Final Report for Phase II:
ILO/JIL Networking of National Institutes for Labour Studies:
2002-2004 Fourth Round of Investigative Studies
Determining the Impact of Information and Communication Technology on Decent Work in the Asian and Pacific Region

Impact of Information and Communication Technology(ICT) on Decent Work in Korea

Korea Labor Institute (KLI)
Jun-wook Hwang, Jai-joon Hur, Kang-shik Choi

Contents

? . Introduction ····· 1
1. Background and Objectives ····· 1
2. Theoretical Benchmark and Methodological Framework ····· 2
3. Contents of the Report ····· 3

? . The ICT and Decent Work in Korea: National Level ····· 5
1. Introduction: ····· 5
2. Review of ICT Development Index ····· 5
3. ICT and Decent Work: ····· 14
4. Summary ····· 23

? . ICT and Worker Participation: Corporate level ····· 28
1. Introduction ····· 28
2. Review of Previous Studies and Research Framework ····· 29
3. Analysis Data and Variables ····· 32
4. Analysis Results ····· 35
5. Summary and Conclusion ····· 48

? . Case Analysis ····· 54
1. Perspective on Decent Work and ICT in the Workplace ····· 54
2. Target companies of Research and Research methods ····· 54
3. The significance of ICT in the workplace and the role of ICT in each company ····· 56
4. Individual Cases ····· 58
5. Conclusion of Case Study ····· 77

? . Conclusion ····· 80

Reference ····· 82

Table

<Table II-1> ICT Approach and Utilization of Indicator Changes: ····· 8
<Table II-2> Number of Workers in ICT and ICT-related Industry ····· 13
<Table II-3> Correlation between decent work and ICT: Synthesis ····· 24

<Table III-1> Classification of Participation-related Variables by Type from Workplace Panel and Descriptive Statistic ····· 34
<Table III-2> Descriptive Statistics on ICT-related Variables ····· 35
<Table III-3> Regression analysis on ICT introduction pace (LIC) and participation indicators ····· 36
<Table III-4> Regression analysis on correlation between individual variables and speed and level of ICT introduction ····· 37
<Table III-5> Participation-related Indicators by Large Businesses and SMEs ····· 39
<Table III-6> Regression analysis between ICT introduction speed and participation variables of large business and SMEs ····· 40
<Table III-7> Participation Indicators for Manufacturing and Service industry ····· 41
<Table III-8> Regression Analysis on ICT Introduction Speed and Participation Variables of manufacturing and service industry ····· 41
<Table III-9> Participation Indicators for the ICT and Non-ICT Industry ····· 42
<Table III-10> Regression Analysis on ICT Introduction Speed and Participation Variables of ICT Industry and Non-ICT Industry ····· 43
<Table III-11> Participation Indicators for Businesses with or without Labor Unions ····· 43
<Table III-12> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with or without a Labor Union ····· 44
<Table III-13> Participation Indicators for Businesses with High or Low Level of ICT Introduction ····· 44
<Table III-14> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with High or Low Level of ICT Introduction ····· 45
<Table III-15> Participation Indicators for Businesses with High or Low Proportion of Female Workers ····· 45
<Table III-16> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with High or Low Proportion of Female Workers ····· 46
<Table III-17> Participation Indicators for Businesses with Prompt or Slow Response to the Market ····· 46
<Table III-18> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with Prompt or Slow Response to the Market ····· 47
<Table III-19> Participation Indicators for Subcontractors and Parent Companies ····· 48
<Table III-20> Regression Analysis on ICT Introduction Speed and Participation Variables of Subcontractors and Parent Firms ····· 48

<Table IV-1> General Information on Target Companies ····· 55
<Table IV-2> Comparison of average wages between graphic designers and miniature manufacturers in the US (as of 2001) ····· 76

Figure

<Figure II-1> Share of ICT Investment and Consumption in GDP: 1999 ····· 6
<Figure II-2> Share of ICT Sector Value-Added in GDP ····· 6
<Figure II-3> Growth Rate of the ICT Sector: ····· 7
<Figure II-4> Internet Subscribers Per 100 Inhabitants: January 2000 ····· 8
<Figure II-5> Gender Trends and the Internet Accessing Rate: ····· 9
<Figure II-6> Internet accessing rate by age ····· 9
<Figure II-7> Internet Accessing Rate by Regions: ····· 10
<Figure II-8> Internet accessing rate by regional size ····· 10
<Figure II-9> Internet Accessing Rate Depending on Marital Status: ····· 11
<Figure II-10> Internet Accessing Rate Depending on Income Level: ····· 11
<Figure II-11> Internet Accessing Rate Depending on Education Level: ····· 12
<Figure II-12> Internet Accessing Rate Depending on Occupation ····· 12
<Figure II-13> Number of Employees in ICT and Related Sector (Compared to Total Number of Employees): ····· 13
<Figure II-14> ICT Investment Intensity Rate: ····· 14
<Figure II-15> Labor Force Participation Rate and ICT Investment Intensity Rate: ····· 15
<Figure II-16> Employment-Population Ratio and ICT Investment Intensity Rate: ····· 16
<Figure II-17> The Unemployment Rate and ICT Investment Intensity Rate: ····· 16
<Figure II-18> Youth Unemployment and the ITC Investment Intensity Rate: ····· 17
<Figure II-19> Share of Wage Employment in Non-Agriculture Employment and ICT Investment Intensity Rate: ····· 17
<Figure II-20> Female Share of Non-Agriculture Wage Employment and ICT Investment Intensity Rate: ····· 18
<Figure II-21> Percent of Employed Below 1/2 of Median and ICT Intensity Rate: ····· 19
<Figure II-22> Extra Hours of Work and ICT Intensity Rate: ····· 19
<Figure II-23> Temporary Work and ICT Intensity Rate: ····· 20
<Figure II-24> Female Share of Employment in Managerial and Administrative Occupations and ICT Intensity Rate: ····· 21
<Figure II-25> Female / Male Wage Ratio and Women and ICT Intensity Rate: ····· 21
<Figure II-26> Mortality in the Workplace (Per 10,000 Employees) and ICT Intensity Rate: ····· 22
<Figure II-27> Fatal Injury Per Thousand Employees and ICT Investment Intensity Rate: ····· 22
<Figure II-28> Union Density Rate and ICT Investment Intensity Rate: ····· 23

<Figure IV-1> Classification of Target Companies ····· 56
<Figure IV-2> Elements Comprising ICT ····· 57
<Figure IV-3> The Enterprise Production Data System of Company A ····· 59

Picture

<Picture IV-1> The B/C of Company A ····· 61
<Picture IV-2> Computer Screen of Manager at Call Center of Company B (CTI System) ····· 66
<Picture IV-3> CDMA Chip of Company C ····· 69
<Picture IV-4> View of Office Place of Company C ····· 71
<Picture IV-5> Working Environment of Companies D and E ····· 73

I. Introduction

1. Background and Objectives

The 21st century has been characterized by a common global phenomenon: Globalization. At the economic level, globalization is the process of denationalizing local and global markets and reshaping their political and legal landscapes. With the ubiquitous expansion of the 'free market principal', trade is being internationalized as investors disregard national bureaucratic obstacles. The 'global economy', therefore, has become an all-encompassing catchphrase for every nation doing trade in the world economy. Intrinsically related to the contemporary trend of globalization is the bewildering speed of the technological revolution due mainly to the development of Information Communication Technology (ICT). Not only have new products implemented such new technologies, but they have also restructured and modified the entire manufacturing process. Therefore, a Knowledge-Based Economy has quickly emerged through this technological-information-production revolution.

As such, these present-day developments greatly affect the world of labor. With the accelerating pace of globalization, on the one hand, there is stiffer competition for International and Domestic markets. This intense competition creates a more flexible labor force in various fields such as working time, type of contract and employment adjustments. Such a swift transition to a knowledge-based economy energized by the pervasive introduction of ICT, on the other, will exert significant influence on other labor-related fields such as wage levels, working process, organization of work, industrial relations and employment. This pattern of globalization propelled by technological change is viewed as restructuring the nature and quality of work and working. There is, therefore, a growing need for a more thorough study from within a systematic and synthetic perspective of the quality-related notion of work and 'decent work.' A closely related --no less indispensable-- research topic is the practical effects of ICT on decent work.

As for Korea, the Korean economy, like other globalized economies, is refashioning itself into a knowledge-based-global society. This refashioning is based on the development of information-communications (IC) related industries. In national nominal GDP terms, IC related industries increased from 4.2% in 1993 to 6.4% in 1998. During the same period, the growth rate also recorded an increase of 28.8% in the software and computer service industry, 25.3% in IC related instruments, and about 14.1% in related service industries (with GDP growth rate of about 10.1%). Noteworthy is the contribution rate of these IC related industries to the total export of Korea which stands at 23.1%, which is nearly four times bigger than their share among the GDP.

The development of the information and communications industry in Korea has played a vital role in the spread of so-called high-profit and risk-taking "venture businesses" based on new technologies. Since the enactment of a special law to promote venture enterprises in 1997, the number of venture enterprises augmented is estimated to be 10,389.

This mind-boggling economic growth of the IC industry in Korea will exert a great deal of pressure on both the employment and labor markets. Initially, on the assumption that these

industries are more sensitive to technological changes and business conditions than traditional industries, production levels are expected to fluctuate widely. In other words, the stability of employment and work in such industries is more likely to be threatened. As such, increased production could create over-time work whereas decreased production could bring about fundamental organizational restructuring: downsizing of employees and organizational models. This fluctuation could be more drastic in small-medium sized enterprises, damaging the stability and quality of their employment.

From another angle, with the introduction of ICT, an increased but flexible working process combined with "cost minimization" could bring about increased pressure on employees, threatening social cohesion. A recent example depicts this social deterioration with the increase of non-regular jobs such as part-time jobs. The proportion of non-regular jobs in all wage earners was 52% in 2000, increased from 43% in 1996.

Such growing concerns of decent work and the importance of ICT motivate research on the societal impact of ICT and decent work in Korea.

The report aims to analyze the impact of ICT on decent work in Korea, not only at the national levels but also at the corporate one. We show the correlation between ICT and various macro indicators of decent work and analyze the effect of ICT on workers' participation at the corporate level. And we explain in detail case study of several firms, which utilize ICT or produces IC-related products.

We expect some policy implications from this report. The expansion of ICT in the economy brings about new needs to redesign policies concerning employment and the workplace. The ICT, by enhancing efficiency, could decrease the volume of manpower in need to produce the same amount of products. The firm could possess more flexibility in the management of human capital by applying ICT on the organization of work. The instability of employment could be raised as a result. In this context, it is not hard to expect that the quality of employment and workers' life could be deteriorated. The employment policy should react to this possible threat. Within the principal research theme of this report, the impact of ICT on decent work, we can show the insight to such reaction and suggest policy orientations.

2. Theoretical Benchmark and Methodological Framework

Unfortunately, there is very little theoretical discussion on 'decent work' regarding the ICT sector. Instead, many studies have concentrated on the relationship between technological development and the variables approximate to the notion of decent work. The income or inequality gap is a good example. Recent studies such as Autor, Katz and Krueger (1998), and Berman, Bound and Machin (1994) find that technological changes have favored the wage prospects of skilled workers in the United States. Also Berman, Bound and Machin (1998) and Machin and Van Reenen (1998) confirm a similar pattern in other developed countries. In Korea, Hur, Seo and Lee [2002] assert that ICT diffusion has a positive relationship with the demand for skilled workers as indicated in the second half of the 1990s. For more general trends, there is research on human resource development in a digital economy (See Cheon et al. 2000). This research, however, focuses more narrowly on the relationship between ICT and skilled labor demand using statistical analysis (Cheon, Hur et al.).

Due to the lack of research on specific changes in labor and employment through the adoption of ICT, research on the relationship between ICT and decent work is limited at best. However, ILO research on the conception and measurement of decent work gives us certain criteria on decent work as a starting point for the research concerned.

At the International Labor Conference in 1999, the International Labor Organization (ILO) stated through the Report of the Director-General that "the primary goal of the ILO today is to promote opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security, and human dignity," making it clear that providing a guarantee for decent work for everyone is the ILO's main purpose. In order to achieve the ultimate goal of "decent work," the ILO proposed four strategic objectives: the promotion of rights at work; employment; social protection; and social dialogue.[1] Since the 1999 International Labor Conference, ILO research on decent work has focused on the concept of decent work, strategies to achieve decent work, and the development of indicators to measure it. More recently, studies have been conducted on the development of a Decent Work Indicator (DWI) which utilizes metrical indicators to facilitate policy support to achieve decent work for each member country and its evaluation.

The conceptual framework on decent work proposed by the ILO covers six dimensions—opportunities for work; freedom of choice of employment; productive work; equity in work; security at work; and dignity at work. In addition, the macroeconomic and social implications of decent work, which signify the development of the national economy and society and enhancement of labor outcome achieved through decent work, are also emphasized (Anker et al. 2002). Based on the conceptual framework, the ILO elaborates 11 groups of indicators to measure decent work, which include wages, hours, workplace and social dialogue and workplace relations (Anker et al.) [2]

Based on such criteria, we will further develop the statistical methodology adopted by Hur et al (2002), by enlarging variables that more accurately estimate decent work. In addition, a case study of selected businesses will be conducted to find other approximate variables.

---

[1] 1) All those who work have rights at work whether organized or not, and wherever work might occur, whether in the formal or the informal economy. Therefore, it includes all types of labor including unregulated wage workers, the self-employed, homeworkers and workers in the voluntary sector. 2) Employment promotion not only refers to the expansion of employment opportunities in terms of quantity, but also means providing quality of working conditions in such areas as equity in employment opportunities, wages and industrial safety. 3) Although these mechanisms are perfectly in place, however, it does not meet all the criteria of decent work. Increased competition based on Globalization may result in drastic changes in industrial structure and measures to prepare for unemployment should be in place, too. In "decent work", social protection against the vulnerability of labor is also stressed. 4) Basically, ensuring security of employment, promoting basic rights of labor and expanding employment opportunities are possible through sustained dialogue and compromise based on active participation of related entities of society. In this context, in order to achieve decent work social dialogue is a prerequisite.

