> analyzed vulnerable jobs affected by the technological development, and plant, machine operators and assemblers was chosen as the most dangerous job from the two studies. Women workers account for a lower employment rate in this job, and women workers relatively have a higher ratio in service industry, despite Kim(2015) and Park et al.(2016) insisted that workers in the manufacturing sector are at a risk of job loss.

On the other hand, there are some studies on the employment shift with the introduction of smart factory, and those studies usually insisted that the technological development led to the increase in the number of jobs, not the loss of jobs in the early phase(Kim & Lee, 2016; Bang & Noh, 2018; Noh, Bang, & Kim, 2019; Ministry of SMEs and Startups, 2019)<sup>8)</sup>. Kim and Lee(2016) analyzed the employment shift in the companies that demand or supply factory system establishment, and the result did not show significant change in both sides. Bang and Noh(2018) focused on the engineering to analyze the employment effect with the introduction of smart factory, and the employment rate has increased after smart factory adoption when the analysis did not use the employment trend before smart factory as a control variate. However, there was not any significant employment change when the analysis used the employment trend before smart factory as a control variate. Noh, Bang, and Kim(2019) also insisted that the introduction of smart factory did not make a large shift in employment. Otherwise, it can be anticipated that the impact of smart factory on employment might differ depending on the advancement of smart factory. 77.4% of smart factory is level 1 and 2, which means the basic level, and there is no smart

6) 김세움(2015).

7) 박가열 외(2016).

8) 김세움·이근희, 2016; 방형준·노용진, 2018; 노세리·방형준·김하나, 2019; 중소벤처기업부, 2019.

factory with more advanced level 5(Kang & Park, 2020:6<sup>9</sup>).

It has been reported that the digital transformation has both negative and positive effects on the quality of jobs. The most typical negative effect is job polarization. Schwab(2016) explained that the 4<sup>th</sup> Industrial Revolution might be an opportunity for improving income level and the quality of life, however, it could also cause job loss due to the technology substitution and job polarization between low skills with low income and high skills with high income<sup>10</sup>). OECD also insisted the portion of mid-skilled jobs is decreasing in most of the OECD countries due to the mega-trends such as automation, aging, and globalization(OECD, 2020b:225). Some research result showed more women workers than men are affected more seriously by the job polarization. The study of Jerbashian(2018) showed the level of decrease in mid-income jobs and the level of increase in high-income jobs was 50% higher among women workers than men, and Jerbashian(2018) explained it is because men workers are more physically capable for the mid-income jobs than women(Jerbashian, 2018: as cited in Lee & Kim, 2018:23-24<sup>11</sup>).

Other impacts of digital transformation on the labor market include shifts in job characteristics such as project-based employment, shifts in ways of working and organizational culture, changed working environments, and competency changes for job duty (Economic, Social & Labor Council, 2019:16-30)<sup>12</sup>). Technological developments give positive effects such as better income, higher productivity, enhancement

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9) 강제원·박재성(2020).

10) Schwab, K.(2016). The Fourth Industrial Revolution: what it means, how to respond. WEF 인터넷 홈페이지 게재(2016.1.14.), <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/> (검색일: 2021.10.10.).

11) 이호영·김희연(2018).

12) 경제사회노동위원회(2019).

of worker's autonomy and work-life balance, and an decrease in dangerous and harmful tasks. On the other hand, OECD(2019a) pointed out that digital transformation could cause negative effects such as non-standardized form of employment like platform job or gig economy jobs, a falloff in job security, or low protection of workers' rights.

### 3. Impacts on Women's Works and Career Development

WEF(2016) anticipated that the job loss with the 4<sup>th</sup> Industrial Revolution affects women workers more than men, because the proportion of women workers is smaller in the fields of computer, mathematics, architect, or engineering(WEF, 2016:14). OECD(2017a) explained that the newly created jobs emphasize the importance of skills, and it can be expected the proportion of women would increase in highly-skilled jobs because women show higher educational attainments than men. However, women workers are in an unfavorable position in terms of getting a newly created job since women showed lower competencies in STEM and numerical skills(OECD, 2017a). OECD·ILO(2015) suggested to enhance the proportion of women in terms of academic degree or certificate in the engineering field to increase the possibility for women to get decent jobs.

OECD(2017a) pointed out employment rate of women would increase because of the flexibility in working environment, working hours, and the ways of working, but still there is a risk in lowering the quality of women's jobs. For example, automation affects not only manufacturing, but also retail, lodging and restaurant businesses where the proportion of women workers is higher. Kang(2018) indicated that the importance of digital technology service is increasing to meet the customer

expectation and demand, and women workers tend to have a role as a bridge to connect IT technology development and customer service.

Gianecchini(2018) specified the impacts of the 4<sup>th</sup> industrial revolution on career development as follows: 1) career development in several companies and diverse professions, 2) workers experiencing highly mobile and non-structured career, 3) workers with a lack of capabilities to catch up with technology changes are required to earn new skills which traditional education system cannot offer, and 4) emerging issues as companies might not be able to define new job requirements nor recognize them from the workers' career history<sup>13)</sup>. The challenges in women's career development are not new but traditional issues. Shin(2017)<sup>14)</sup> investigated the workers in Information and Communication Professionals and Technical Occupations, and Electrical and Electronic Related Machine Operating Occupations. Shin(2017) specifically explored that the technological development would lead to the decrease in the number of women whose career was interrupted due to marriage, childbirth and childcare, or to the increase in the opportunity of reemploying those women. The survey participants responded that the number of career-interrupted women would decrease but the opportunity for reemployment would also decline in both occupations(Shin, 2017). Jang & Kim et al.(2017) asked 596 experts of the 4<sup>th</sup> Industrial Revolution and women's career about the impact of the 4<sup>th</sup> Industrial Revolution on gender gap. Most of the experts anticipated the gender gap will be reduced in the employment opportunity, income level, and job security, and the occupational gender segregation will also be tempered. Also, the career discontinuity of married women would be

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13) Gianecchini(2018). "Career development in the fourth industrial revolution: work in progress?" <https://5c.careers/2018/04/05/career-development-in-the-fourth-industrial-revolution-work-in-progress>

14) 신전미 외(2017).

mitigated(Jang et al., 2017:686-712). Those research results are broadly distinctive with the studies concerning job losses with digital transformation.

#### 4. Social Protection of Women Workers

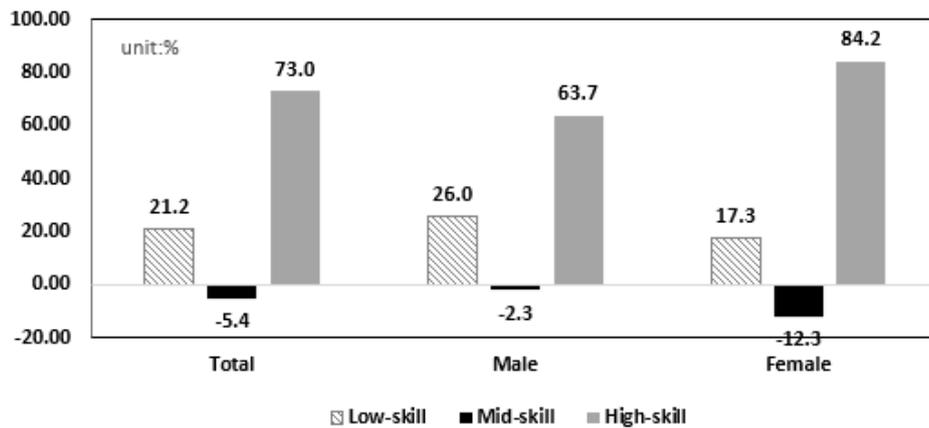
Digital Transformation helped employers design the job duty more effectively and precisely, and changed the hiring process in a more cost-effective way. This makes it possible to maintain many of the jobs, which were under standardized employment arrangements before the digital transformation, as the jobs with non-standardized employment arrangements(ILO, 2016). The increase of non-standardized jobs is a global phenomenon, and Korea is no exception. Specifically, the transition to non-standardized form of employment is more drastic in women paid workers. The issue of social protection of women workers due to the digital transformation is aligned with how to continue the policy support of social protection for those with non-standardized employment arrangements. This kind of policy support is directly connected to rectify the discriminative exclusion of women from social protection.

### III. Changes in Women's Jobs

#### 1. Polarization of Women's Jobs

A number of previous literature mentioned the job polarization due to the technological development(Autor, 2015; OECD, 2020b:225; Jerbashian, 2018), therefore, this study explored the issue of job polarization in

Korean women's jobs. The Economically Active Population Survey in 2000 and 2020 were analyzed, and the classification of skill levels was based on the 7<sup>th</sup> Korean Standard Classification of Occupations. Figure 3 shows the number of mid-skilled jobs has declined among men and women, and the number of highly skilled and low-skilled jobs has increased in both genders. Specifically, the number of highly-skilled jobs has greatly increased in women's jobs.



\* In interpreting Figure 3-1, it is necessary to consider that Korean Standard Classification of Occupations has been changed from 2000 to 2020.

Resource: Statistics Korea, Economically Active Population Survey(2000, 2020).