[2] The 11 groups of indicators include employment opportunities; unacceptable work; adequate earnings and productive work; decent hours; stability and security of work; fair treatment in employment and at work; safe work environment; social protection; combining work and family life; social dialogue and workplace relations; economic and social context of decent work. For instance, statistical indicators for employment opportunities include employment-population ratio and youth unemployment rate, and statistical indicators for fair treatment include occupational segregation by sex and female ratio in managerial jobs.

This analysis will be performed at both the national and corporate levels. For the national level, we will discuss the effect of ICT on decent work in Korea making use of variables suggested by the ILO representing decent work and of available macro data of Korea.

As for the corporate level, two methods are used in order to analyze the effect of ICT on decent work: Corporate Survey, and an in-depth case study on several businesses. As for the corporate survey, the KLI ***Workplace Panel Survey*** (WPS)[3] will be employed for a trial survey on the establishments pursued by the Korea Labor Institute in 2002. This survey covers a wide range of materials from HRM to Industrial Relation Managers on such issues as Corporate Management Circumstances, Employment, Recruiting, Training, Employee Evaluations, Promotion, Compensation, Labor Organization, Worker Participation, Working Hours, Retirement System, Qualification System, Iinformation/Computerization and Industrial Relations, whose effective sample reaches 1,939 in total.

The case study of firms employs three different methods: Questionnaire, Interview and Direct Observation. The selection of companies was based on their size, industry and other characteristics: 5 companies were selected, four for an in-depth analysis and one for a reference. The company 'A' is a listed major automobile manufacturing firm; 'B' is a listed on the Kosdaq offering software production and services; 'C' produces ICT hardware as a non-listed small-medium size company; 'D' is also a non-listed small-medium sized company that produces visual effects for background movie images using digital computer graphic technology. Finally, 'E' is another small producer of miniature background movie images. 'E' was compared with 'D'. The 'E' company is located at rural area while others are placed at urban area. Selection of target companies follow also criteria suggested by ILO: ICT producing/non-ICT producing and utilizing of ICT /less utilizing of ICT. Companies B and C belong to ICT producing while A, D, and E are non-ICT producing. Four companies: A, B, C, and D utilize more ICT while E depends less on ICT for its production. The survey was continued from January 2003 to December 2003.

3. Contents of the Report

The final report consists of three sections: First, the effect of ICT on decent work will be analyzed at the national level. The proliferation of ICT in Korea will also be described. Not only topics related to ICT production but also those related to ICT utilization will be explained. As such, a brief discussion of the digital divide will be discussed. To this end, 14 variables in seven fields of decent work indicators will be selected to represent decent work and analyze the effects of ICT on decent work in Korea. An example of such items as economic activity participation rates, employment rates, and unemployment rates are chosen in the field of employment opportunities. Such statistical indicators and available serial macro data will illustrate the impact of ICT on decent work as well as the state of decent work in Korea. Next, the implications of ICT on decent work will be analyzed at the corporate level using the KLI workplace panel survey data. Workers' participation will be main theme of this analysis, explaining the influence

[3] The KLI WPS is, in nature, time-series data because it is panel data. However it has been started from 2002. The data we utilize here is one for a starting year, 2002.

of ICT on participation. Thirdly, the case study results will function as the primary source for this microanalysis. Such analysis will be performed on representative fields of the decency of work. The cases of five firms relatively representing ICT hardware producing, ICT software producing, ICT more using, ICT less using will show us the effect of ICT on decent work as well as the feature of ICT use and production at Korean enterprises.

II. The ICT and Decent Work in Korea: National Level

1. Introduction:

The world has been revolutionized by the rapid development and implementation of Information and Communication Technology (ICT). ICT combines the disciplines of information technology and communication technology. The digital conversion of these two technologies leads to data transmission through the Internet. Likewise, the adoption of ICT is expected to influence all fields including labor relations and employment in labor market. In particular, this technological revolution will radically alter the creation and destruction of Decent Work: the labor process, quality of labor, and eventually income distribution. As such, systematic research on the relationship between ICT and decent work is needed.

This paper will review expenditure trends on ICT and such ICT-related issues such as consumption, investment and diffusion. Next, the concept of "Decent Work" will be explained from the perspectives of job security as sustainable and balanced social development. Since the concept of Decent Work cannot be grasped with a single indicator, a multi-perspective approach will be employed. This research, as recommended by the ILO's *Measuring Decent Work with Statistical Indicators* (2002), will analyze several indicators such as "Employment Opportunity", "Adequate Earnings", "Decent Working Hours", "Stability and Security of Work", "Fair Treatment in Employment", "Safe Work", and "Social Dialogue and Workplace Relations". After reviewing these indicators, this paper will examine the relationship between the ICT development index (i.e. ICT investment intensity and ICT diffusion index) and such Decent Work indicators. However, considering the limitations of available data, the theoretical connection of cause and effect between ICT and such indicators are at best limited. Therefore, this paper will examine the correlation between indicators associated with the ICT development index and the Decent Work indicators.

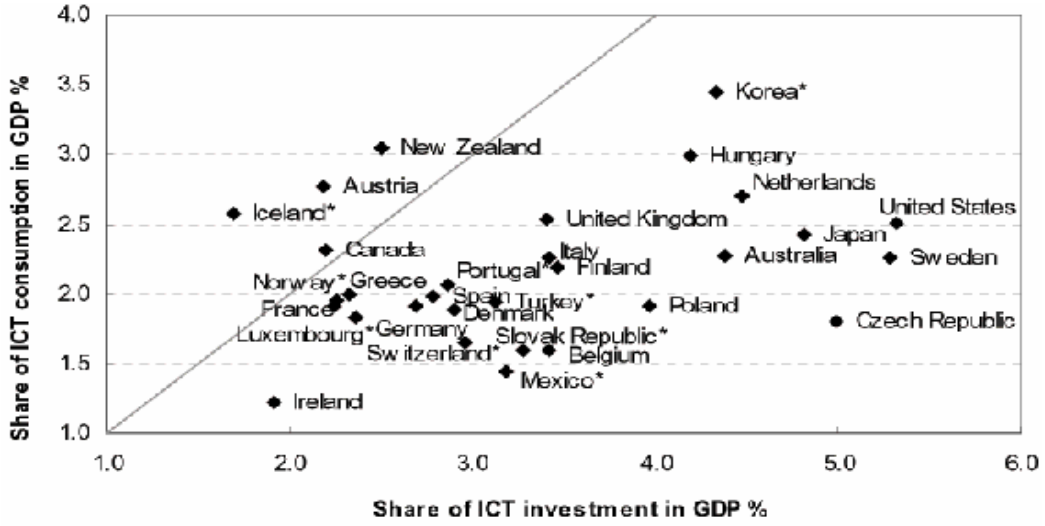
The following organizational structure is followed: Chapter 2 reviews ICT-related indicators in Korea. Chapter 3 explores various Decent Work indicators from the perspective of correlation analysis between ICT and Decent Work. Chapter 4 summarizes and concludes the analysis.

2. Review of ICT Development Index

2.1 Analysis of ICT Expenditure :

The share of investment in and consumption of ICT in GDP has been quite high in Korea compared to other countries. In fact, the share of ICT consumption expenditure in GDP in Korea was the highest among OECD countries as compared in Figure II-1. It illustrates the investment in and consumption of ICT as a share of GDP in various OECD countries in 1999. As for the share of consumption and investment expenditure of ICT, Korea had the highest ranking in comparison with other nations.

<Figure II-1> Share of ICT Investment and Consumption in GDP: 1999



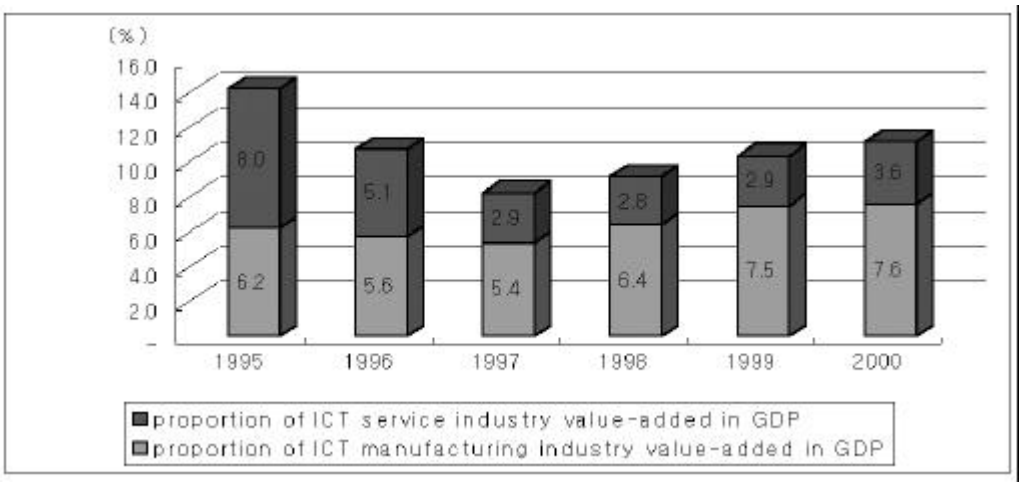
Source: OECD, *Purchasing Power Parities Database*, March 2002. Recited from OECD, *Measuring the Information Economy*, 2002.

Much of the ICT consumption, however, was related to the communications sector rather than the information sector. Also, most of the investment expenditure in Korea was spent on communications equipment while the United States and Sweden (which had higher ICT investment shares) spent relatively less on communications equipment.

2.2 Share of ICT-Producing Sectors

The share of ICT-producing activities in the non-agricultural business sector in Korea was around 14% in 2000. Moreover, the share of ICT manufacturing was much higher than the share of ICT services. The share of ICT manufacturing was about 11%, and the share of the service industry was only about 3%.

<Figure II-2> Share of ICT Sector Value-Added in GDP



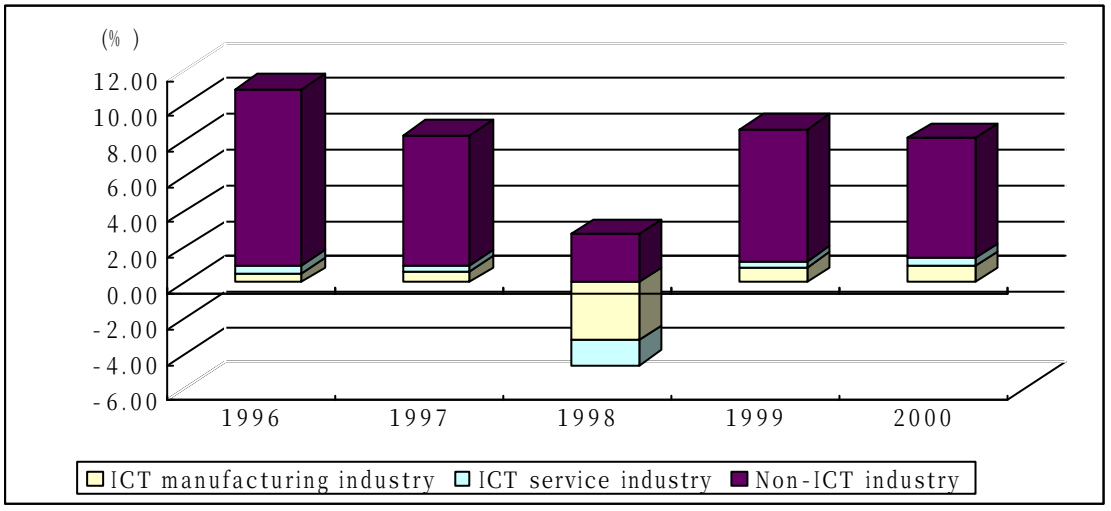
Source: Electronics and Telecommunications Research Institute, Seoul.

As a result, Figure II-2 depicts the share of value-added in the ICT sector within the total GDP in Korea in different years. The share of value-added in the ICT sector, however, decreased from 1995 to 1997, and increased after 1998. In the case of the ICT manufacturing industry, the proportion of value-added continuously inclined while the proportion of value-added in the ICT service industry declined until 1997 and increased after 1998. The share of value-added in ICT service was higher than that of the ICT manufacturing industry in 1995, but it has been reversed since 1996.

2.3 Contribution of the ICT Sector to Economic Growth:

After the financial crisis in 1998, the GDP in Korea has seen steady growth. The ICT sector has also grown annually with the exception of 1998. The ICT sector has contributed 0.99%p to the total GDP growth rate in 1996 and the contribution of ICT has increased to 1.38%P in 2000. The contributions of ICT manufacturing and ICT services to the total GDP growth were similar in 1996, but the contribution of ICT manufacturing was larger than that of ICT service in 2000. Also, Figure II-3 highlights how non-ICT sectors have contributed to the economic growth every year.

<Figure II-3> Growth Rate of the ICT Sector:

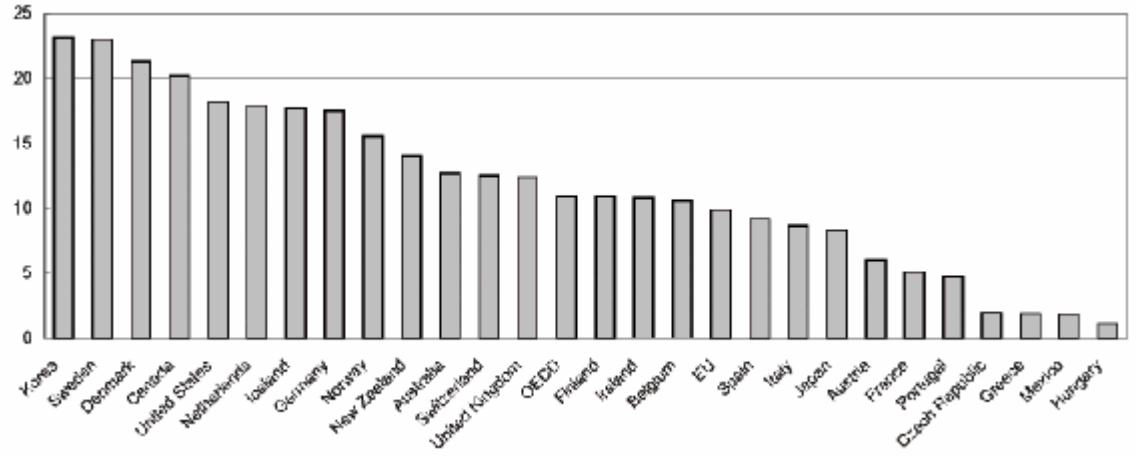


Source: Same as Figure II-2.

2.4 Diffusion of ICT

Korea was deemed highly developed in terms of ICT penetration and its utilization. It is noted that information can be broadly diffused through data communication based on the Internet. In this regard, examining data communication in Korea will be meaningful. Figure II-4 displays the actual number of Internet subscribers per 100 inhabitants in major OECD countries. Again, Korea records the highest in number, followed by Sweden, Denmark, Canada, and the United States.

<Figure II-4> Internet Subscribers Per 100 Inhabitants: January 2000



Source: OECD, *Telecommunications Database*, June 2001. Recited from OECD, *Measuring the Information Economy*, 2002.

The annual number of Internet subscribers in Korea is thus rapidly increasing. The number of Internet subscribers grew from 360 thousand in 1995 to 14.26 million in 2000. The number of hosts has also increased greatly until 1999. Its increase rate was lessened to 4.9% in 2000, but the number of subscribers recorded more than 480 thousand. As for IP addresses, the number has increased from 4.78 million in 1995 to 18.9 million in 2000.

Regarding '.kr' domains, there was a significant increase of 517,354 in 2000, starting with no more than 436 in 1995. There has been a gigantic increase in '.kr' domains compared to other indicators each year, with a vast increase of 692.5% compared to the previous year in 1999.

<Table II-1> ICT Approach and Utilization of Indicator Changes:

(Thousand, number)

	1995	1996	1997	1998	1999	2000
Number of Internet Subscribers[1)]	366 (-)	731 (99.7)	1,634 (123.5)	3,103 (89.9)	5,712 (84.1)	14,262 (149.7)
Number of Hosts	36,644 (-)	73,189 (99.7)	131,055 (79.1)	202,510 (54.5)	460,794 (127.6)	483,700 (4.9)
Number of Holding IP Addresses	4,776,208 (-)	6,208,000 (30.0)	7,256,576 (16.9)	8,174,080 (12.6)	10,402,304 (27.3)	18,921,984 (81.9)
Number of .kr Domains	436 (-)	2,664 (511.0)	8,045 (202.0)	26,116 (224.6)	206,973 (692.5)	517,354 (150.0)

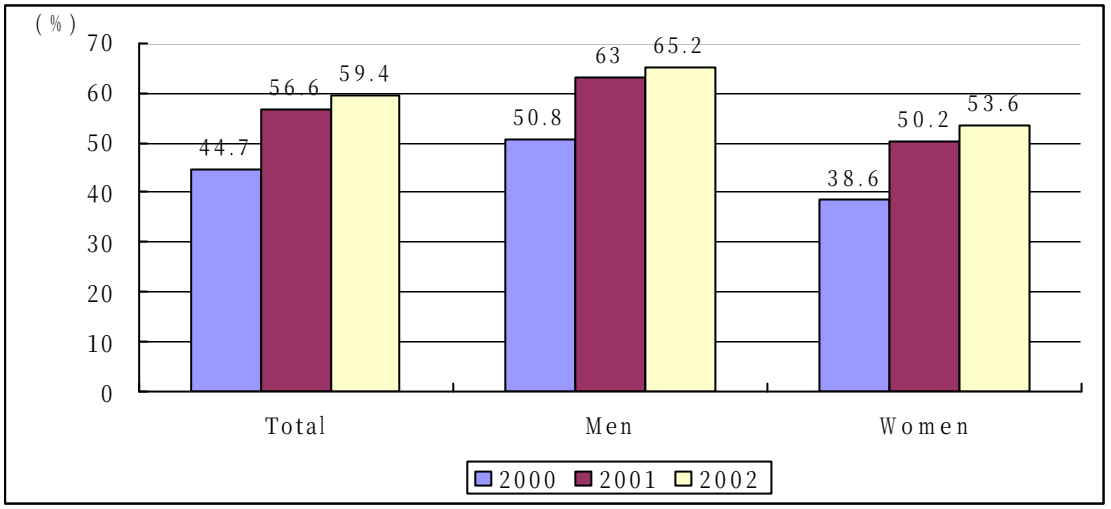
Note: 1) Estimates of National Computerization Agency were used in 1999 and 2000.
2) Increase rate in parenthesis.
Source: Korea Network Information Center

2.5 Digital Divide:

Despite the rapid diffusion of ICT, digital divide problems are causing havoc as the diffusion rate of ICT differs according to sex, age, region, income level, education level, and occupation. First, the Internet utilization rate reveals a huge difference between genders: 50.8% for men and 38.6% for women in 2000. In 2002, the Internet accessing rate continued to increase by the rate

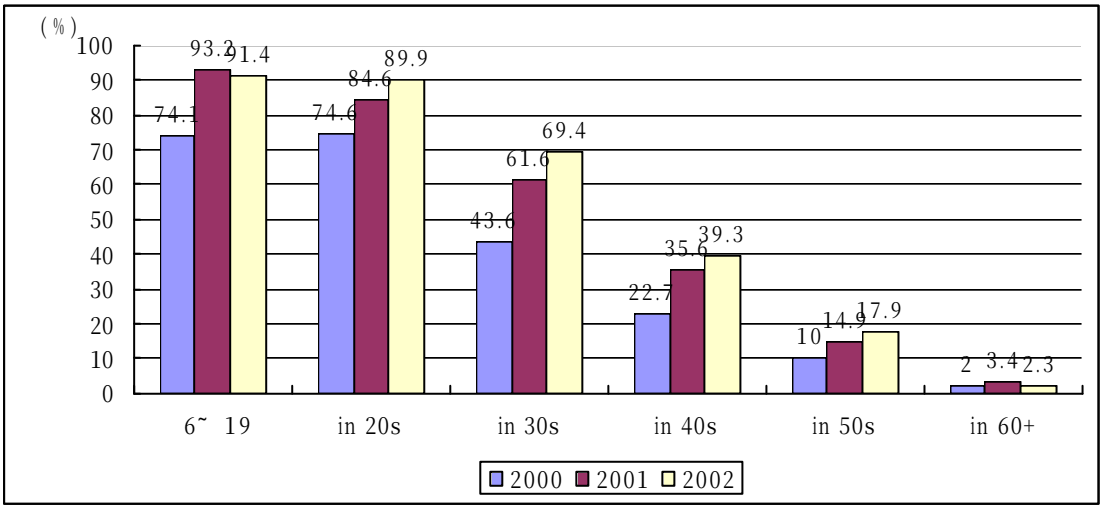
of 65.2% for men and 53.6%for women, but there still remains a difference between the accessing rate of the genders.

<Figure II-5> Gender Trends and the Internet Accessing Rate:



Source: KNIC

<Figure II-6> Internet accessing rate by age

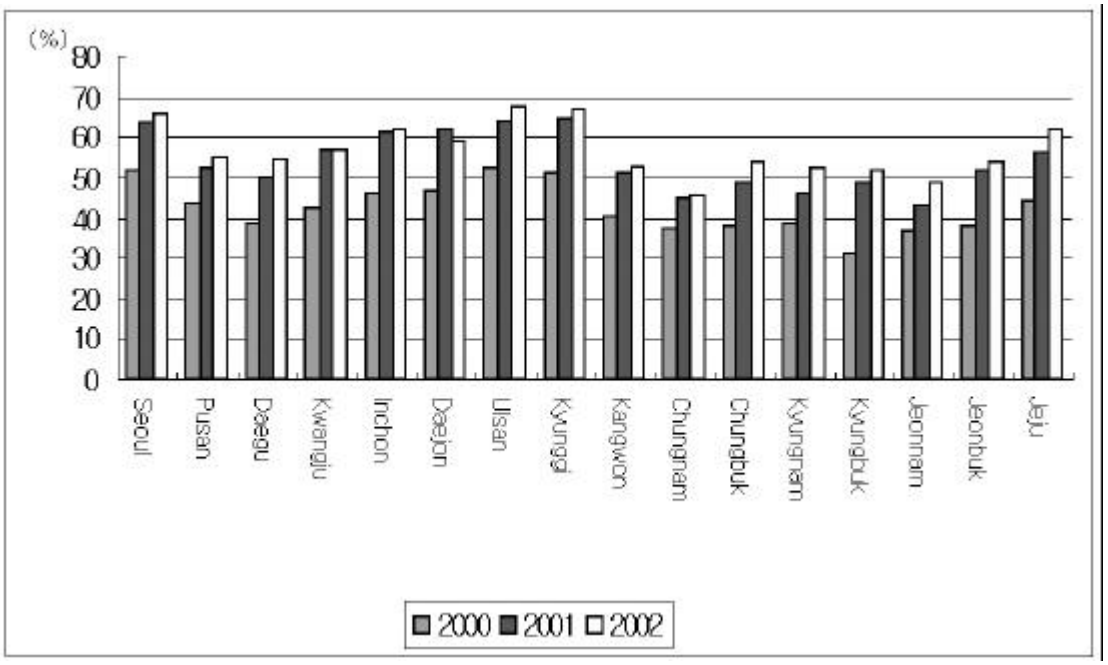


Source: Same as Figure II-5

Regarding age, the accessing rate decreases as age increases as displayed in Figure II-6. The Internet accessing rate is shown to be above 90% in those below 20s and near 90% for those in their 20s. Furthermore, the accessing rate of people in their 20s to 50s tends to be increasing, while that of those in their 60s is found to be very low with rather reduced rates compared to the previous year in 2002. This phenomenon shows how serious the digital divide is by age bracket.

In the case of regions, Figure II-7 indicates that Seoul, Ulsan and Kyunggi-province have higher accessing rates, while those of Chungnam and Jeonnam Provinces show relatively lower rates with less than 50% of Internet accessing rates. However, the regional gap is not likely to be a serious factor as the Internet accessing rate is increasing every year in all areas.

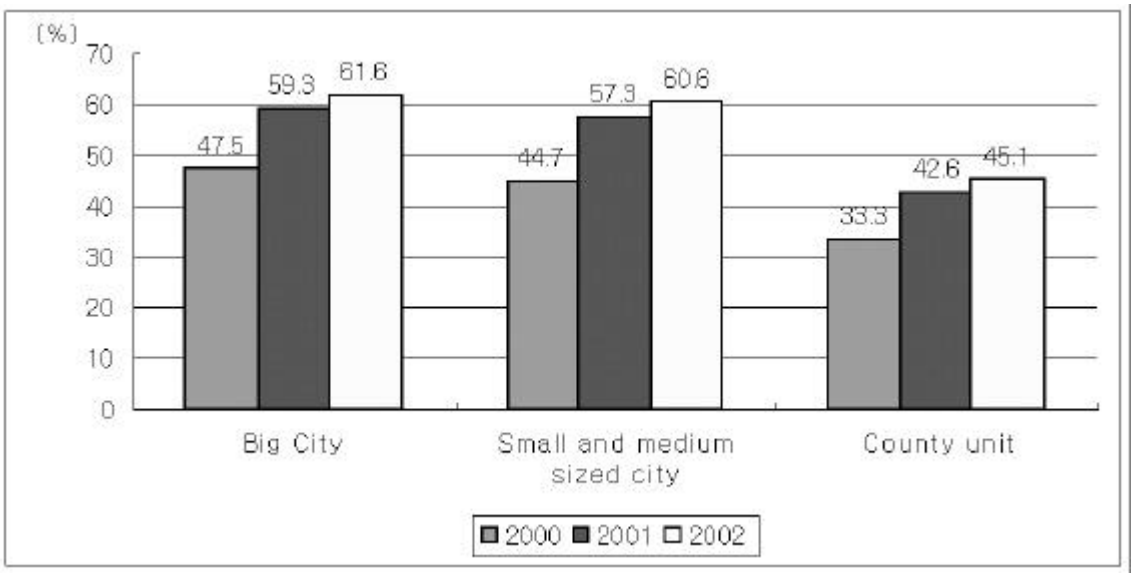
<Figure II-7> Internet Accessing Rate by Regions:



Source: same as Figure II-5.

However, there appears to be a significant gap between the urban and rural units. According to regional size, an accessing rate of 60% or higher is recorded in big cities and small-medium sized cities, while relatively lower rates (45.1%) are seen in small county-unit areas.