[Figure 1] Change of Employment Rate by Gender, Depending on the Levels of Skills (2000 vs 2020)

## 2. Shifts in Women's Jobs in the Businesses that Develop and Utilize Digital Transformation Technology

Business Activity Survey 2017 and 2019 were used to explore the shifts in the proportion of women workers in the businesses that develop and utilize digital transformation technologies. <Table 3> shows that the portion of businesses in the area of digital transformation technology

development and utilization has increased from 7.9%(2017) to 12.7% (2019), and the percentage of women workers in those businesses has declined by 0.2%p, from 26.9%(2017) to 26.7%(2019). However, the percentage of women workers in the businesses that do not develop or utilize digital transformation technologies increased by 0.4%p during the same period of time.

**〈Table 3〉 Percentage of Women Workers in Businesses that develop and utilize Digital Transformation Technologies (2017 vs 2019)**

Classification	2017			2019			B-A (%p)
	Number of Business	Percentage (%)	Percentage of Women Workers (A, %p)	Number of Business	Percentage (%)	Percentage of Women Workers (B, %p)	
Total	12,579	100.0	26.8	13,255	100.0	27.1	0.3
Business using Digital Transformation Technologies	990	7.9	26.9	1,688	12.7	26.7	-0.2
Business NOT using Digital Transformation Technologies	11,253	97.4	26.8	11,212	97.3	27.2	0.4

\* Non-response made the total sum of the business under 100%.

Resource: Business Activity Survey(Statistics Korea, 2017; 2019)

### 3. Shifts in Women's Jobs in Science & Technology

Regional Employment Survey (2020) was used to analyze women's job situation in Science & Technology, such as Science Professionals and Related Occupations, Information and Communication Professionals and Technical Occupations, and Engineering Professionals and Technical Occupations. The number of women employee in Science Professionals and Related Occupations increased 45.5%, and the proportion of women also increased from 38.4%(2017) to 43.8%(2020). The number of women

employees in Information and Communication Professionals and Technical Occupations increased 30.9% but the percentage of women employees is 13.5%. Also, the number of women employees increased 30.9% in Engineering Professionals and Technical Occupations and women's proportion is 12.3%.

〈Table 4〉 Women's Job Situation in Science & Technology (2017–2020)

Occupation	Category	2017	2020	'20-'17	Rate of Change
Science Professionals and Related Occupations	Number of Women Employee (Thousands)	31.2	45.4	14.2	<b>45.5</b>
	(Percentage)	<b>(38.4)</b>	<b>(43.8)</b>	<b>(5.4)</b>	
Information and Communication Professionals and Technical Occupations	Number of Women Employee (Thousands)	53.1	69.5	16.4	<b>30.9</b>
	(Percentage)	<b>(12.3)</b>	<b>(13.5)</b>	<b>(1.2)</b>	
Engineering Professionals and Technical Occupations	Number of Women Employee (Thousands)	85.4	106.5	21.1	<b>24.7</b>
	(Percentage)	<b>(10.2)</b>	<b>(12.3)</b>	<b>(2.0)</b>	

Resource: Regional Employment Survey(Statistics Korea, The First Half of 2017; The First Half of 2020)

The average hourly wage of women is from 73% to 84% of men's. The average wage per hour is highest in Information and Communication Professionals and Technical Occupations. It means the wage per hour is higher in the occupations with a lower number of women workers. The gender salary gap is the biggest in Engineering Professionals and Technical Occupations, as KRW 27,000 for men and KRW 19,800 for women.

〈Table 5〉 Hourly Wage in Science and Engineering by Gender (2020)

Science and Engineering Occupation Category	Men		Women		B/A(%)
	Average(A)	Standard Deviation	Average(B)	Standard Deviation	
Science Professionals and Related Occupations	2.70	1.4	2.22	1.3	0.82
Information and Communication Professionals and Technical Occupations	2.73	1.3	2.28	1.1	0.84
Engineering Professionals and Technical Occupations	2.70	1.4	1.98	0.8	0.73

Resource: Regional Employment Survey(Statistics Korea, The First Half of 2017; The First Half of 2020)

The research result suggested that women’s jobs have undergone polarization process. The number of highly-skilled women’s jobs has greatly increased and low-skilled women’s jobs also increased, however, the number of mid-skilled jobs of women decreased for the last 20 years. Also, it shows that businesses of digital transformation technology are lack of gender diversity. It can be concluded that women usually engage in low-income jobs in Science and Engineering field, therefore, they rarely have the opportunity for career development in highly-skilled, high-income jobs in Science and Engineering field. This sort of labor market situation could worsen the exclusion of women from highly-skilled key tasks, and women workers might be easily substituted by technological development.

## IV. Shifts in Women's Jobs in Manufacturing SMEs and Policy Support

### 1. Research Design

A survey questionnaire was designed to explore the impacts of digital transformation on women workers' career development and social protection, and the shifts of women's jobs in manufacturing SMEs with digital transformation. The survey participants are small and medium-sized enterprises with 50 to 300 regular employees, of whom 20% or more is women employees, and they are equipped with one or more information systems. The data is appropriate to understand the current situation of women employees in manufacturing SMEs in the early stage of digital transformation, based on the level of informational system establishment, functions in ERP and GW, and situation of the human resources for information system. The survey participants are the people in managerial position or HR, and the major questions asked includes 1) the level of digital technology application, 2) the shifts of human resource utilization with digital technology, 3) level of support to educational training and career development regarding digital transformation, 4) the experiences of women support policy and needs, and 5) background questions for statistical analysis.

**<Table 6> The Characteristics of the Businesses Surveyed**

	Category	Frequency	Percentage
	Total	(400)	100.0
Type of Businesses	Small and Medium Enterprise	(267)	66.8
	Medium Enterprise	(133)	33.3
Percentage of Women Employee	from 20% to less than 30%	(108)	27.0
	from 30% to less than 60%	(241)	60.3
	over 60%	(51)	12.8
Sub-Industries in Manufacturing	Manufacture of food products	(30)	7.5
	Manufacture of beverages	(7)	1.8
	Manufacture of textiles, except apparel	(24)	6.0
	Manufacture of wearing apparel, clothing accessories and fur articles	(16)	4.0
	Manufacture of leather, luggage and footwear	(5)	1.3
	Manufacture of coke, briquettes and refined petroleum products	(3)	0.8
	Manufacture of chemicals and chemical products; except pharmaceuticals and medicinal chemicals	(19)	4.8
	Manufacture of pharmaceuticals, medicinal chemical and botanical products	(21)	5.3
	Manufacture of rubber and plastics products	(8)	2.0
	Manufacture of electronic components, computer; visual, sounding and communication equipment	(71)	17.8
	Manufacture of medical, precision and optical instruments, watches and clocks	(47)	11.8
	Manufacture of electrical equipment	(30)	7.5
	Manufacture of other non-metallic mineral products	(4)	1.0
	Manufacture of basic metals	(8)	2.0
	Manufacture of fabricated metal products, except machinery and furniture	(9)	2.3
	Manufacture of other machinery and equipment	(20)	5.0
	Manufacture of motor vehicles, trailers and semitrailers	(25)	6.3
	Manufacture of wood and of products of wood and cork; except furniture	(1)	0.3
	Manufacture of pulp, paper and paper products	(3)	0.8
	Printing and reproduction of recorded media	(5)	1.3
Manufacture of furniture	(5)	1.3	
Other manufacturing	(39)	9.8	
Location of the Business	Seoul and Metropolitan Area	(273)	68.3
	Non-Metropolitan Area	(161)	40.3

## 2. The Women Workers' Participation in Digital Technology Application

Businesses where women employees account for 60% or more, showed lower level of information system establishment and less functions in ERP and GW than the businesses with 20 to 30% of women employees. Moreover, in the case of businesses with higher percentage of women, they demand more human resources for information system compared to the current number of employees exclusively responsible for the system, including the employees with dual responsibilities and workers from external service providers. These survey results indicate that the digital transformation can be deferred in the businesses with higher percentage of of women employees (60% or above) than the companies with higher proportion of men employees, and it could weaken the competitiveness of the businesses. The number of employees who are responsible for information system is 6,755 and women takes up 36.5%(2,038) in the 400 companies surveyed.

## 3. The Impacts of Digital Transformation on Women Human Resources

The analysis result is as follows. First, the workers in the production lines of small and medium manufacturing companies is usually known to be predominantly men, however, all the businesses surveyed in this study answered that 20% or more of their employees are women. Therefore, women workers account for a large proportion(43.7%) among production workers, and 42.3% of the companies answered that the proportion of their women production workers increased recently. This result implied digital transformation could expand the proportion of

women workers in man-dominated occupations.

Second, women can have more opportunity in the man-dominated tasks, departments, or promotions due to the information system establishment, automation in production line, and smart factory. For example, 22.5% of the businesses responded that they appointed women to the position which was usually dominated by men. Also, 58.9% of the responding businesses explained that such a trend is mainly due to the information system establishment, automation of production line, and smart factory.

Third, 23.5% of the businesses responded they hired more human resources from science and engineering, and 46.8% of responding businesses answered it is mainly due to the information system establishment, automation of production line, and smart factory. Those business also responded that women would have more advantages in the hiring process if they majored in science or engineering.

#### 4. Educational Training and Career Development for Digital Transformation

22,523 people participated in the information education and training from 400 businesses, and women took up 37.0% in 2020. The portion of women employees is about 40%, therefore, women's participation rate for information education and training is a little less than the total proportion of women employees.

Second, the businesses said that they need education and training for big data(42.0%), crowd work(34.8%), AI(32.3%), and SW convergence (29.5%), when asked which ICT technology education and training is necessary for women employees and managers. In addition, 17% of the

total women employees (or an average of ten women per business) responded that they need education and training programs for ICT technology.

Third, the business surveyed offered career development support programs, and most typical programs included job competency improvement program(55.3%), managerial competency improvement program(39.3%), counseling and consultation for career development (19.5%), work transition program(18.5%), and retirement preparation program(9.0%). The most necessary program for women employees and managers is the program for job competency. improvement.

Lastly, the participants responded that the challenges in women's career development are the difficulties in securing time from working hours for career development(37.0%), work-life balance(34.0%), lack of interest and will for career development(29.3%), and rare opportunity for career development of women employees due to the characteristics of women's jobs(28.8%).

## **5. Experiences in Policy Support for Women and Policy Demands**

The women's jobs support policy that was participated the most by businesses is the substitute worker provision service for those who take a maternity leave(42.8%), service for gender equality education(32.8%), recruitment support for hiring women(31.5%), and return-to-work service for career-broken women professionals in science and engineering field(22.5%). Meanwhile, 66% to 85% of the businesses that participated in such policy programs responded that the policy support was helpful for utilizing women workforce, and 76% to 91% intend to participate

in those policy support schemes again. 10 to 20% of companies participated in Women Internship and Youth Hiring Fund, Novice Women Researcher Hiring Fund, Leadership Education for Women Middle Manager respectively. 64 to 86% of the participated businesses responded that those projects were helpful and 76 to 85% also intend to participate in those policy support programs again. Therefore, it can be concluded that the companies perceive those support programs for women's career as helpful and tend to participate again.

46.8% of the surveyed businesses responded that they have their own programs for workplace adaptation, career-break prevention, return-to-work after maternity leave, and continuous career development of women employees. Percentage of such companies increased to 58.9%(in the case of the businesses that have women employees dedicated to information system), and 54.3%(in the case of the businesses with automation). In other words, about a half of the small and medium-sized manufacturing businesses may not be able to equip themselves with the system and policy for women employees' career development.

Lastly, education and training service for empowerment of women employees' digital and information competency is the most necessary policy support(32.3%) for enhancing the level of information and digitalization of small and medium-sized manufacturing businesses. Also, 25.5% of the businesses surveyed chose women ICT human resource hiring fund for business support. 16.5% of the participants chose education and training of women for new technologies. Therefore, almost half of the research participants needs education and training support for their women employees. In conclusion, the education for digitalization and ICT technology is the most essential support for the workers in small and medium-sized manufacturing businesses in digital transformation.

## 6. Policy Suggestions

### 1) Support for Digital Transformation of Employees and Businesses with Higher Proportion of Women

The first policy suggestion is to support the SMEs with deferred digital transformation. Covid-19 accelerated digital transformation and businesses might lose their competitiveness if they cannot adapt to the change. Businesses with higher proportion of women workers, also need to support their women employees' adaptation to the labor market shifts. In the survey, companies responded that a customized vocational training is the most necessary policy support for digital transformation of small and medium-sized manufacturing businesses.

It also needs to investigate the blind spot in the digital competency improvement support such as the national vocational training voucher and training programs offered by employers. Ministry of Employment and Labor in Korea offers customized on-the-job trainings via the training support center for small and medium-sized manufacturing businesses. It needs to review the policy delivery structure for the businesses with higher proportion of women to participate in such support systems. Also, the survey result shows that big data, crowd work, AI, and SW convergence were in great demand for education and vocational training for women employees and managers in digital transformation. This kind of needs should be considered to organize vocational training topics and programs for women workers.

### 2) Utilization of Women Professionals for Digitalization of Small and Medium-Sized Manufacturing Businesses

In the 400 companies surveyed, 36.5% of the 775 employees

responsible for information system are women. and Choi and Oh (2019:31)<sup>15)</sup> indicated that women employees take up 29.3% of the full-time employees of ICT industry as of 2018. Therefore, the proportion of women is higher among the professionals for digitalization in small and medium-sized manufacturing businesses than in the ICT industry. Also, the outlook for future workforce is positive because the scale of the additionally required workforce for the future is at a level of 30% of the current workforce. When asked whether the number of women employees for information system has increased in recent 3 years, 45.5% of the businesses responded 'yes', and 43.7% answered there is not a big change. Also, 10.8% of the businesses said the number of women employees for information system has decreased. According to the interview analysis, it is difficult to secure software developers regardless of gender because there has been a great increase in the demand for the relevant workforce. Also, women have a potential capability for information service sales, not just for software development. Usually these businesses work as a project-based team for each customer company, and the sales person takes the responsibility as a project manager and coordinates between the demands from the customer company and what is implemented by the software developers. Therefore, this position requires a capability for thorough planning and highly skilled communication for understanding the demands from customers. Hence, it is necessary to conduct a follow-up research on the manpower demand and the competency requirements in the relevant fields so that policies could be prepared to increase the utilization of women workforce in the area of digitalization, such as software developers or technology sales persons in small and medium-sized manufacturing enterprises.

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15) 최지은·오윤석(2019).

### 3) Expanding Women Talents in Science Engineering and Software Convergence

Among women college graduates, the number of women majoring in science engineering is very small. Shin et al.(2020:23-26) indicated that 11.4% of women graduates from 4-year college, and 6.8% of women from 2-year college with major in science engineering. The unemployment crisis of those who graduate with major in humanities and social science might worsen, and Shin et al.(2020:126) suggested that 70.0% female students of humanities and social science intend to participate in the vocational training in science and technology to improve their employability. However, this kind of vocational training and education needs to be offered within the college curriculum to enhance the employability of young women. Lee et al.(2020:42)<sup>16)</sup> insisted that the percentage of women graduates majoring in computer and communication was 34.4% in 2000, however, the proportion has decreased to 20.3% in 2020 and 26.8% in 2019.

〈Table 7〉 Policy Suggestions for Small and Medium-Sized Manufacturing Businesses

Policy Suggestion	Contents
1) Support for Digital Transformation of Employees and Businesses with Higher Proportion of Women	<ul style="list-style-type: none"> <li>- Enhancing digital competency and reducing the blind spot through vocational education and training for the existing employees (National Vocational Training Voucher system or trainings offered by employers with support from the Ministry of Employment and Labor)</li> <li>- Activating small and medium-sized manufacturing businesses' participation in the field practices through the Training Support Center for SMEs</li> <li>- Reflecting the needs of women workers and managers in the ICT development and new technology education programs regarding big data, crowd work, AI, or SW convergence technologies</li> </ul>

16) 이승현 외(2020).

Policy Suggestion	Contents
2) Utilization of Women Professionals for Digitalization of Small and Medium-sized Manufacturing Businesses	<ul style="list-style-type: none"> <li>- Providing women workforce for digitalization of small and medium-sized manufacturing businesses, or women software developers/technology sales personnel for related businesses</li> <li>- Developing non-science majored people as new workforce based on the intensive vocational training of 6-month or over</li> </ul>
3) Expanding Women Majoring in Science Engineering and Software Convergence	<ul style="list-style-type: none"> <li>- Vocational education and training for non-science majored female students</li> <li>- Gender Impact Assessment for Software-Focused University Projects conducted by the Ministry of Science and ICT in Korea</li> </ul>

## V. Shifts in Nursing Jobs with Nursing Information System and Policy Support

### 1. Research Design

This chapter identifies the impact of digital transformation on nursing jobs, specifically with the nursing information system, and suggested policy support for nurses' career development based on the research results. The survey questionnaire 'Actual Usage of Nursing Information System and Career Development of Nurses' was operated and 302 female nurses from high-level general hospitals in Seoul and Gyeonggi province participated in the survey. The main questions are ① personal backgrounds including education and career, ② nursing information system and working environment, ③ medical digitalization and participation of nurse, and ④ digitalization competency of nurses and policy support. In addition to survey questionnaire, one-time policy forum and experts' advisory meetings were proceeded.

**〈Table 8〉 Characteristics of Survey Participants**

Category	Frequency	Percentage	Average Age	Year of Employment	Period of Career(Years)
Total	302	100.0	35.8	2008	12.8
General-Duty Nurse	280	92.7	34.7	2009	11.7
Managerial Nurse	22	7.3	49.0	1995	26.5

## 2. Nursing Information System and Working Environment

The average working hour of participants is 8.7 hour per day. 93.4% of research participants spend 21% or more of the working hours to use the nursing information system, and 57.3% responded they spend 61% of their working hours for using the nursing information system.

**〈Table 9〉 The proportion of using nursing information system to average working hour per day(%)**

Category	Frequency	Working Hours per Day	20% and less	21~40%	41~60%	61~80%	81% and above	Average
Total	302	8.7	6.6	12.9	23.2	31.1	26.2	66.2
General-Duty Nurse	280	8.7	6.8	12.1	22.5	31.4	27.1	66.7
Managerial Nurse	22	9.0	4.5	22.7	31.8	27.0	13.6	59.8

\* The responses are based on the working hours the previous month. The nurses in shiftwork gave responses according to their working hours with more frequent use of nursing information system.

In the survey, 47.0% of the participants responded that the nursing information system improved their business processing time, or data accessibility(33.4%). Also, the participants expected positive changes in nursing jobs with the enhancement of convenience and availability of nursing information system, such as increase in job satisfaction,

collaboration with other department, patients' satisfaction, direct nursing hours, opportunity for career development, and demand for nurses. The nursing information system give benefit to the organization, such as improvement in profit or the number of daily treated patients.