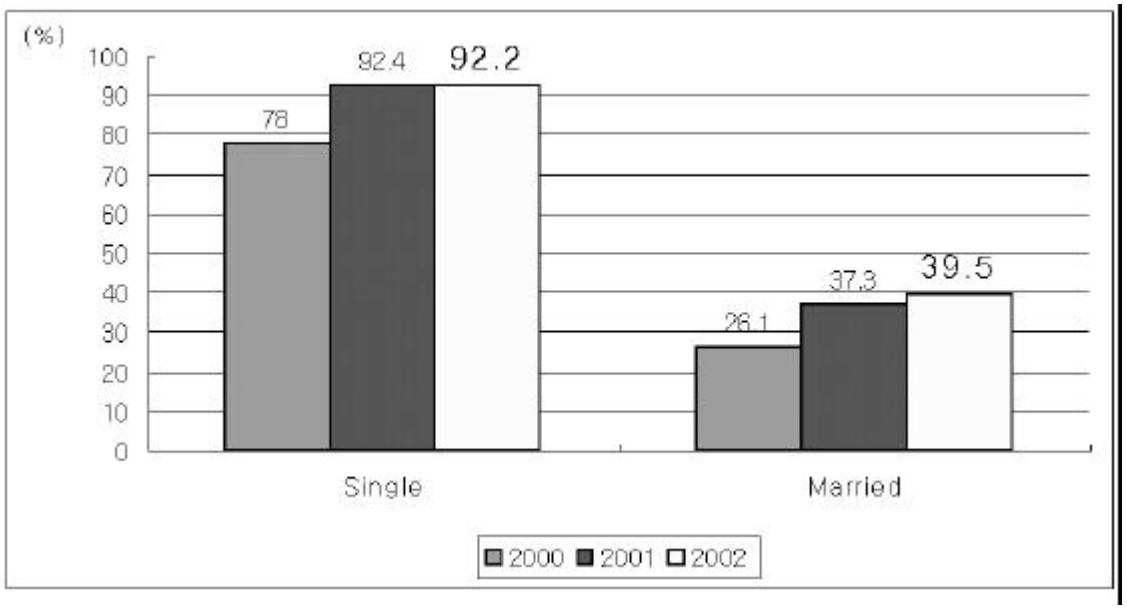
<Figure II-8> Internet accessing rate by regional size



Source: Same as Figure II-5

By marital status, singles show a higher accessing rate of 92.2%, while the married show a lower accessing rate of 39.5%. As the married are mostly older, it is likely related with the lower accessing rate seen in people in their 30s or older.

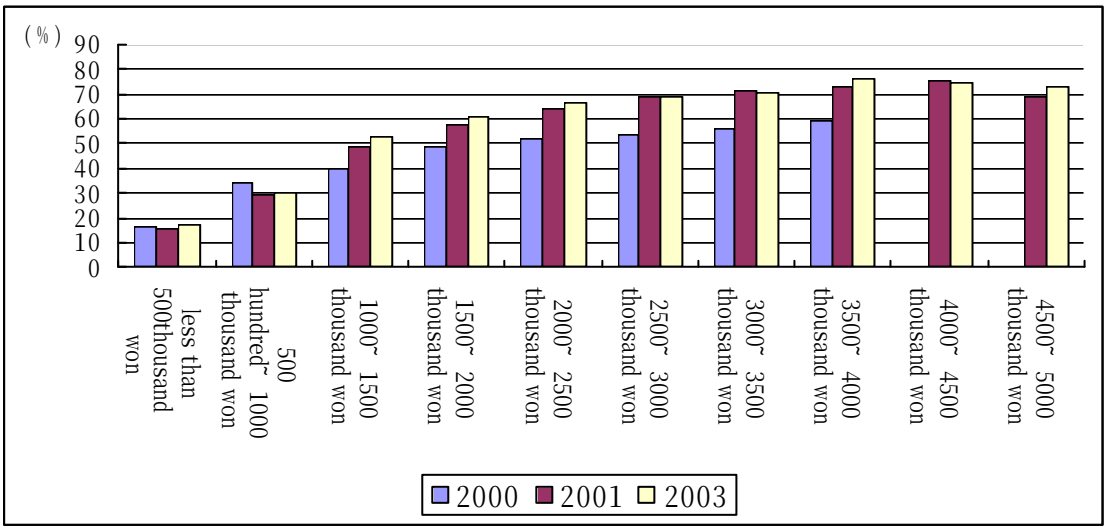
<Figure II-9> Internet Accessing Rate Depending on Marital Status:



Source: Same as Figure II-5

Higher income brackets show higher Internet accessing rates. Nevertheless, there does not seem to be a significant difference among people who earn an average monthly income of 1,500 thousand won or higher. For those earning more than 1,500 thousand won, the accessing rate was found to be more than 60%.

<Figure II-10> Internet Accessing Rate Depending on Income Level:



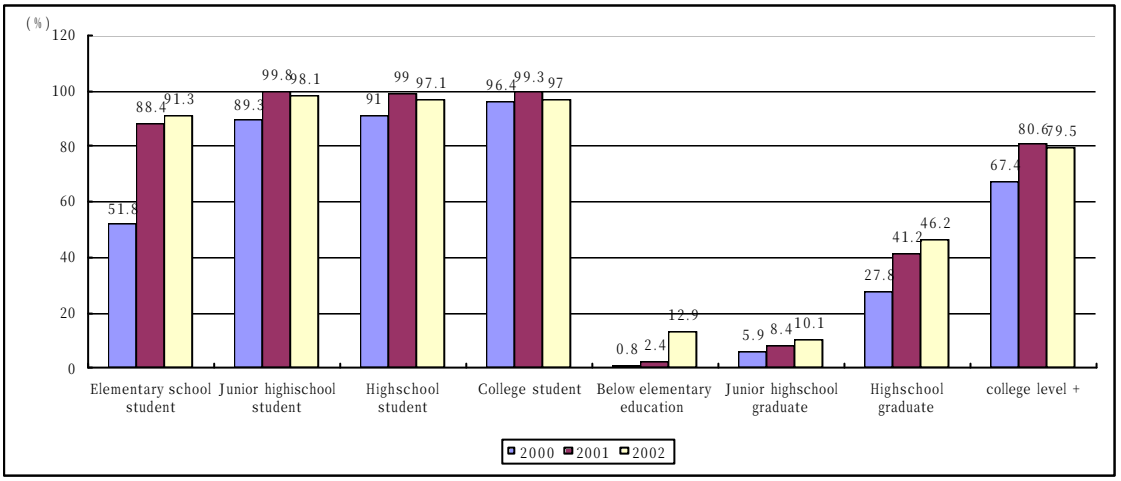
Source: Same as Figure II-5

In the case of education, a higher level of education shows a higher Internet accessing rate. In 2002, those who have received more than university education marked a rate of 79.5%; High School graduates 46.5%; Junior High School 10.1%; and less than Elementary School 12.9% respectively. For those individuals with less than elementary school level education, the

accessing rate indicated an incredible increase from 2.4% to 12.9% from 2001 to 2002. Furthermore, except for elementary school students, the accessing rate decreased in 2002 compared to the previous year.

While the accessing rates were higher in most schooling levels, the Junior High school level ranked the highest. Also the accessing rate of Elementary school students increased from 51.8% in 2000 to 88.4% in 2001.

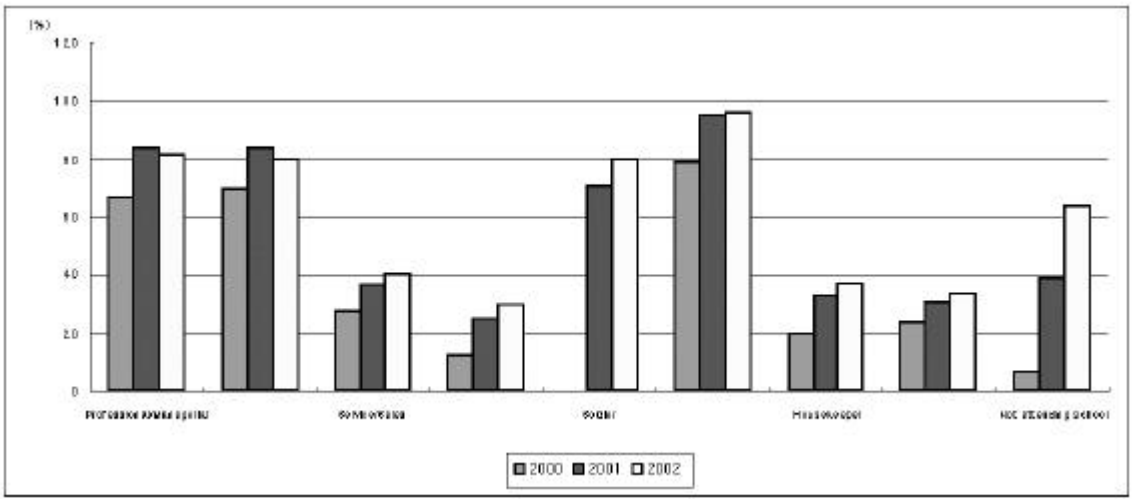
<Figure II-11> Internet Accessing Rate Depending on Education Level:



Source: Same as Figure II-5

As for classification by occupations, the Internet accessing rates for students, professional/managerial and office workers are high. On the other hand, the rates are relatively low for production workers and the unemployed.

<Figure II-12> Internet Accessing Rate Depending on Occupation



Note: Soldiers excluded in 2000 data survey.

Source: Same as Figure II-5.

2.6 ICT-related Human Resources:

With the increased investment in ICT and its diffusion, human resources engaged in this sector also increased. In OECD countries, the annual growth rate of ICT sector workers from 1995 to 2000 was 4.1%. This figure is nearly three times the growth rate in total private sector employment (1.4%). Furthermore, the annual growth rate of the ICT service sector employment was 6.3%.

Also in Korea, the number of ICT and ICT-related industry workers, as table II-2 indicates, had been on the increase until 2000. It decreased in 2001 due to the overall IT market recession, but was augmented again in 2002. On the other hand, the share of workers engaged in the ICT industry in the total number of employees had continuously increased until 2000, as Figure II-13 shows.

<Table II-2> Number of Workers in ICT and ICT-related Industry

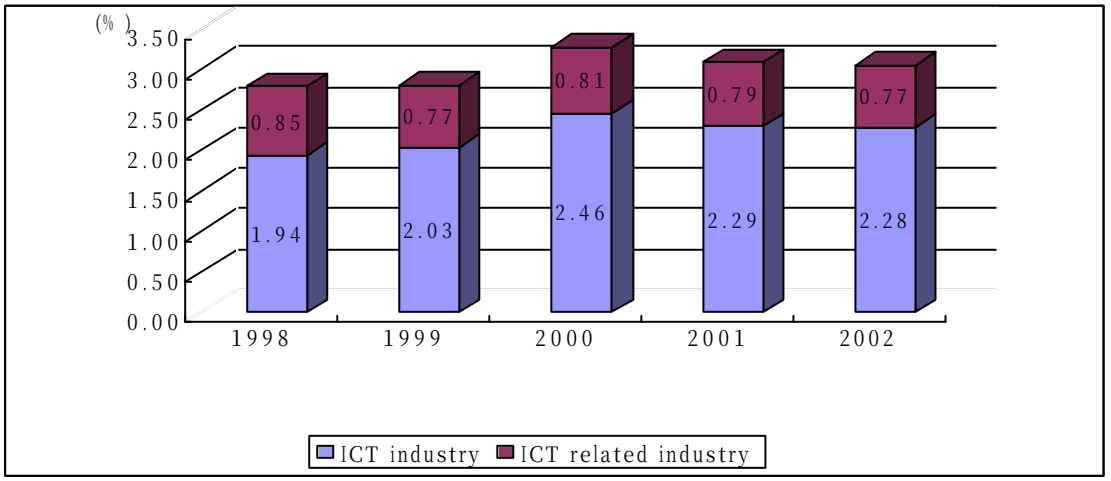
(unit:number)

	Total Number of the Employed	ICT Industry				ICT-related Industry		
		Sub-Total	ICT Service	ICT Equipment	S/W and computer-related service	Sub-total	ICT Construction Industry	ICT-related Distribution Industry
1998	19,938,000	387,062	99,270	241,621	46,171	169,025	56,594	112,431
1999	20,291,000	412,858	90,753	266,816	55,289	156,390	60,878	95,512
2000	21,156,000	520,814	98,286	332,812	89,716	171,175	63,948	107,227
2001	21,572,000	494,825	93,386	312,438	89,001	170,461	63,806	106,655
2002	22,326,000	510,060	95,319	324,968	89,773	171,904	64,946	106,958

Note: Second quarter data was used for 2002

Source: Korea Association of Information and Telecommunication, *Employment trend of Information and Technology sector: 2nd quarter of 2002*. Seoul.

<Figure II-13> Number of Employees in ICT and Related Sector (Compared to Total Number of Employees):



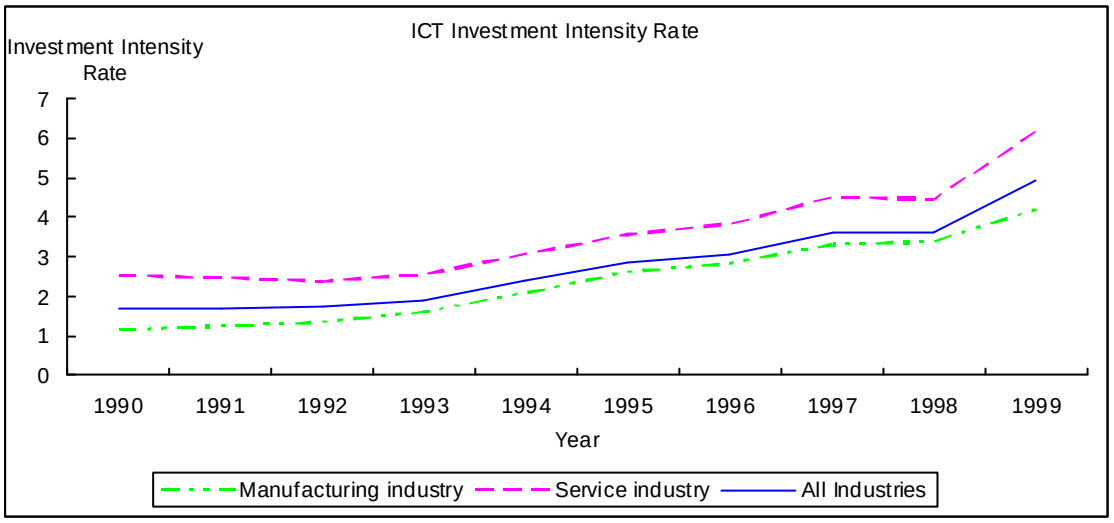
Source: same as Table II-2.