**〈Table 10〉 The Impact of Nursing Information System on Medical Environment (1st choice, %)**

Category	Frequency	Improving business processing time	Improving communication	Improving data accessibility	Improving accuracy of vital sign monitoring	Decreasing errors in medical treatment	Improving profit of the hospital
Total	302	47.0	13.9	33.4	2.3	2.6	0.7
General-Duty Nurse	280	47.9	14.3	32.9	2.1	2.1	0.7
Managerial Nurse	22	36.4	9.1	40.9	4.5	9.1	0.0

**〈Table 11〉 The Possibility of Shifts in Nursing Jobs due to the Improvement in Nursing Information System's Convenience and Availability(% , Score out of 4-point Likert Scale)**

Construct	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Neutral (-)	Average Score
Increasing job satisfaction	4.0	8.6	41.1	43.4	3.0	3.3
Increasing collaboration with other departments	1.3	8.6	42.1	45.0	3.0	3.3
Increasing patients' satisfaction	1.0	14.6	47.0	34.1	3.3	3.2
Increasing direct nursing hours	2.0	19.9	40.7	35.8	1.7	3.1
Improving profit of the hospital	1.3	18.2	44.4	25.8	10.3	3.1
Increasing opportunity of career development	4.6	29.8	33.4	22.8	9.3	2.8
Increasing opportunity of job transition	4.3	35.1	30.8	16.6	13.2	2.7

Construct	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Neutral (-)	Average Score
Increasing burden for legal accountability	5.3	35.8	34.4	20.2	4.3	2.7
Increasing number of patients per day	5.6	39.4	33.8	16.6	4.6	2.6
Increasing personal time	11.3	40.1	28.1	18.2	2.3	2.5
Expanding nursing manpower	7.9	54.0	18.2	11.3	8.6	2.4
Decreasing manpower demand	21.5	55.0	11.9	8.3	3.3	2.1
Increasing manpower demand	2.3	35.4	32.1	21.5	8.6	2.8

\* The answer 'neutral' was excluded for computing average value.

### 3. Participation of Nurses in Medical Digitalization

Most of the general hospitals, which participated in the survey, are equipped with the department for information system. However, few nurses work for the department even though their workplace has such a department dedicated to information system. 91.8% of the nurses responded they have never worked for the information system department in their hospitals, and 96.5% of the respondents have never participated in the information system department in the past and present.

(Table 12) Existence of an information system department at the hospital & nurses' experience of working in the department(%)

Category	Existence of an Information System Department (Case 302)		Working Experience in the Department in the Current Workplace (Case 245)		Working Experience in the Department in the Previous Workplaces (Case 22)	
	With	Without	Yes	No	Yes	No
Total	81.1	18.9	8.2	91.8	3.5	96.5
General-Duty Nurse	81.1	18.9	7.0	93.0	1.9	98.1

Category	Existence of an Information System Department (Case 302)		Working Experience in the Department in the Current Workplace (Case 245)		Working Experience in the Department in the Previous Workplaces (Case 22)	
	With	Without	Yes	No	Yes	No
Managerial Nurse	81.8	18.2	22.2	77.8	25.0	75.0

\* 57 nurses who work for the hospital without information system department were asked if they ever worked for the information system department in the past.

The survey shows that the nurses are not playing a key role in terms of data production, although they think they are contributing to the process of data production. For example, 41.4% of the respondents insist that 50% to 70% of the medical data is made by the nurses. 23.2% of the nurses answered 70% of the data may be produced by nurses. However, only 43.4% of the nurses have complained about the inconveniences in the system.

〈Table 13〉 The proportion of nurse-produced data in the whole medical data(%)

Category	Frequency	30% or less	from 30% to 50%	from 50% to 70%	70% or above
Total	302	5.3	30.1	41.4	23.2
General-Duty Nurse	280	4.6	30.0	41.8	23.6
Managerial Nurse	22	13.6	31.8	36.4	18.2

〈Table 14〉 Experience of making complaints to improve the system and its application(%)

Category	Experience of Complaints			Application of the Complaints		
	Frequency	Yes	No	Frequency	Yes	No
Total	302	43.4	56.6	131	70.2	29.8
General-Duty Nurse	280	41.1	58.9	115	69.6	30.4
Managerial Nurse	22	72.7	27.3	16	75.0	25.0

51.3% of the survey respondents were interested in expanding their opportunity for career development through participating in the work for medical digitalization, but 21.2% said the opportunity is fair, 26.5% chose unfair, and 52.3% chose uncertain. Meanwhile, 83.8% of the nurses surveyed responded that doctors are the most benefited group for career development with the medical digitalization.

(Table 15) The interest and fairness in career development with medical digitalization(%)

Interest for career development through participation in medical digitalization				Fairness in Career Development				Advantaged group for career development with medical digitalization		
Category	Frequency	Interested	Not Interested	Frequency	Fair	Unfair	Uncertain	Frequency	Doctor	Nurse
Total	(302)	51.3	48.7	(302)	21.2	26.5	52.3	(80)	83.8	16.3
General-Duty Nurse	(280)	50.4	49.6	(280)	19.3	25.7	55.0	(72)	84.7	15.3
Managerial Nurse	(22)	63.6	36.4	(22)	45.5	36.4	18.2	(8)	75.0	25.0

#### 4. Digital Competency of Nurses and Experience of Vocational Education

Nurses do not tend to evaluate their digital competency as high. The survey participants responded that their general digital competency can be assessed as an average of 3.5 to 3.6 out of 5.0, but they estimate their creative thinking for improving digital system to be 3.0 and program design and development ability to be 2.3 in average.

〈Table 16〉 Self Evaluation Score of Digital Competency(5-point scale)

Category of Digital Competency	Total (302)	General-Duty Nurse (280)	Managerial Nurse (22)
General Competency for Utilization of Digital Device	3.6	3.6	3.3
General Competency for Processing Data using Digital Device	3.5	3.6	3.4
Creative Thinking for Improving Digital System	3.0	3.0	3.3
Program Design and Development Ability	2.3	2.3	2.3
Ability to Deliver Digitalization-Related Demands to the Hospital as a Nurse	3.3	3.3	3.5
Ability to Collaborate with Medical Team using Digital System	3.4	3.4	3.4
Ability for Data Production and Analysis using Digital Records	3.0	2.9	3.0

Nurses' self-evaluation for statistical analysis is also low. According to the survey, 44.7% of the respondents do not have basic knowledge on statistics, and 27.8% was able to understand statistics with experts' explanation, 11.6% can read and understand the statistical results, and 5.0% can manipulate, process, and analyze data by themselves. 42.7% of the nurses surveyed took nursing information class at university and the nurses' first experience with the nursing information system is usually via work experiences, such as nursing training(29.5%), on-the-job training(25.0%), or vocational training(18.0%), rather than via classes in college(26.5%). Nurses have less experience of vocational education and training on digitalization, but they are willing to participate in the future.

〈Table 17〉 Experience of Vocational Education and Training for Digitalization of Hospital and Future Interest in Participation(%)

Category	Education Experience		Future Interest in Participation	
	Yes	No	Yes	No
Education for Search and Analysis of Similar Cases using Information System	27.8	72.2	73.2	26.8
Education for Information System Development	10.3	89.7	52.6	47.4
Education for Statistical Analysis	38.4	61.6	64.6	35.4
Education for National Public Health Information System	14.9	85.1	62.6	37.4
Digital Education for the 4 <sup>th</sup> Industrial Revolution, Internet of Things, or AI	25.8	74.2	71.2	28.8

## 5. Policy Suggestions

The research suggestions driven by the study are as follows. First, the policy suggestions for utilization of nursing information system is to standardize the nursing information. Current nursing information system makes it difficult for nurses to record data promptly, which gives a higher risk of data error. Therefore, it is necessary to standardize the Korean nursing information system. Second, nursing information system needs to be used for calculating an appropriate number of nurses. The data accumulated in nursing information system makes it possible to estimate the appropriate number of nurses, and it can help identify nurses' dissatisfaction with their organization in advance. Therefore, use of the system can help to build up positive relationship among the healthcare workers, hospital management, and government authorities.

Third, it is necessary to develop the nurses' competency for activation of Personal Health Record. Nurses need offer the PHR system education to the patients and caregivers to track their condition with access to their health records during in hospital or after leaving the hospital. Additionally, nurses need to have an opportunity for developing their

professional job capabilities.

Also, there are some policy suggestions for career development of nurses on medical digitalization. First, nurses need to participate in the process of electronic nursing record system development. For example, 1 or 2 nurses from diverse clinical divisions should work 3 to 6 months for the information departments as a part-time employee, and it could lead to the development of the most suitable system for each department and division.

Second, the nursing colleges need to strengthen their nursing information system education. 74% of the nursing colleges offer the classes on nursing informatics, but only 20% of them requires students to take the class as a mandatory course, and 80% of nursing colleges offer the class as an elective course.

Lastly, supplementary education is needed to strengthen nurses' digital competency. It is mandatory for nurses to take 8 hours of supplementary education a year, therefore, those opportunities should be used for enhancing digital competency of nurses. The way of offering supplementary education also needs to be changed to increase the participation and the effectiveness of education.

〈Table 18〉 Policy Suggestions for Nursing Service

Policy Suggestions	Contents
1) Standardization of Nursing Information System	- Enhancing the accuracy and utilization of electronic records via standardization of Korean nursing terminology
2) Use of the Nursing Information System for Calculating the Number of Nurses	- Saving extra time for enhancing the workload of nurses through Nursing Information System - Analysis on each nurse's contribution to the treatment of patients and its reflection in the medical fee - Fair distribution of the profit generated through the digitalization of health care information

Policy Suggestions	Contents
3) Competency Development for Activation of PHR(Personal Health Record)	<ul style="list-style-type: none"> <li>- PHR system education offering for patients to track their condition in/out of the hospital with easy access to their health care information</li> <li>- Nurses' data analysis competency development to develop educational programs for patients based on the inquiries entered by patients or their caregivers to the PHR system</li> </ul>
4) Career Development of Nurses for Medical Digitalization	<ul style="list-style-type: none"> <li>- Participation of professional nurses in the digitalization department</li> <li>- Nurses' participation in the process of electronic nursing system during 3 to 6 months at the digitalization department</li> <li>- Growth of nurses into an information expert at the hospital, or entry of nurses into IT businesses specialized in public health based on their clinical experience</li> </ul>
5) Enhancing Nursing Informatics Education	<ul style="list-style-type: none"> <li>- Wider application of nursing informatics education to colleges as well as to refresh trainings for nurses, and creation of nursing informatics education as a mandatory major course at nursing colleges</li> <li>- Offering a continuous, customized nursing education on statistics and digital competency</li> <li>- Improving the teaching and learning methods for continuous nursing education</li> </ul>

## VI. Working Situation of Women SW Developers in the Crisis of Career Interruption

### 1. Research Design

This chapter explored the policy suggestions for competency development and social protection of women software developers regarding the problems in career development, specifically in the time of rapid transition of skills and competencies to AI programming. 337 women software programmers who are experiencing career interruption or are at a risk of career interruption participated in survey questionnaire. The main content of survey includes 1) the general job situation, 2) past/present economic activity and main duties, 3) thoughts and future

plan for career interruption, and 4) their opinions on shifts in AI technology development. <Table 19> shows the participants' characteristics.

<Table 19> Participants' Characteristics

Category		Frequency	Percentage
Total		337	100.0
Age	20s	118	35.0
	30s	136	40.4
	40s or over	83	24.6
Educational Attainment	2-year College Graduated or below	61	18.1
	4-year College Graduated or over	276	81.9
Working Condition	Full-time Employee	271	80.4
	Part-time Employee	66	19.6
Business Size	100 employees or less	233	69.1
	100 employees or more	104	30.9
Employment Status	Employed	304	90.2
	Unemployed	33	9.8

## 2. Work Characteristics of Women SW Developers

Most of the research respondents perceived the job characteristics of a software developer as follows. First, it is difficult to have work-life balance due to the long working hours and heavy workload. Second, there is a few women role model because of their career interruption. Also, there is a certain level of gender discrimination in the workplace specifically in terms of HRM. Therefore, the survey respondents answered it is necessary to get rid of gender discrimination and try to reduce the working hours and workload. Specifically, it needs to relieve the job insecurity for temporary workers, daily employees, or freelancers. It was also confirmed that these types of workers actually experience discrimination in terms of using the main benefit plans related to work-life balance.

**〈Table 20〉 Working Environment Changes Required to Help Women Employees Work for a Longer Period of Time in Software Programming Related Fields**

Category	Frequency	Percentage
Efforts for eliminating gender discrimination in HRM	83	24.6
Reducing long working hours and workload	80	23.7
Job Insecurity	35	10.4
Gender discrimination in promotion or job placement	34	10.1
Employment instability such as termination of contract period	28	8.3
Dissatisfying level of salary	26	7.7
Dissatisfying benefit plans	21	6.2
Distance of commute and the location of workplace	10	3
Mismatched job with career or major	8	2.4
Mismatched aptitude	7	2.1
Etc.	5	1.5
Total	337	100

**〈Table 21〉 Benefit Plans and Experience of Utilization**

Category		With or Without			Use of Benefit Plans	
		With	Without	Uncertain	Used	Not Used
Pregnancy and Childbirth Support	Frequency (Percentage)	184 (61.7)	39 (13.1)	75 (25.2)	47 (25.5)	137 (74.5)
Childcare Support	Frequency (Percentage)	170 (57.0)	45 (15.1)	83 (27.9)	38 (22.4)	132 (77.6)
Nursery Facilities in Workplace	Frequency (Percentage)	37 (12.4)	231 (77.5)	30 (10.1)	10 (27.0)	27 (73.0)
System for Substitute Workers	Frequency (Percentage)	49 (16.4)	125 (41.9)	124 (41.6)	16 (32.7)	33 (67.3)
Flexible Working	Frequency (Percentage)	173 (58.1)	91 (30.5)	34 (11.4)	120 (69.4)	53 (30.6)
Policy for Vacations such as Sick Leave, Family Leave, or Partial use of Annual Leave	Frequency (Percentage)	206 (69.1)	53 (17.8)	39 (13.1)	137 (66.5)	69 (33.5)

In the survey, 63.2% of the respondents had anxiety over possible career break. In the case of employed women, 85.5% wanted to work in the similar jobs if they can be re-employed. 70.4% of career-broken women also wanted to work in the similar jobs. It can be concluded that women software developers want to stay in the similar field.

〈Table 22〉 The Degree of Anxiety over Career Break

Category	⑤ Very anxious	④ Anxious	③ Neutral	② Not anxious	① Never anxious	Mean (SD)
Frequency (Percentage)	61 (18.1)	152 (45.1)	88 (26.1)	29 (8.6)	7 (2.1)	3.69 (0.936)

〈Table 23〉 Intention to Work at a Similar Job in case of Reemployment

Category	Employed Women		Career-Broken Women	
	Yes	No	Yes	No
Frequency (Percentage)	243 (85.6)	41 (14.4)	19 (70.4)	8 (29.6)

### 3. Adaptation to AI Industry and Policy Support

The participants responded that it is the most important to strengthen job competency continuously. 64.1% of the respondents think it is easy to lose the competitiveness without AI technologies, and 91.1% answered they would be uncompetitive without constant competency development. Also, more respondents(40.8%) answered that there is a lack of education and vocational training programs for AI development technology in Korea, compared to those(21.1%) who responded that there are enough education and training programs in Korea. The survey participants responded that they might not be able to gain the knowledge and experience on AI programming if their career is discontinued at this time. The rate of negative response(42.1% of current workers and 42.1% of

career-broken women) is higher than positive one (24.6% of current workers and 31.6% of career-broken women) when asked about the possibility of gaining the knowledge and experience on AI programming by themselves.

〈Table 24〉 Opinions on AI Jobs

Statements	Unit	⑤ Strongly Agree	④ Agree	③ Neither Disagree nor Agree	② Disagree	① Strongly Disagree	Mean Score (SD)
1) Job Competency: I might become uncompetitive without continuous education and vocational training.	Frequency (Percentage)	147 (43.6)	160 (47.5)	26 (7.7)	3 (0.9)	1 (0.3)	4.33 (0.683)
2) Opinions on AI competency: I might be uncompetitive in the labor market if I do not have AI development programming technology.	Frequency (Percentage)	54 (16.0)	162 (48.1)	85 (25.2)	35 (10.4)	1 (0.3)	3.69 (0.873)
3) (Current workers) The education programs on the AI development programming are offered enough.	Frequency (Percentage)	13 (4.3)	51 (16.8)	116 (38.2)	107 (35.2)	17 (5.6)	2.79 (0.934)
4) (Current Workers) Opinions on AI related job: I may not be able to gain the knowledge and experience on AI programming if my career is discontinued at this time.	Frequency (Percentage)	31 (10.2)	157 (51.6)	73 (24.0)	39 (12.8)	4 (1.3)	3.57 (0.888)
5) (Current Workers) Opinions on AI related jobs: I may be able to improve my job competency on AI programming by myself using online education programs or so on.	Number of Respondents (Percentage)	8 (2.6)	67 (22.0)	101 (33.2)	98 (32.2)	30 (9.9)	2.75 (0.993)
6) (Career-Broken Women) Opinions on AI related job: I may be able to improve my job competency on AI programming by myself using online education programs or so on.	Frequency (Percentage)	2 (10.5)	4 (21.1)	5 (26.3)	8 (42.1)	0 (0.0)	3.00 (1.054)

Women software programmers(39.2%) participated the most in self-directed learning on the new technologies related to their jobs, but 24.6% of the respondents answered they need help from their colleagues or the persons in the same field. It can be concluded that the educational training via online is not enough for women software programmers to acquire AI technologies.

〈Table 25〉 Ways for Acquiring New Technology Related to Jobs (1st Choice)

Category	Vocational Education and Training offered by the Workplace	Vocational Education and Training offered by the Government, Colleges, or the Local Municipalities	Help from colleagues and employees from the same field	Self-Directed Learning via Online	ETC
Frequency (Percentage)	67 (19.9)	53 (15.7)	83 (24.6)	132 (39.2)	2 (0.6)

The participants responded they need financial support for educational program(31.8%), systemic support for voluntary participation in AI education(23.1%), and expansion of AI-related vocational education and trainings(22.3%) for enhancing their job competency on AI technology.