2.7 ICT Investment Intensity Rate:

Figure II-14 shows the intensity of ICT investment in total investment across industries. The

intensity rate of the ICT service industry is higher than that of the manufacturing industry. However, in both the manufacturing and service industries, intensity of ICT investment increases as time goes by and particularly, investment intensity in the service industry after 1998 is on a distinct upswing.

<Figure II-14> ICT Investment Intensity Rate:



3. ICT and Decent Work:

This chapter reviews the relationship between ICT development and Decent Work. The concept of "Decent Work" will be viewed from the perspectives of job security within a sustainable and balanced social development. As recommended by the ILO's *Measuring Decent Work with Statistical Indicators* (2002), this research will analyze multiple indicators such as "Employment Opportunity", "Adequate Earnings", "Decent Working Hours", "Stability and Security of Work", "Fair Treatment in Employment", "Safe Work", and "Social Dialogue and Workplace Relations".

To analyze the effect of ICT development on Decent Work, it is necessary to examine both investment on ICT and its diffusion. In this research, the intensity of ICT investment in total investment is used as an index of ICT investment. The number of Internet subscribers is used as an index of ICT diffusion.

However, due to limitations in available data, it is difficult to analyze the theoretical cause and effect between ICT and Decent Work indicators. Therefore, this paper will focus on examining the correlation between such indicators.

3.1 Employment Opportunity Indicators:

This research utilizes the labor force participation rate, the employment-population ratio, the share of wage employment in non-agriculture employment, and the female share of non-agriculture wage employment. The unemployment rate and youth unemployment rate are also used as indicators, but these two indicators illustrate the negative rather than the positive aspects

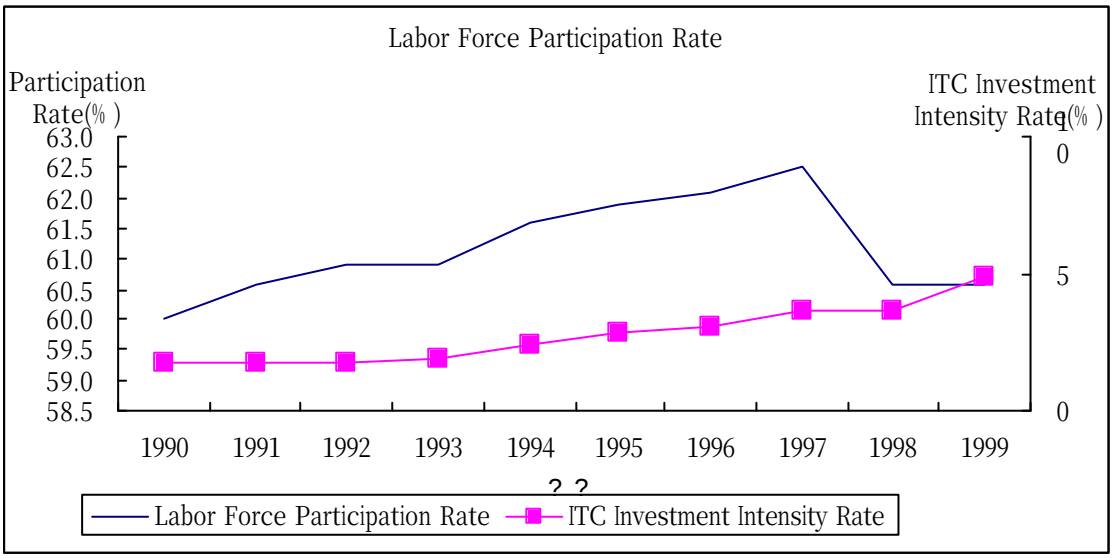
of decent work. Therefore, it should be noted that the sign of the correlation with these two particular indicators indicate an opposite meaning when interpreting the relationship between ICT and Decent work.

1) Labor Force Participation Rate:

The labor force participation rate in Korea had increased up to 62.5% until 1997. The participation rate had sharply dropped to 60.6% in 1998 when the Asian financial crisis hit in Korea, and the same rates have not recovered since 1997. On the other hand, the intensity of investment in ICT was very low in the early 90s. Since 1993, however, it had been continuously augmented until 1998.

During the period of 1990-1999, the correlation coefficient between labor force participation rate and ICT investment intensity was about 0.243, which shows a positive correlation. On the other hand, the correlation coefficient between participation rate and the number of Internet subscribers, which indicates the diffusion of ICT is found to be –0.535. This implies that the trend of ICT diffusion has a opposite relation to the labor force participation rate.

<Figure II-15> Labor Force Participation Rate and ICT Investment Intensity Rate:

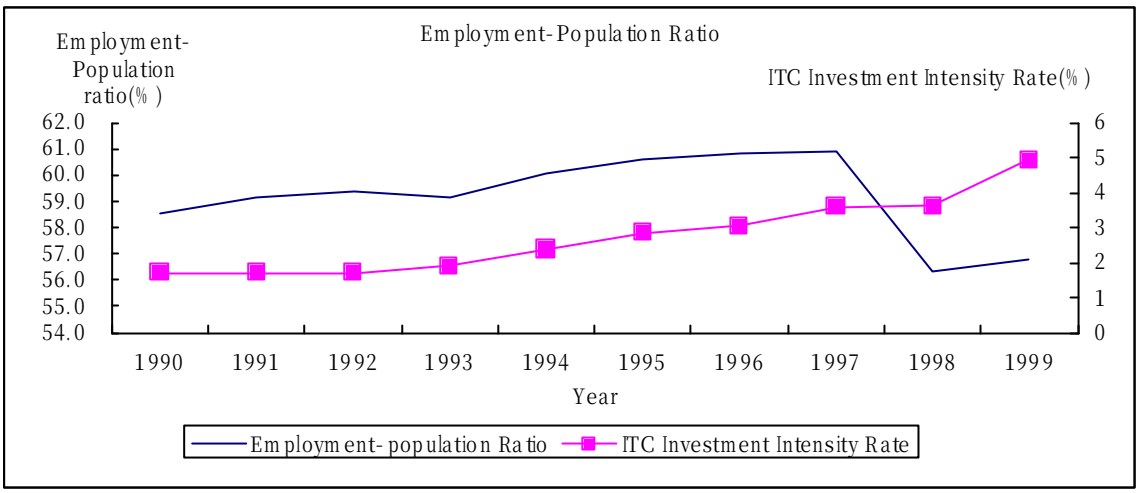


source : National Statistical Office, *Annual Report on the Economically Active Population Survey*

2) Employment-Population Ratio:

The employment-population ratio is the percentage of working-age people who have jobs in the working age population (aged 15 years and up). The employment-population ratio had decreased temporarily in 1993 and had increased until 1997 at 60.9%. Nevertheless, after the financial crisis in 1998, the ratio dropped to 58.4%. The correlation coefficient between the employment-population ratio and the intensity of investment in ICT is found to be –0.353, which is a negative correlation, but the degree is not significant. Moreover, the correlation coefficient with the number of Internet users indicating ICT diffusion is also –0.418, which indicates an opposite relation to the employment-population ratio.

<Figure II-16> Employment-Population Ratio and ICT Investment Intensity Rate:



source : National Statistical Office, *Annual Report on the Economically Active Population Survey*

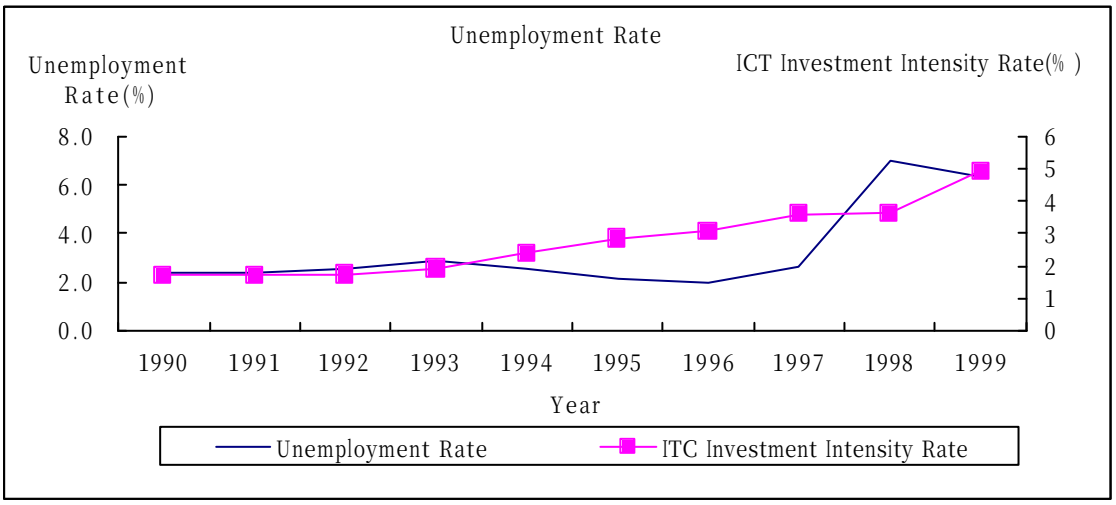
3) The Unemployment Rate:

The unemployment rate had been less than 3% until 1997. Just after the financial crisis, however, the unemployment rate soared up to 7.0% and then declined to 4.1% in 2000.

The coefficient between the ICT investment intensity rate and the unemployment rate is found to be 0.686, showing that ICT investment has a negative relationship with decent employment.

The coefficient between the number of Internet users and the unemployment rate was 0.331, which also indicates a negative relationship with decent employment.

<Figure II-17> The Unemployment Rate and ICT Investment Intensity Rate:



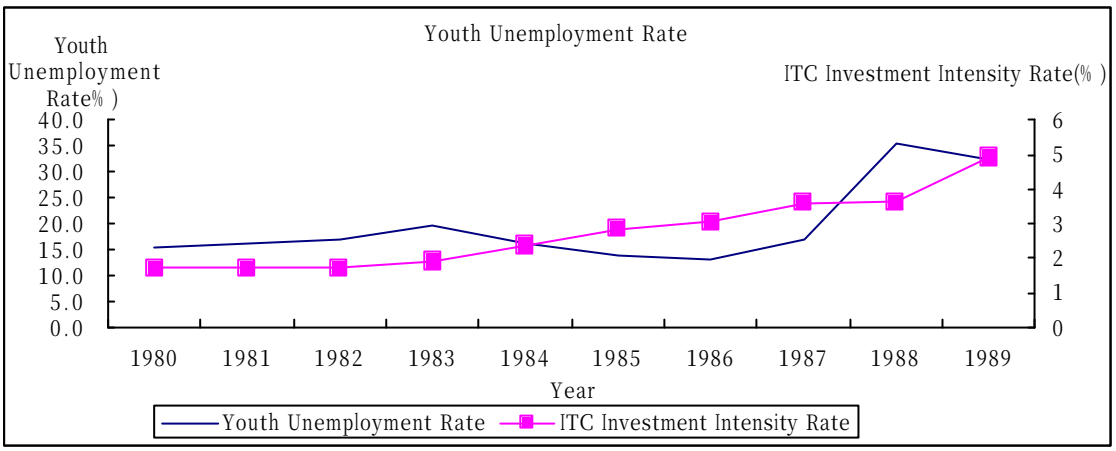
source : National Statistical Office, *Annual Report on the Economically Active Population Survey*

4) Youth Unemployment Rate:

Like the unemployment rate for all ages, the youth unemployment rate (between the ages of 15-24) also increased to 35.6% in 1998 and decreased to 23.1% in 2000. The correlation

coefficient between the intensity of investment in ICT and the youth unemployment rate is found to be 0.648, and the correlation coefficient between the number of Internet subscribers and the youth unemployment rate is 0.341. Both figures imply that ICT has a negative relation with decent work.

<Figure II-18> Youth Unemployment and the ITC Investment Intensity Rate:

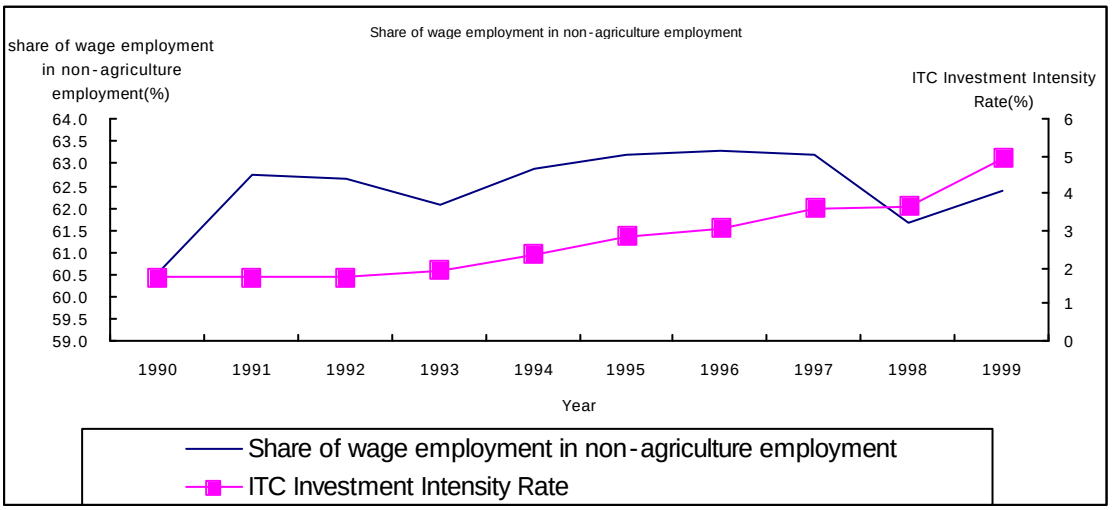


source : author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office.