〈Table 26〉 Policy Support Needed to Increase AI-Related Job Competency

Category	Frequency	Percentage
Expansion of vocational education and training on AI related field	75	22.3
Financial support for participating in educational program	107	31.8
Financial support for workplace to offer the educational programs on AI	58	17.2
Systemic support for voluntary participation in AI education	78	23.1
Network building for those who are in similar situations to each other	17	5.0
Etc.	2	0.6
Total	337	100.0

#### 4. Policy Suggestions

The low percentage of women employees and their risk of career interruption in the software development field might give negative impact the individuals, industries, and national development. Specifically, as the competition for taking market dominance in AI field is fierce these days, an active policy support is essential. The policy for women's employment is considerably well-organized in terms of both quantity and quality. Therefore, it is not timely to set up a general policy support for embracing women's career itself, but it is important to establish more detailed policy support for each industry and job. The same is true for the software development field, and the policy suggestions are as follows.

First, a one-stop career development management service needs to be introduced for the women software developers with career break or at risk of career break. There are some social protection systems such as work-life balance, vocational training and education, or maternity protection schemes, but the process and details in those policies should be customized to the software industry and women software developers. The related governmental organizations such as Ministry of Gender Equality and Family, Ministry of Labor, Ministry of Science and ICT, and Ministry of Trade, Industry and Energy need to cooperate with each other for the one-stop career development service.

Second, the education programs on AI algorithm should be expanded for women software developers. The content and level of educational programs should be enhanced with the help of professionals and advices from mentors in the relevant field, and the teaching methods need to be diversified to face-to-face as well as online delivery.

Third, it is necessary to reduce the blind spot in terms of the systems

and policies for social protection of vulnerable groups. The social protection for job security of temporary workers, daily employees, and freelancers should be strengthened. Also, both the consultation for social protection policies and stricter labor supervision should be implemented from a carrot-and-stick approach perspective.

Fourth, the policies for work-life balance need to be reconsidered for relieving excessive workload, overtime work, and work centralization, which are the fundamental issues of software development field. The cooperation among the relative government organizations should be encouraged and if necessary, efforts should be made for social consensus through working group of Economic, Social & Labor Council. Lastly, investment in AI technologies for women-dominated industry could be considered because women are part of the key consumer groups in AI applicable areas. The comprehensive competency of women software developers would be a great advantage in those fields, and this advantage can lead to the establishment of secure work environment while improving HRM policies in businesses with the increasing number of women software developers.

〈Table 27〉 Policy Suggestions for AI Industry and Women Software Developers

Policy Suggestions	Contents
1) One-stop management service for career development of women software developers	<ul style="list-style-type: none"> <li>- Targeting women software developers with career-break or at risk of career break</li> <li>- Improving the way of delivering social protection policies such as work-life balance, vocational education and training, and maternity care</li> <li>- Temporary cooperation among governmental organizations to provide a one-stop management service for career development of women who are undergoing career break crisis</li> <li>- Cooperation among Ministry of Gender Equality and Family, Ministry of Labor, Ministry of Science and ICT, and Ministry of Trade, Industry and Energy</li> </ul>

Policy Suggestions	Contents
2) Expanding AI Algorithm Education	<ul style="list-style-type: none"> <li>- Development of educational contents for meeting the educational needs of women software developers</li> <li>- Enhancing the level of education for highly-skilled workers</li> <li>- Organization of blended learning with face-to-face practice and practical exercise in the physical workplace</li> </ul>
3) Supplement for the Blind Spot of Social Protection	<ul style="list-style-type: none"> <li>- Reducing the blind spot of temporary workers, daily employees, or freelancers</li> <li>- Consultation for the social protection policies and stricter labor supervision at the same time</li> </ul>
4) Expanding Women-Dominated AI Industry	<ul style="list-style-type: none"> <li>- Expanding AI technology application to the women-dominated areas to make the best use of women software developers' comprehensive competencies</li> <li>- Expanding the efforts to achieve digital technology convergence for women-dominated areas in a long term</li> </ul>
5) Expanding the System for Work-Life Balance	<ul style="list-style-type: none"> <li>- Development of work-life balance arrangements suited for temporary workers, daily employees, or freelancers</li> <li>- Reducing the blind spots through business consultation and labor supervision</li> <li>- Efforts to reduce overtime work or excessive working hours</li> <li>- Needs for policy refinements based on the consultation of working groups from Economic, Social &amp; Labor Council</li> </ul>

## VII. Working Situation of Crowd Workers

### 1. Research Design

The research on crowd workers is combined with the FGI study and questionnaire survey. The participants for FGI study were divided into two groups, where group 1 consists of the platforms for low-skilled tasks and group 2 consists of the platforms for highly-skilled tasks. The interview participants are assigned by gender and age for each group. The final interview participants are shown in <Table 28>.

<Table 28> FGI Participants Profile for Platform Work

Type of the Platform	Main Platforms	Gender	Age	Number of Interviewees
Group 1: Platforms for Low-skilled Tasks	Crowdworks, CashMission, Labelr and etc.	Women	30s or below	1
			30s or over	2
		Men	30s or below	1
			30s or over	2
Group 2: Platforms for High-skilled Tasks	Kmong, Soomgo, Otwojob and etc.	Women	30s or below	2
			30s or over	2
		Men	30s or below	1
			30s or over	0

Also, the survey questionnaire for crowd workers had limits in securing enough samples for probability sampling, therefore, the authors requested the research consulting company to construct the samples from their online survey panel pool. The potential samples had been asked about their experience of working as crowd workers, and if their answer was yes, such samples were finally selected as survey participants. The final 361 crowd workers' personal backgrounds are shown in <Table 29>.

<Table 29> Personal Backgrounds of the Survey Respondents for the Survey on Working Situation of Crowd Workers

Category		Frequency	Percentage
Gender	Men	123	34.1
	Women	238	65.9
Age	20s	82	22.7
	30s	139	38.5
	40s	95	26.3
	50s or above	45	12.5
Educational Attainments	Highschool graduates or below	174	48.2
	2 or 3-year college graduate	180	49.9

Category		Frequency	Percentage
	4-year graduate or above	7	1.9
Marital Status	Not married	174	48.2
	Married and with spouse	180	49.9
	divorced/separation/bereavement	7	1.9
Total		361	100.0

Women respondents account for 66%, more than men, and participants in their 20s and 30s are majority taking up 61.2%. Among the participants, graduates of high school or below was 48.2%, and graduates of 2-year college or above is 51.8%. The percentage of married and unmarried participants is similar.

## 2. The Job Characteristics of Crowd Workers and Working Conditions

<Table 30> shows 35.8% of the respondents work only as crowd workers, without any other jobs. 28% of men work only as crowd workers but the percentage is higher than women(39.8%).

<Table 30> Response results on the question “I am working only as a crowd worker”

Category		Working only as Crowd worker		Total	
		Frequency	Percentage	Frequency	Percentage
Gender	Men	33	28.0	118	100.0
	Women	92	39.8	231	100.0
Total		125	35.8	349	100.0

<Table 31> shows 58.7% of the married women with spouse working only as crowd workers, and the percentage is about twice higher than

men. Therefore, it can be interpreted that married and unemployed women seek the job as crowd workers to work and at the same time care for their children and housework.

〈Table 31〉 Distribution of Marital Status and Gender of Crowd Workers(%)

Category		Marital Status			Total
		Unmarried	Married with Spouse	Married without Spouse	
Gender	Men	63.6	30.3	6.1	100.0
	Women	40.2	58.7	1.1	100.0
Total		46.4	51.2	2.4	100.0

Among the 224 respondents who answered they have other jobs except crowd worker, 56.7% have full-time jobs and 43.3% for part-time jobs(those who have other jobs except crowd work were asked to give an answer based on the highest-paid job). More women(46%) than men work as part-time workers.

〈Table 32〉 Employment Status of Other Jobs except Crowdworker

Category		Full-time employed		Part-time employed		Total	
		Frequency	%	Frequency	%	Frequency	%
Gender	Men	52	61.2	33	38.8	85	100.0
	Women	75	54.0	64	46.0	139	100.0
Total		127	56.7	97	43.3	224	100.0

Also, the participants who have other jobs were asked about the proportion of the income made by crowd work, and it accounts for an average of 15.4% of the whole income. There is no significant difference in gender, age, and educational attainments, but the employment status made significant difference on the proportion of the income.

〈Table 33〉 The Proportion of Income made by Crowd Work

Category		Frequency	Average(%)	Standardized Deviation	Significance
Gender	Men	85	15.5	18.51	0.934
	Women	139	15.3	15.60	
Employment Status	Full-time	127	9.1	8.51	0.001
	Part-time	97	23.9	20.81	
Total		224	15.4	16.72	-

The crowd workers are registered and working for two platforms on average, men for 1.77 and women for 2.13, and it is statistically significant. The gap between full-time crowd workers or part-time crowd workers is also statistically significant, the full-time crowd workers work for 2.33 platforms on average but 1.83 platforms in the case of the part-time crowd workers.

〈Table 34〉 The Average Number of Platforms in Transaction with Crowd Workers

Category		Frequency	Frequency	Standardized Deviation	Significance
Gender	Men	118	1.77	1.158	0.040
	Women	231	2.13	1.670	
Employment Status as Crowd workers	Part-time Crowd Workers	224	1.83	1.285	0.003
	Full-time Crowd Workers	125	2.33	1.839	
Total		349	2.01	1.524	-

The respondents spend 26.1 hours on crowd work per week, and they are paid 476,000 Korean Won on average. Women workers work for 25.4 hours and are paid 445,000 Korean Won, and it seems that women work less and paid more than men. However, the variance between the groups was too big to be statistically significant.

Among those who have other jobs, the respondents spend 7 hours less per week but paid 60,000 Korean Won more. However, this result is not statistically significant due to the great variance.

〈Table 35〉 Working Hour and Income of Crowd Workers on a Weekly Average

Category		Frequency	Average Working Hour per a Week	Average Income per Week (10,000 Korean Won)
Gender	Men	123	27.8	53.5
	Women	238	25.3	44.5
Employment Status as Crowd Workers	Part-time Crowd Workers	224	23.6	49.0
	Full-time Crowd Workers	125	30.8	42.8
	Sum	349	26.2	46.8
Total		361	26.1	47.6

### 3. Career Development and Social Protection of Crowd Workers

The FGI participants can be divided into group 1 consisting of highly skilled freelance crowd workers, and group 2 consisting of low-skilled crowd workers for simple labor. Group 1 participants are largely categorized as the self-employed and it is difficult for them to benefit from employment insurance and occupational health and safety insurance. Therefore, they need a valid means to take up the insurance policies. In the case of Group 2, they usually acknowledge the needs for employment insurance unless they are already protected by the insurance due to the other job. However, they are concerned of heavy insurance fee, difficulties in proving their income or qualification as a beneficiary of public assistance.

Both groups experienced violation of their rights as workers or impairment of fairness in labor relationship with the crowd work platforms. Also, they experienced improper suspension of account or unreasonable job evaluation system, and complained about excessively low salary and immoderate brokerage fee.

This study showed that the uninsured rate of employment insurance is 60.4%, and 64% for occupational health and safety insurance. Specifically, the percentage of uninsured women(63.4%) is higher than that of uninsured men(54.5%) for employment insurance, and 52% of men and 70.2% of women are not insured with occupational health and safety insurance. The gender gap is still the same in the uninsured rate for national pension and national health insurance even though the absolute figure is low. The part-time workers with crowd work or the workers who engage only in crowd work showed significantly high uninsured rate. Meanwhile, the workers who engage only in crowd work showed an uninsured rate of 86.4% for employment insurance and an uninsured rate of 89.6% for occupational health and safety insurance.

〈Table 36〉 Percentage of the Uninsured regarding Social Insurance(%)

Category		Frequency	Employment Insurance	Occupational health and safety insurance	National Pension	National Health Insurance
Gender	Men	123	54.5	52.0	35.0	13.8
	Women	238	63.4	70.2	45.0	25.2
Type of Working	Full-time work and Crowd Work	127	24.4	29.1	11.8	2.4
	Part-time work and Crowd Work	97	75.3	77.3	54.6	22.7
	Work only as Crowd Workers	125	86.4	89.6	61.6	38.4

Category	Frequency	Employment Insurance	Occupational health and safety insurance	National Pension	National Health Insurance
Sum	349	60.7	64.2	41.5	20.9
Total	361	60.4	64.0	41.6	21.3

When asked of the intention to take up the unemployed insurance or occupational health and safety insurance, 46.8% answered they would not take up those insurances. 48.3% of women answered they would not intend to take up the insurance, but the rate declined to 30% in the case of the respondents working both as a part-time worker and a crowd worker, or the respondents working only as a crowd worker. Therefore, it implies that those types of workers have a wide range of incentives to take up social insurances through crowd work.

〈Table 37〉 Intention for Taking up the Social Insurance(%)

Category		Frequency	Would NOT take up the insurance(%)
Gender	Men	123	43.9
	Women	238	48.3
Type of Working	Full-time work and Crowd Work	127	59.8
	Part-time work and Crowd Work	97	37.1
	Work only as Crowd Workers	125	39.2
	Sum	349	46.1
Total		361	46.8

The survey asked why the respondents said they would not take up the social insurance, and 56.2% of them answered that they don't need it because they do not care about the unemployment status and there is

a low risk of industrial accident. Also, 31.4% of them said that they would not get such an insurance because of the burden of the fee, and 7.7% of them mentioned that they think the level of insurance coverage would be low.

(Table 38) The Reason for Not Taking up the Social Insurance(%)

Category		Frequency	Not Necessary	Burden for the Fee	Low Expectation of the Coverage
Gender	Men	54	51.9	31.5	9.3
	Women	115	58.3	31.3	7.0
Type of Working	Full-time work and Crowd Work	76	61.8	26.3	5.3
	Part-time work and Crowd Work	36	52.8	36.1	8.3
	Work only as Crowd Workers	49	53.1	34.7	8.2
	Sum	161	57.1	31.1	6.8
Total		169	56.2	31.4	7.7

The other controversial issue for crowd work is the limited opportunity for career development due to the low accessibility to vocational education and training(Scarpetta, 2016:3). Group 1, the highly skilled freelancer crowd workers, perceive the crowd work as a foundation for their career development, but they do not think they need to have additional vocational education and training from related institutions. However, the group 2, low-skilled crowd workers for simple labor, perceive it is good for them to work and be paid from crowd work without entry barriers, but they think they need the vocational education and training programs and career development path for advancing to the highly-skilled, high paid jobs.

The survey participants were asked about how strongly they agree with the statement that ‘This work does not require special skill or competency, but anyone can do this job if they can use PC or smart phone’. Answers to this question was measured with the 5-point Likert scale, 1 for Strongly Disagree to 5 for Strongly Agree, and the response showed an average score of 3.45. Therefore, it can be concluded that the crowd workers consider their work as a simple labor without high skills or competencies. Women showed higher degree of agreement with the statement as 3.54, which is higher than that of men(3.28).

〈Table 39〉 The Score of Perception on the Skill Level for the Task

Category		Frequency	This work does not require special skills or competencies, but anyone can do this job if they can use PC or smart phone.
Gender	Men	123	3.28
	Women	238	3.54
Employment Status as a Crowd Worker	Part-time Crowd Worker	224	3.44
	Full-time Crowd Worker	125	3.52
	Sum	349	3.47
Total		361	3.45

\* 5-point Likert Scale, 1 for Strongly Disagree→5 for Strongly Agree

The survey participants also responded to the statement on the needs for new certificates or license for crowd work, and their agreement with the statement was measured with 4-point Likert scale. The score is 2.41 on average, therefore, it seems that most of the participants perceive that such new certificates or license are needed. Women showed higher level of agreement with the statement as 2.39, which is higher than that of men(2.42). Also, the score is higher in the group working only as crowd

workers(2.62).

**〈Table 40〉 The Score of Perceptions on the Needs for New Certificates or License**

Category		Frequency	There is a need for new certificates or license to carry out crowd work better.
Gender	Men	123	2.39
	Women	238	2.42
Type of Working	Full-time work and Crowd Work	127	2.59
	Part-time work and Crowd Work	97	2.58
	Work only as a Crowd Worker	125	2.62
	Sum	349	2.60
Total		361	2.41

\* 4-point Likert Scale, 1 for Strongly Disagree→4 for Strongly Agree

#### 4 Policy Suggestions

Crowd workers are not recognized as a worker under the labor law or related legal system. Therefore, it is necessary to support the career development and enhance social protection of crowd workers with alternative legislations such as “Legislative Bill on Support and Protection for Platform Workers(플랫폼 종사자 보호 및 지원 등에 관한 법률안)”, amendment of the legislations related to the social security act, or establishment of administrative rules and social standards. Specifically, it is necessary to support women crowd workers with more targeted policies. The policy suggestions for social protection are as follows: 1) support for private autonomy between the platform and crowd workers, 2) expanding the application of employment insurance, and 3) legal actions for maternity care, prohibition on gender discrimination or

sexual harrasment. The policy suggestions for career development of crowd workers include 1) national employment support system and 2) national vocational training voucher.

**〈Table 41〉 Policy Suggestions on the Platform Industry for Crowd Work and Crowd Workers**

Policy Suggestions	Contents
1) Support for Private Autonomy between the Platform and Crowd workers	<ul style="list-style-type: none"> <li>- Establishing a Code of Conduct for platform businesses and making it compulsory</li> <li>- Approval system and monitoring of government on terms of the sevice agreements</li> <li>- Support for fraternal organization or autonomous organizations of crowd workers, such as cooperatives</li> </ul>
2) Policy Support for Career Development of Crowd Workers	<ul style="list-style-type: none"> <li>- Revision of the national employment support system to include crowd workers or other types of platform workers in the system</li> <li>- Revision of national vocational training voucher system to better motivate the training institutions and enhance the incentives of training for crowd workers</li> <li>- Revision of the rules regarding the training support funds to help platform workers benefit from such funds</li> </ul>
3) Expanding the Application of Employment Insurance	<ul style="list-style-type: none"> <li>- Expanding the range of national employment insurance with amendment of the related legislation</li> <li>- Fundamental data collection for selecting crowd workers to be covered by the national employment insurance</li> </ul>
4) Legal Actions for Maternity Care, Prohibition of Gender Discrimination or Sexual Harrasment.	<ul style="list-style-type: none"> <li>- Establishment of anti-discrimination measures and prohibition of unfair treatment</li> <li>- Expanding the scope of the existing paid maternity leave for the uninsured to include crowd workers</li> </ul>

## VIII. Situation of Women Job Seekers' Response to Digital Transformation

### 1. Research Design

This chapter discovered the impact of digital transformation on the job searching and career development of women, and made some policy suggestions to prevent women from being excluded from digital transformation. The survey questionnaire for 'Investigation on the impact of digital technology development on women job seekers' was implemented in 2021. The research participants are 525 women from the 18 New Career Center for Women(Saeil Center). Some of the research participants were already employed at the time of research and they participated in the survey as the employed. The main items include information searching competency, job searching activities, and the impact of digital technology on women's jobs and career development. <Table 42> shows personal characteristics of the respondents.