5) Share of Wage Employment in Non-Agriculture Employment:

The share of wage employment in non-agriculture employment had increased since 1990, and had dropped to a small amount in 1993. It had been on the increase again until 1997, but fell sharply in 1998. The correlation coefficient between this indicator and the intensity of investment in ICT seems weak with 0.219, but it has a positive correlation. The correlation coefficient between this indicator and the number of Internet subscribers is -0.001.

<Figure II-19> Share of Wage Employment in Non-Agriculture Employment and ICT Investment Intensity Rate:

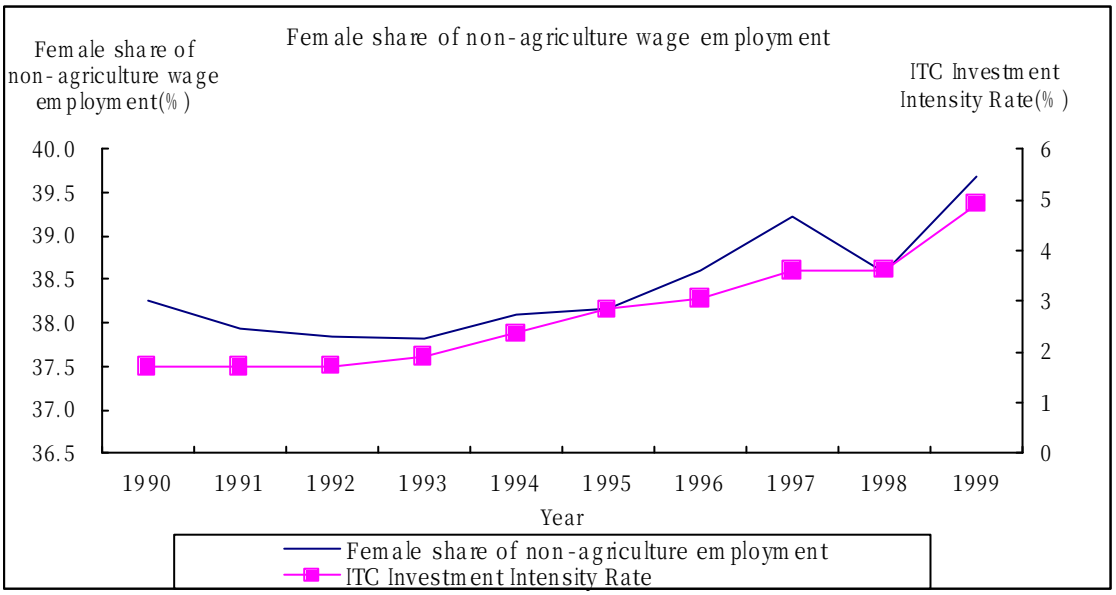


source : author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office.

6) Female Share of Non-Agriculture Wage Employment:

The female share of non-agriculture wage employment was on the decrease until 1993, but it was on the increase afterwards, recording 39.2% in 1997. Just after the Asian financial crisis in 1998, there was a slight decrease but there was a increasing trend again with figures up to 41.3% in 2002. The coefficient between the intensity of investment in ICT and the female share of non-agriculture wage employment is found to be 0.922, which displays a very high positive correlation. The coefficient with the number of Internet subscribers also has a very high correlation with 0.896. Among the indicators of Employment Opportunity, the female share of non-agriculture wage employment shows the highest correlation with ICT investment and its diffusion index.

<Figure II-20> Female Share of Non-Agriculture Wage Employment and ICT Investment Intensity Rate:



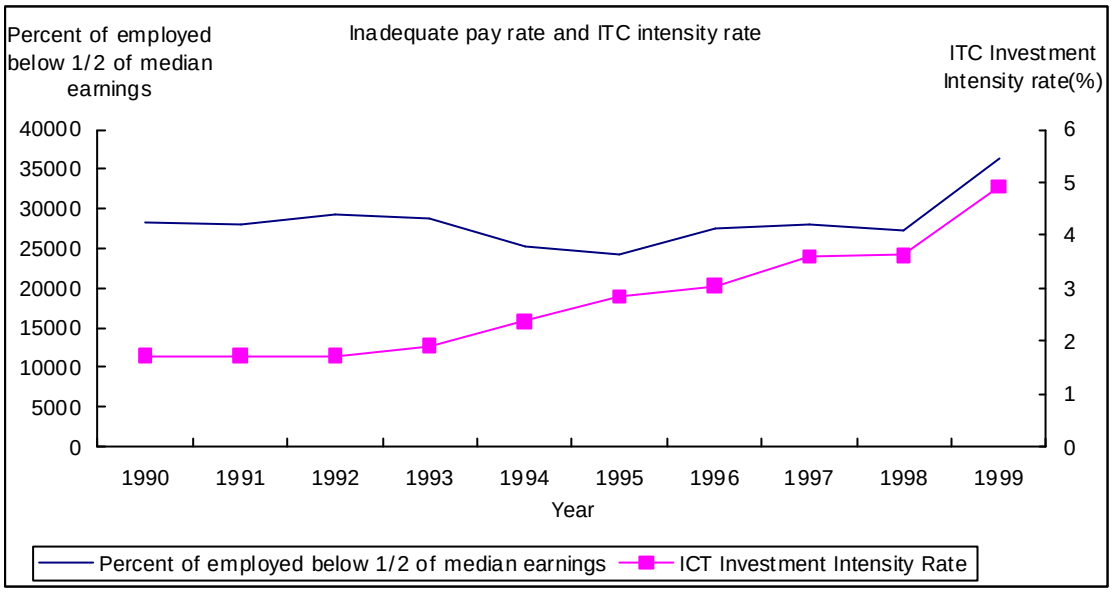
source : author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office

3.2 Adequate Earnings and Productive Work:

This study defines the percentage of employed earning below 1/2 of median earnings as an inadequate pay rate. The proportion of workers that receive inadequate pay among total workers was 5.9% in 1990 and 7.2% in 1992. Subsequently, the rate declined by 6.0% in 1994. Since 1995, it was on the increase again and recorded 7.7% in 1999.

The coefficient between the intensity of investment in ICT and the percentage of employed earning below 1/2 of median earnings is 0.512, which shows a positive correlation. The coefficient between the number of Internet subscribers and the percentage of employed below 1/2 of median earnings is 0.952. This result suggests that the intensity of investment in ICT and ICT diffusion has a very strong negative relationship with the earnings equality.

<Figure II-21> Percent of Employed Below 1/2 of Median and ICT Intensity Rate:

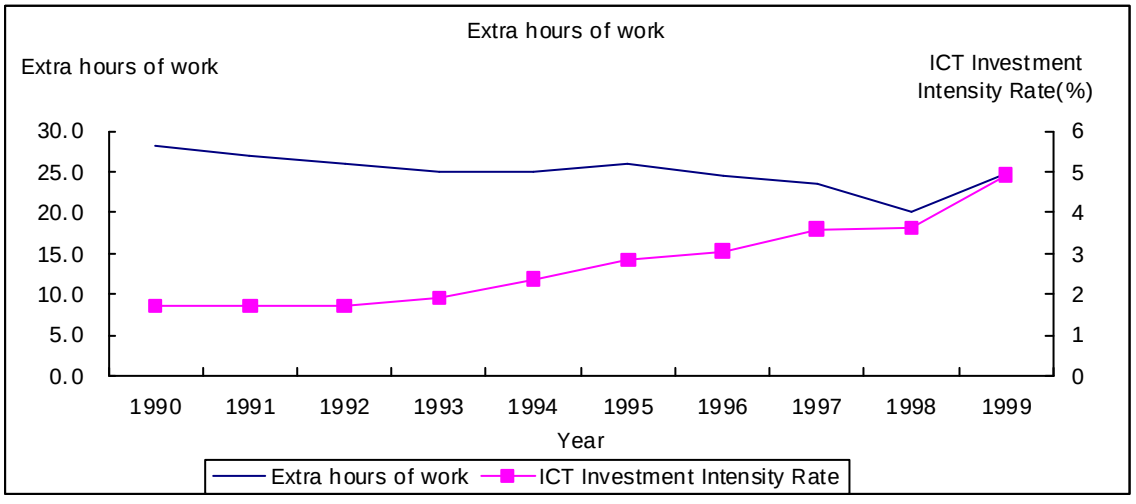


source : author's calculation based on *Survey on wage structure* of Ministry of Labor.

3.3 Decent Hours:

This research selected extra working hours to analyze as an indicator in order to show decent hours. Extra working hours were 28.1 hours in 1990, but it had gradually decreased until 1998. However, the correlation coefficient between the intensity of investment in ICT and extra working hours showed a negative correlation with –0.598. However, the coefficient with the number of Internet subscribers was 0.236. In other words, extra working hours decrease as the intensity of investment in ICT increases, showing a positive relationship with decent hours. But the higher the intensity of investment in ICT, the higher extra working hours increase, showing a negative relationship with decent hours.

<Figure II-22> Extra Hours of Work and ICT Intensity Rate:

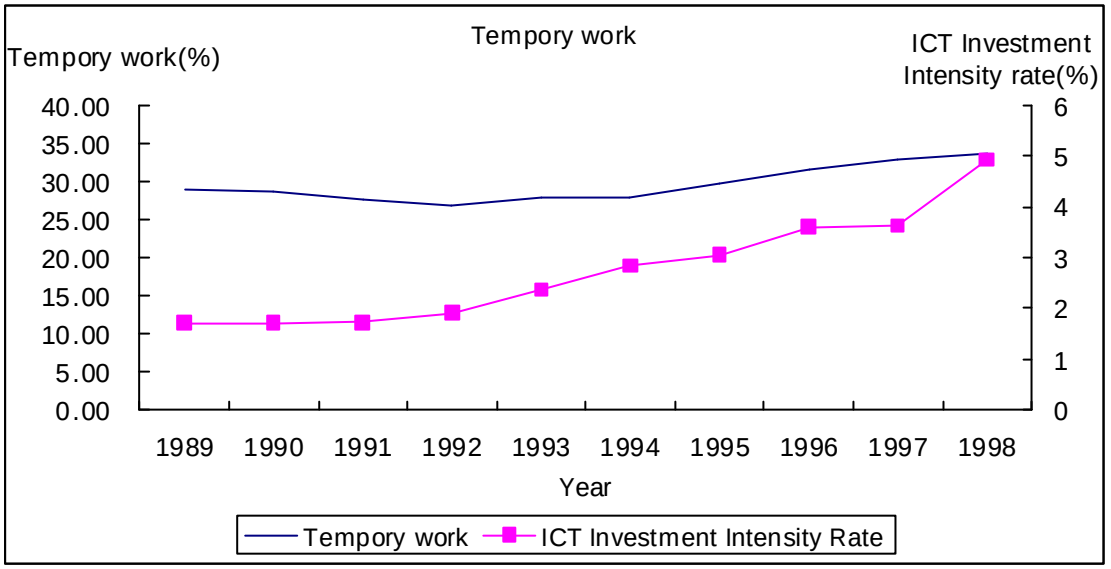


source : National Statistical Office, *Annual Report on the Economically Active Population Survey*

3.4 Stability and Security of Work

As an indicator of the stability and security of work, this research utilized the share of temporary work. Temporary work seemed to decline until 1993, but it increased afterwards. The coefficient with the intensity of investment in ICT is 0.867, and the coefficient with the number of Internet subscribers is 0.784. Both coefficients show a strong negative relationship with decent work.

<Figure II-23> Temporary Work and ICT Intensity Rate:



source : National Statistical Office, *Annual Report on the Economically Active Population Survey*

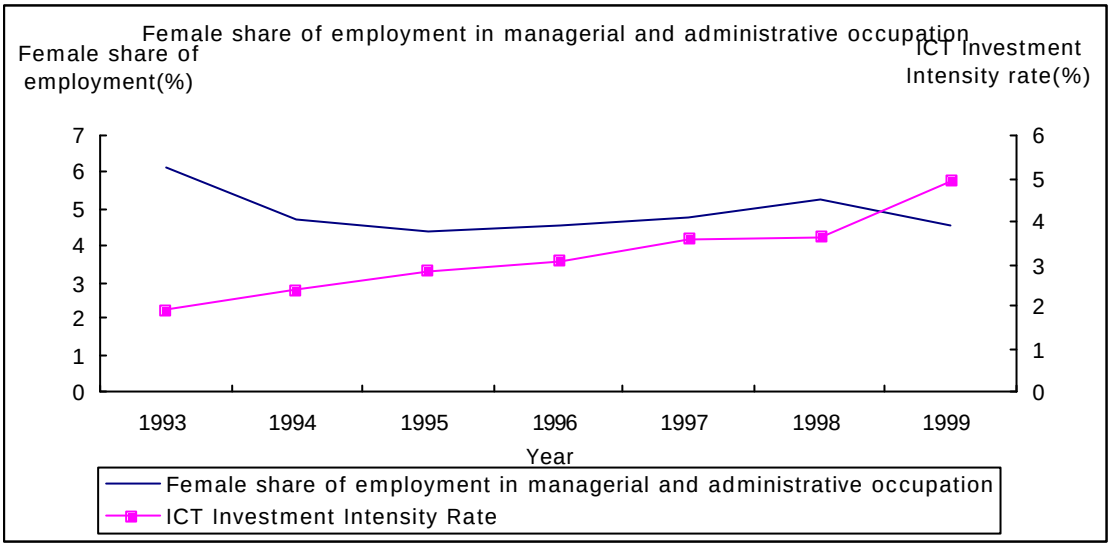
3.5 Fair Treatment in Employment

The female share of employment in managerial and administrative occupations and the female/male wage ratio are used as indicators for measuring fair treatment in employment.