<Table 42> Personal Backgrounds of the Respondents

Category		Frequency	Total(%)
Total		525	100.0
Employment Status	Unemployed	323	61.5
	Employed	202	38.5
Age	20s	141	26.9
	30s	129	24.6
	40s	191	36.4
	50s or above	64	12.2
Educational Attainments	Highschool graduates or below	61	11.6
	2 or 3-year college graduates	142	27.0

Category		Frequency	Total(%)
	4-year college graduates or above	322	61.3
Working Experience	Never	60	11.4
	5 years or less	153	29.1
	5 to 10 years	135	25.7
	10 to 15 years	96	18.3
	15 years or more	81	15.4
Experience of Career Interruption	Yes	357	68.0
	No	108	20.6
	Never worked before	60	11.4
Purpose of the Job Center	Career Development	177	33.7
	Career Searching	348	66.3

## 2. The Competency of Information Search and Job Searching Activities of Women

In the survey, 87% of the respondents answered that computer skills are necessary for the current or future jobs. The participants in their 20s and 30s more strongly agreed with the importance of computer skills for jobs than the ones in their 40s or more. Among the participants, graduates of 2-year college or over more strongly agreed than the graduates of high schools or below. Meanwhile, 14.3% of the respondents experienced the failure in employment due to their low level of computer skills for the last 5 years. The participants in their 40s have more experiences of failure than the ones in 20s or 30s, and the graduates of high school or below experienced more failure than the graduates of 2-year college or over. 87.3% of the respondents answered it may be more advantageous if they enhance their computer skills, and 81.5% agreed with the statement that the higher the computer skills, the better their jobs will be. This result shows that improvements in information searching skills could be helpful for job-searching activities.

Also, the knowledge on jobs or occupations emerging through digital technology development was investigated to identify the survey participants' demand for digital and information education. 60.2% of the survey participants answered 'yes' when asked about whether they know about the emerging jobs and occupations. There are great differences in the answers from the survey participants depending on their level of educational attainments. According to this survey, 65.5% of those who graduated from 4-year colleges or over were aware of the emerging jobs, and 54.9% of the graduates from 2-year colleges or below and 44.3% of the highschool graduated participants answered they acknowledge the emerging jobs. Therefore, it can be concluded that the graduates of high schools or below are vulnerable in terms of acquiring information and knowledge of the new jobs brought by digital technology development. Also, 39.8% of the participants do not know about the information or knowledge of emerging jobs and occupations, therefore, it is necessary to provide them with the education programs on emerging jobs and occupations.

The result of educational demands is as follows. 55.4% of the participants need education on media creation or app development, 48.0% for emerging technologies such as big data analysis or Internet of Things. Also, 37.0% of women respondents need education for using word processing programs or computer skills to use tax accounting programs in the office.

When asked about the level of education programs, the respondents said they want to have a basic level of education for the new technology or equipments (79.1% for Robot, Drone, and automation facilities, and 79.0% for big data analysis and Internet of Things). However, the respondents showed a larger demand for intermediate or higher level of

education for the word processing program(71.6%) or MS office program(48.0%), which are offered constantly from Saeil Centers and perceived as basic skills. The needs for media creation or application development education is the highest among those in 20s(57.4%), 30s(70.5%), and 40s(50.8%). However, participants in their 50s showed the highest demand for the education on word processing(48.4%).

### 3. The Impact of Digital Technology on Women's Jobs and Career Development

74.3% of the survey participants have used the computer or data processing device for their jobs for the last 5 years. However, a few of them worked for development or utilization of new technology or related tasks(7.1%) or used automation facilities, automation machines or related tasks(3.8%). In the case of the participants who graduated from 4-year colleges or over, the rate of experience with development or utilization of new technology or related tasks is higher(9.2%) than the group of high school graduates or below.

The percentage of the respondents whose skill level was not matched with the level of skills required at work was 20.5%. In the case of the high school graduates or below, 5.8% experienced the mismatch between their own skill level and the level of skills required at work. Meanwhile, 71.4% of the 4-year college graduates experienced that their skill level lower than the required skill level, and 60.7% of the 2 or 3-year college graduates has lower skill level than the required level of skills. In terms of jobs, Research and Engineering Technicians(35.6%) showed the highest skill mismatch, and education, law, social welfare, police, firefighter, and military professions showed the lowest skill

mismatch(14.7%).

98.1% of the survey participants have a intention to improve their skill level for employment or staying in the labor market. 87.9% of the respondents are also interested in the emerging fields where employment opportunities will increase along with job creation through the digital technology development. The respondents in their 50s(92.2%) showed greater interest in this area, compared to those in their 20s(78.0%), and it could be interpreted that the older generation is anxious about possible job shortage with the shifts in technology developments.

67.6% of the participants anticipated that the job opportunity would increase due to the development of digital technology. In the case of the respondents who graduated from 4-year colleges or over, 73% of them showed a more positive perception compared to other groups, while expecting an increase in job opportunities. According to the purpose of the job center, career-focused job centers(72.9%) showed higher expectations for increasing job opportunities than general Saeil centers(64.9%).

The most necessary support policy is vocational education and training for enhancing skill level(41.5%), which is followed by the provision of job and labor market-related information for women(24.8%), career and employment consultation for unemployed women(14.7%), career consultation and coaching(13.0%), and assistance to business starters (6.1%). Therefore, the demand for vocational education and training is in great need. There is an age difference in support policy demand; the respondents in their 20s and 30s demand vocational education and training for enhancing skill level(48.2% of 20s and 42.6% of 30s), however, the other two age groups said they need information on jobs and labor market for women(31.4% of those in 40s and 31.3% of those in 50s).

#### 4. Policy Suggestions

The policy suggestions are as follows based on the research results.

First, it needs to offer the education programs on the information and knowledge of the emerging jobs and occupations with the development of digital technology. The survey participants showed high interest in the new jobs and occupations(87.9%) but they do not have knowledge and information about(39.8%) them. This means that they have low access to such information compared to the amount of their interest in this field. Therefore, the relevant educational programs should be offered.

Second, educational programs on digitalization and women's promising future jobs need to be offered. 87.0% of the survey participants answered that they need computer skills for future jobs, and that it is also important for job opportunity. Therefore, educational programs on digitalization and women's future jobs should be offered to meet the large demand for the education on new technologies and other related sectors created through the digital technology development. However, the differences in age and educational attainments should be considered to choose the participants and educational content. For example, the graduates from 2-year colleges or over, who are in their 20s, 30s, and 40s need to access the education on media creation, application development, and new technologies. The high school graduates and women in their 50s need an education opportunity for word processing and office programs.

Third, it needs to diversify the level of the basic computer skill education and training programs. According to the survey, 14.3% of the respondents have experienced failure in employment because of the lacking computer skills. The younger generation in their 20s to 40s also demand the education and training for word processing and office

programs, therefore, those kinds of educations should be offered continuously. Additionally, it needs to offer intermediate or higher level of education programs with basic computer skill trainings.

Fourth, the consultation and information on long-term career development should be offered in a way that is customized by age and educational attainments of the participants. 98.1% of the respondents was willing to improve their information searching skill related to jobs and employment, and 81.8% of them had long-term efforts for career development. The respondents in their 20s and 30s demand vocational education and training for enhancing their skills and competencies, and the ones in their 40s and 50s showed a higher demand for information about jobs and labor market. Therefore, the following three stages of support should be strengthened; 1) analysis on the labor market demand with digital technology development, 2) offering labor market information and consultation support, and 3) connection to the vocational education and training programs.

Lastly, the job centers for women(hereafter referred to as Saeil Centers) needs to understand the impact of the development of digital technologies on women's jobs and reduce the training programs on the jobs which may be declining with social changes. At the same time, Saeil Centers need to focus on expanding training opportunities on the emerging jobs. Specifically, for those in their 20s and 30s, the centers should try to develop the promising training courses for constant career development and increase the education opportunities. From this perspective, it needs to reconsider the roles and vision of career-development focused Saeil Center and general(career-searching focused) centers.

〈Table 43〉 Policy Suggestions for Women

Policy Suggestions	Contents
1) Development of New Educational Programs and Support	- offer the education programs on the information and knowledge of the emerging jobs and occupations created through the development of digital technology
2) Development of Women's Promising Future Jobs	- informing women's promising future jobs created through the development of digital technology - offering educational programs on digitalization
3) Offering Customized Computer Skill Education for Performing Jobs	- continue to deliver education and training for word processing and office programs - offering intermediate or higher level of education programs to enhance the job competency and skills
4) Offering Customized Consultation for Career Development by Age and Educational Level	- offering digital technology-related information and consultation on career development by age - Strengthening the connection to the vocational education and training programs
5) Reconsideration of the Role and Vision of Saeil Centers	- Reformulating the roles and mission of Saeil Centers based on the development of digital technology - Efforts to develop promising training courses for constant career development and increase education opportunities - Consideration on the assignment of roles between career-development focused Saeil Center and general(career-searching focused) centers

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