1) Female Share of Employment in Managerial and Administrative Occupations:

The female share of employment in managerial and administrative occupations was 6% in 1993 and decreased to 4% in 1995. However it was augmented again and maintains a level of about 5%. The correlation coefficient with the intensity of investment shows a negative correlation with –0.457. However, the correlation coefficient with the number of Internet subscribers as an indicator of the diffusion of the Internet shows a positive correlation with 0.320.

<Figure II-24> Female Share of Employment in Managerial and Administrative Occupations and ICT Intensity Rate:

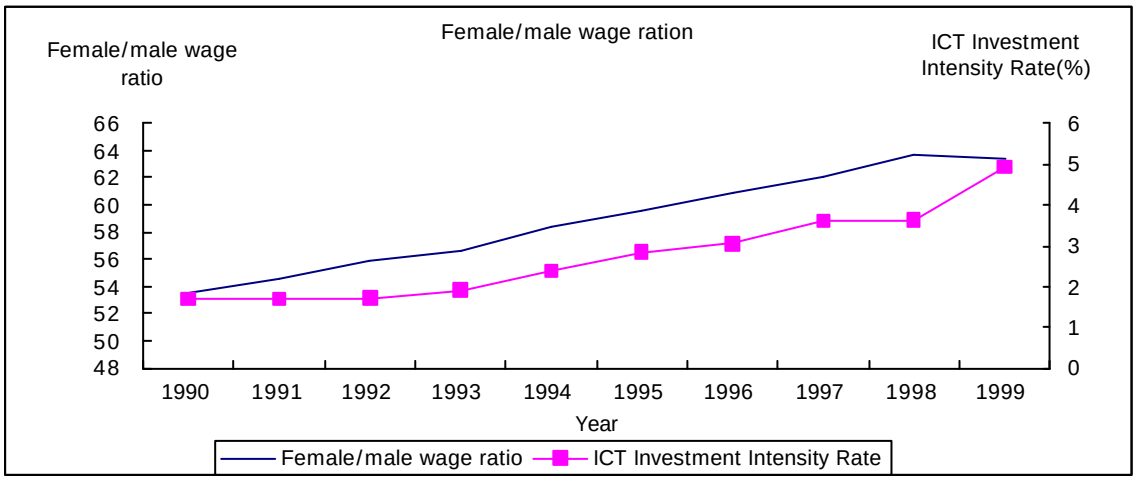


source : author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office

2) Female / Male Wage Ratio:

The Female / Male wage ratio increased with time. The average wage of females was only 50% of males in 1987, but the percentage was on the constant increase and reached to 64% in 1998. Recently, it fell by a small amount, but it recovered to record 64% again in 2001. The coefficient between the intensity of investment in ICT and the female/male wage ratio is 0.922, which shows a very high degree of positive correlation. Similarly, the coefficient of the number of Internet subscribers has also a strong correlation with 0.588. Along with the female share of non-agriculture wage employment, the female/male wage ratio is found to have a strong positive relationship with ICT development.

<Figure II-25> Female / Male Wage Ratio and Women and ICT Intensity Rate:



source : KLIDB

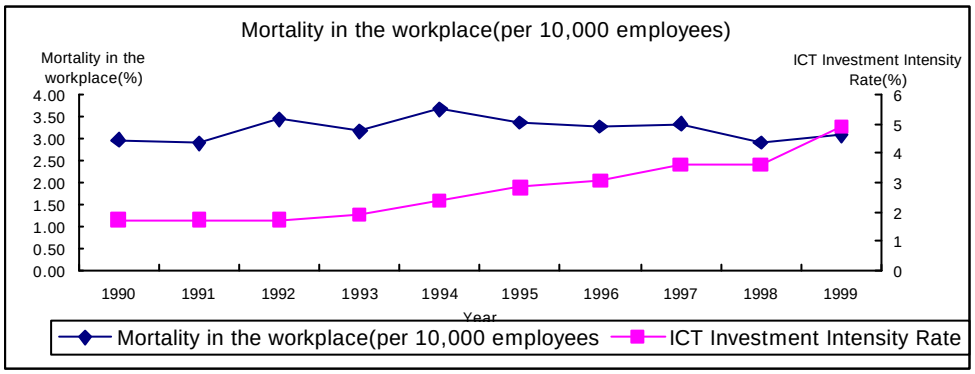
3.6 Safe Work:

This research utilizes mortality in the workplace (per 10,000 employees) and fatal injury (per 1,000 employees) as indicators of safe work.

1) Mortality Per Ten Thousand:

Mortality per ten thousand was 2.96 in 1990, and increased to 3.68 in 1994. Afterwards, the mortality rate decreased gradually and settled at 2.60 in 2001. The coefficient with the intensity of investment shows little correlation, while the number of Internet subscribers has a strong negative correlation with –0.890.

<Figure II-26> Mortality in the Workplace (Per 10,000 Employees) and ICT Intensity Rate:

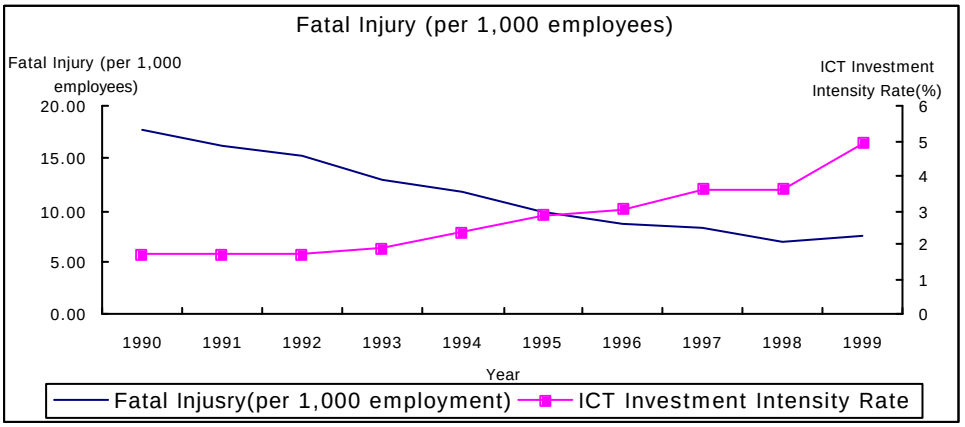


source: Ministry of Labor, *Report on Industrial Accident and disease*.

2) Fatal Injury Per Thousand Employees:

Fatal injury per 1,000 employees was 17.62 in 1990, but it gradually decreased, recording 7.27 in 2000. The coefficient with the intensity of investment shows a negative correlation with –0.831. Similarly, the coefficient with the number of Internet subscribers shows a negative correlation with –0.572. Accordingly, the intensity of investment and the ICT diffusion rate have a very positive connection to safe work.

<Figure II-27> Fatal Injury Per Thousand Employees and ICT Investment Intensity Rate:

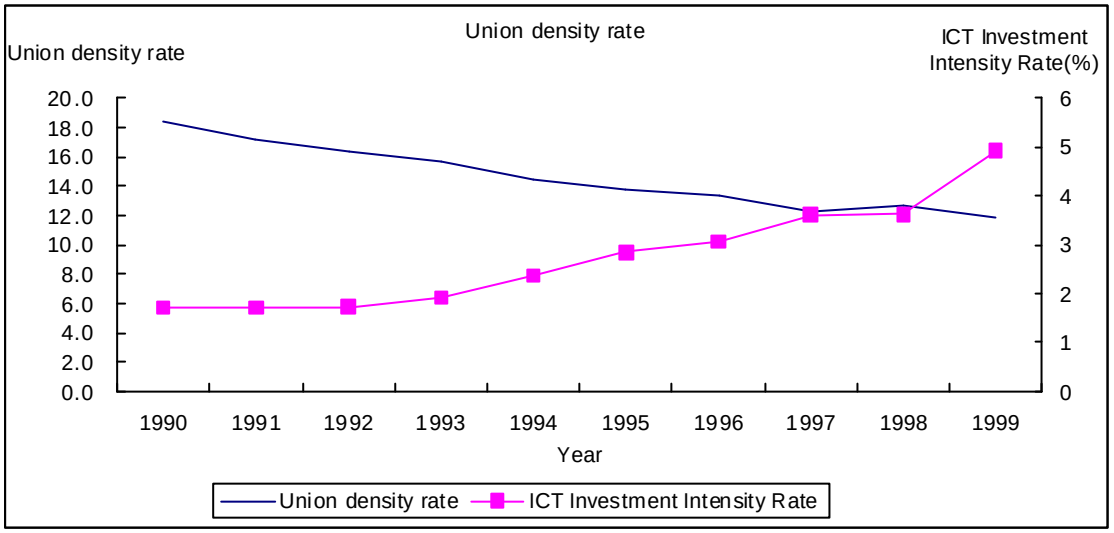


source: Ministry of Labor, *Report on Industrial Accident and disease*.

3.7 Social Dialogue and Workplace Relations:

As for the social conversation and workplace relationship indicators, the union density rate is utilized here. The density rate has been on the decrease since 1990. It was 18.4% in 1990, but decreased to 12.0% in 2000. The coefficient between the intensity of investment and density is –0.901, showing a strong negative correlation. The coefficient with ICT diffusion is –0.652, also showing a strong negative relationship.

<Figure II-28> Union Density Rate and ICT Investment Intensity Rate:



source : KLIDB

4. Summary

This paper reviewed trends of expenditure on ICT including ICT-related consumption and investment, the diffusion of ICT, the digital divide issue with regard to ICT diffusion, and the ICT-related workforce. Korea is a country that has a high proportion of both ICT investment and ICT consumption comprising GDP. In particular, the share of ICT consumption in GDP is deemed to be the highest among OECD comparison nations. Also, the Internet accessing rate, an indicator of ICT diffusion, is also the highest among OECD comparison countries. However, the so-called "digital divide" is causing serious problems in such categories as sex, age group, regional size, education level and occupation.

In order to look at the relationship between "investment of ICT/diffusion on ICT" and "Decent Work", this research estimated the correlation coefficients between ICT investment intensity rate/Internet accessing rate and indicators of Decent Work.

Table II-3 summarizes these results. Indicators of decent work having *highly positive* relation with ICT investment, are "the female share of non-agriculture wage employment" in Employment Opportunities, "female/male wage ratio" in Fair Treatment in Employment, "extra working hours" in Decent Hours, "fatal injury rate" in Safe Work. "Labor Force participation rate" and "share of wage employment in non-agriculture employment" in Employment

opportunity indicators are found to have *moderately positive* relationships.

On the other hand, *highly negative* relationships with ICT investment are found in "unemployment rate" and "youth unemployment rate" in Employment Opportunities, "percent of employed below 1/2 of median earnings" in Adequate Earnings, "share of temporary work" in Stability and Security of Works, and "union density rate" in Social Dialogue and Workplace Relations.

Indicators of decent work having *highly positive* relation with the number of Internet subscribers indicating ICT diffusion, are "female share of non-agriculture wage employment" in Employment Opportunities, "female/male wage ratio" in Fair Treatment in Employment, "Mortality rate in the workplace" and "fatal injury rate" in Safe Work. "Female share of employment in managerial and administrative occupations" in Fair Treatment in Employment is found to have a *moderately positive* relationship.

On the other hand, *highly negative* relationships with ICT diffusion are found in "labor force participation rate" in Employment opportunities, "percent of employed below 1/2 of median earnings" in Adequate Earnings, "share of temporary work" in Stability and Security of Works, and "union density rate" in Social Dialogue and Workplace Relations.

<Table II-3> Correlation between decent work and ICT: Synthesis

Decent Work Indicator	Relationship with ICT Investment		Relationship with ICT Diffusion	
	Correlation Coefficient	Relationship with DW	Correlation Coefficient	Relationship with DW
Employment Opportunity I Economic activity participation rate	0.243	+	-0.535	--
Employment-population ratio	-0.353	-	-0.418	-
Unemployment rate	0.686	--	0.331	-
Youth unemployment rate	0.648	--	0.341	-
Share of wage employment in non-agriculture employment	0.219	+	-0.001	0
Female share of non-agriculture wage employment	0.922	++	0.896	++
Adequate Earnings Percent of employed below 1/2 of median earnings	0.512	--	0.952	--
Decent Hours Extra hours of work	-0.598	++	0.236	-
Stability and Security of Work Temporary work	0.867	--	0.784	--
Fair Treatment in Employment Female share of employment in managerial and administrative occupations	-0.457	-	0.320	+
Female/Male Wage Ratio	0.896	++	0.898	++
Safe Work Mortality in the workplace (per 10,000 employees)	-0.088	0	-0.890	++
Fatal Injury per 1,000 employees)	-0.831	++	-0.572	++
Workplace Relations Union Density Rate	-0.901	--	-0.652	--

Note: ++ Highly Positive Relationship; + Moderately Positive Relationship; 0 No Significant

Relationship; – Moderately Negative Relationship; — Highly Negative Relationship.

In summary, indicators of Decent Work having highly positive relationships with ICT are those related to women (i.e., "female share of non-agriculture wage employment" and "female/male wage ratio") and related to Safe Work (i.e., mortality rate, fatal injury rate). On the other hand, indicators with highly negative relationships with ICT are the "unemployment rate," "share of temporary work," "income equality," and labor union density rate. This result implies that the investment in ICT and its diffusion is not necessarily connected to all aspects of decent work, and that policy measures to resolve the digital divide problem in employment and income are needed.

<Appendix 1> Decent Work indicators (I)

Year	Labor Force participation rate	Employment-population ratio	Unemployment rate	Youth unemployment rate (age of 15-24)	Share of wage employment in non-agriculture employment	Female share of non-agriculture wage employment	Percent of employed below 1/2 of median earnings
1980	59.0	55.9	5.2	23.6	47.2	31.7	
1981	58.5	55.9	4.5	21.3	47.1	31.5	
1982	58.6	56.0	4.4	21.5	47.6	32.8	
1983	57.7	55.3	4.1	19.5	49.4	33.8	
1984	55.8	53.7	3.8	18.6	52.9	33.4	
1985	56.6	54.3	4.0	20.7	54.1	34.7	
1986	57.1	54.9	3.8	18.3	54.4	35.1	
1987	58.3	56.5	3.1	15.9	56.2	36.1	
1988	58.5	57.0	2.5	15.1	57.0	36.1	
1989	59.6	58.1	2.6	14.2	59.2	38.0	
1990	60.0	58.6	2.4	15.5	60.5	38.3	5.9
1991	60.6	59.1	2.4	16.1	62.7	37.9	6.1
1992	60.9	59.4	2.5	17.1	62.7	37.8	7.2
1993	60.9	59.1	2.9	19.5	62.1	37.8	6.6
1994	61.6	60.1	2.5	16.1	62.9	38.1	6.0
1995	61.9	60.6	2.1	13.9	63.2	38.2	6.1
1996	62.1	60.9	2.0	13.3	63.3	38.6	6.5
1997	62.5	60.9	2.6	16.9	63.2	39.2	7.0
1998	60.6	56.4	7.0	35.6	61.7	38.6	7.1
1999	60.6	56.8	6.3	32.3	62.4	39.7	7.7
2000	61.0	58.5	4.1	23.1	63.2	40.4	
2001	61.3	59.0	3.8	22.2	63.3	41.4	
2002	61.9	60.0	3.1	18.6	64.0	41.3	

Source :

Labor Force participation rate, Employment-population ratio, Unemployment rate: National Statistical Office, *Annual Report on the Economically Active Population Survey*

Youth unemployment rate, Share of wage employment in non-agriculture employment, Female share of non-agriculture wage employment: author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office

Percent of employed below 1/2 of median earnings: author's calculation based on *Survey on wage structure* of Ministry of Labor.

<Appendix 2> Decent Work Indicators (II)

Year	Extra Hours of Work	Ratio of Temporary Workers	Female share of employment in managerial and administrative occupations	Female/Male Wage Ratio	Mortality per ten thousand	Fatal Injury (per 1,000 employees)	Union density rate
1980	28.6			44	3.4	30.2	21.0
1981	32.6			45	3.7	34.1	
1982	32.2			45	3.5	39.8	
1983	34.1			47	3.7	39.8	
1984	34.1			48	3.8	36.0	
1985	32.8			48	3.8	31.6	16.9
1986	34.4			49	3.5	29.9	16.8
1987	33.9			50	3.3	26.6	15.7/18.5
1988	31.2			51	3.4	24.8	19.5
1989	28.5	28.6		53	2.6	20.1	19.8
1990	28.1	29.0		54	3.0	17.6	18.4
1991	26.9	28.7		55	2.9	16.2	17.2
1992	26.1	27.7		56	3.4	15.2	16.4
1993	25.1	26.7	6.11	57	3.2	13.0	15.6
1994	25.0	27.8	4.71	58	3.7	11.8	14.5
1995	26.0	27.9	4.39	60	3.4	9.9	13.8
1996	24.6	29.6	4.57	61	3.3	8.8	13.3
1997	23.4	31.6	4.75	62	3.3	8.1	12.2
1998	20.1	32.9	5.28	64	2.9	6.8	12.6
1999	24.8	33.6	4.58	63	3.1	7.5	11.9
2000	25.6	34.5	4.90	63	2.7	7.3	12.0
2001	22.7	34.6	5.86	64	2.6	7.7	
2002		34.5					

Source :

Extra Hours of Work, Ratio of Temporary Workers : National Statistical Office, *Annual Report on the Economically Active Population Survey*

Female share of employment in managerial and administrative occupations : author's calculation based on *Annual Report on the Economically Active Population Survey* of National Statistical Office

Female/Male Wage Ratio, Union density rate : KLI(Korea Labor Institute) DB
Mortality per ten thousand, Fatal Injury (per 1,000 employees) : Ministry of Labor, *Report on Industrial Accident and disease*.

III. ICT and Worker Participation : Corporate level

1. Introduction

Worker participation is deemed to be one of the major comprehensive indicators to measure decent work in that worker participation increases autonomous decision-making in the workplace and at the social level and ultimately achieves "humanization of labor" through proactive participation in decision-making. More specifically, worker participation plays a key role in measuring decent work as worker participation enables the sharing of information on working conditions and the rights of workers and also enables workers to express their opinions and make decisions at their discretion, thereby playing a vital role in social dialogue.

This paper explores the effect of ICT on the quality of work in the workplace by finding out whether the ICT diffusion promotes worker participation in the workplace. To this end, this paper takes consideration of two aspects. One aspect is whether ICT enhances the overall level of participation of businesses on the whole and the other aspect is whether ICT reduces the gap in the participation level of businesses categorized by a variety of features. The reason we need to consider the second aspect on the gap among businesses, other than the first aspect, is that decent work is a concept that needs to be determined comprehensively by a variety of variables in addition to a factor of participation. Hence, it is difficult to say that ICT is a factor that has a positive effect on decent work, merely because it has a positive effect on enhancing the overall level of participation, which is one variable among many. Each variable that has an effect on decent work may be traded off in relations of mutual substitution or supplementation on an individual level. For instance, longer overtime for an individual worker or a company than other companies with similar conditions, which is a variable with a negative effect on decent work, may be traded off by higher wages. In order to overcome the limitations of an individual approach, which is an analysis through only one factor (here, participation) out of a number which affect decent work, this study adopts the perspective of equality. The equality lies at the heart of the notion of decent work(Hepple, 2001) and in a situation where each entity has a relative perspective on decent work, decent work may be understood from a perspective of whether to promote social equality. And the introduction of equality leads to the question of whether ICT's effect on participation widens the gap of the participation level among businesses or reduces it.

A priori, the introduction of ICT is expected to simplify the process for worker participation and reduce participation costs through e-mails and bulletin board utilizing networks such as the Internet and Intranet. Based on this strength, businesses are expected to provide information on various areas to workers in a speedier and easier way and listen to workers' opinions. Meanwhile, the level of worker participation in decision-making may be more dominantly influenced by decision-making methods, working methods and corporate culture of a business rather than the effect of ICT. However, if competition accelerates due to ICT, requiring speedy decision-making, ICT is expected to broaden the chapter for workers to participate in decision-making.

However, the introduction of ICT, which may expand information-sharing and consultations, may serve as means of surveillance and control, thereby, in practice, undermining the quality of

work. Moreover, participation itself may be interpreted from the perspective of control imposed by the management in a bid to induce behaviors favorable to them (Frenkel et al.1999). In this context, the effect of ICT on broader scopes including participation, control and surveillance may be subject to a power relationship between entities in an organization (between management and workers). [1]

Furthermore, various study results show that technological advances based on ICT affect participation. In an article on improving workplace performance in theoretical and historical contexts, Parks (1995) states that the background for transforming the workplace into the so-called "high-performance" organization which focuses on worker participation includes the need for increasing productivity per labor cost due to ever-increasing competition; the introduction of new technologies represented by ICT; and changes in labor markets such as a decline in labor union joining rate. According to the study, the introduction of new technologies imposes more responsibility on workers in the working process, requires cognitive abilities and necessitates close cooperation between workers and management. Whitfield and Poole (1997) also argue in their paper on the outcome of high-performance work organizations that the introduction of new technologies which make possible tailored responses to the market can cause more flexible work organizations with stronger worker participation.

In order to understand the effect of ICT on worker participation, this paper intends to examine whether ICT dissemination increases the whole level of participation; whether ICT affects all types of participation; and in what types of participation ICT has a relatively big effect. Moreover, this study reviews whether the effect of ICT on worker participation varies depending on firm size (small and medium-sized businesses or large businesses), sectors (manufacturing/service, ICT-related industry) and characteristics of businesses (unionized or non-unionized businesses; proportion of female employees; the degree of response to the market; parent companies/ subcontracting companies). Lastly, this paper analyzes what effect ICT has on the participation gap among businesses.

2. Review of Previous Studies and Research Framework

According to Dachler and Wilpert (1978) who studied conceptual dimensions and boundaries of participation in organizations, theoretical approaches on participation include the democratic approach where participation as a member of an organization enhances democracy; the social approach where workers can be economically-liberated through active participation in the production process; the human resource development approach where the autonomous, independent and self-control attributes of workers can be developed through participation; and the productivity approach where inefficiency caused by alienation and dissatisfaction in the workplace can be overcome through participation. Until the 1970s, researches mainly adopted democratic and social approaches to promote industrial democracy and complement limitations

[1] This is a fundamental restraint on understanding the quality of work through worker participation and it is considered that this needs to be additionally researched on the basis of qualitative analysis such as case study rather than quantitative analysis, which this study adopts. For this reason, this paper does not focus on this part and is only limited to use a few cases when interpreting analysis results in the conclusion part.

of the existing framework of labor-management negotiations. With the economic downturn caused by the 1970s' oil crisis as a turning point, however, there was an awareness that worker participation is a major means to "secure competitiveness of businesses" through management innovation, and more studies were based on human resource development and productivity approaches.

Although there are diverse classifications and definitions of participation depending on various approaches, participation can be largely divided into participation in companies' outcome distribution processes and participation in decision-making processes, depending on the domain of participation (Lee Won-deok, Yoo Gyu-chang 1997). Also, categories of participation can be divided into participation in a broad sense, which includes both the former and latter, and participation in a narrow sense, which includes only the latter (Kim Dong-bae, Lee Gyeong-muk 2003). In consideration of the perspective of this research, namely the effect of ICT on decent work, the domain of participation which requires more attention is participation in the work process, rather than participation in the outcome distribution process. Thus, the scope of this research will be limited to participation in a narrow sense. Theoretically, besides participation of individual workers, the issue of participation includes collective participation of parties including labor unions and labor-management consultation bodies. However, this study focuses only on participation of individual workers.[2]

Worker participation in the decision-making process can be classified on the basis of various criteria such as types, degree, level, content and range of participation. Yet this study adopts the criteria of access to participation in decision-making which was proposed by Dachler and Wilpert (1978). The reason for this approach is that the premise of Dachler and Wilpert that participation in decision-making is a point on the continuity from non-participation to participation, not a dichotomous division of participation and non-participation, is deemed to be a more realistic assumption in studying worker participation in businesses. Access to participation in decision-making is determined by the quantity and quality of information possessed by employees, and when participation is classified on the basis of this criteria, there are six phases—a state where advance information on decision-making is not provided (phase 1); a state where advance information on decision-making is provided (phase 2); a phase where employees' present their opinions on decisions (phase 3); a phase where employees' opinions are reflected in the decision-making process (phase 4); a state where rights to veto or agree in advance to decisions are offered (phase 5); and a state where it is possible for any member of an organization, without separating employees and management, to make decisions (phase 6). There are several ways to classify participation which are similar to the classification approach adopted here. Levine and Tyson (1990) classified participation into consultative participation and substantive participation depending on the degree of worker influence. Consultative participation means that workers are allowed to express their opinions, yet final decisions are made by management and workers' opinions do not directly influence decision-making. This

[2] We believe that in the actual workplace, individual and collective participation are not separate. Rather, it seems more reasonable that an individual worker's participation is manifested in labor-management relations which are formed on the basis of a labor-management consultation body and activities of labor unions. However, this approach may be controversial, thus this paper mainly focuses on individual participation which is differentiated from collective participation.

kind of participation corresponds to phase 1 to phase 4 out of the above-mentioned 6-phase access to participation. On the other hand, substantive participation means that workers make decisions based on their discretion and directly influence decision-making and corresponds to phases 5 and 6.

In consideration of the classifications of the degree of participation mentioned above, this paper classifies the degree of worker participation into the following three types. The first type is information-sharing, where basic information on workplace, management and market conditions is shared with workers to enhance worker participation. The second type is consultations where workers express their ideas on production and management and management reflects them in decision-making. The third type is autonomous decision-making where workers directly participate in decision-making based on their responsibility.

Such categorization dictates the types of participation in a phased manner from information-sharing to autonomous decision-making, yet it cannot be presumed that types of participation in actual business settings evolve in such a phased manner. Moreover, it is not deemed always desirable to take this phased course. From a long-term perspective, however, if workers participate in decision-making in a situation where necessary information-sharing and consultations are not in place, a question may be raised on the effectiveness of the worker participation. For example, when it comes to autonomous worker participation on work methods in a workplace, there are cases where information-sharing and consultations are already sufficiently made or where autonomous decision-making does not greatly require information-sharing and consultations. From a long-term perspective, however, in an environment where much of the businesses information is rapidly changing, if decisions are not made based on shared information and subsequent consultations, a question may be raised on the effectiveness of workers' decision-making and it would be difficult to maintain autonomous decision-making on a sustained basis.

Meanwhile, according to research results of Kim Dong-bae and Lee Gyeong-muk (2003), major factors affecting participation in decision-making include size of businesses, labor unions, management values, export-oriented companies, the degree of skills, competition environment, competition strategies and the introduction of new technologies. The introduction of ICT does not merely mean an increase in capital stock by introducing computers and communication equipment, but is a process of reengineering an organization following the introduction of technology[3] and transforming methods of producing goods and services (Bresnahan et al, 2002). Moreover, ICT introduction is achieved on a strategic level, making ICT a strategic means, and ICT may play various roles ranging from merely facilitating transformation to inducing innovation more actively and serving as a mechanism for concrete restructuring, depending on the degree to which it is used (Vendramin & Valenduc, 2002). The strategic introduction of ICT by businesses is well manifested in "knowledge management," which has been vigorously introduced and discussed in recent years. Knowledge management is "a method to simplify and

[3] Research studies on organization transformation following the introduction of information technology (IT) started to be promoted by Hammer and Davenport who influenced the concept of the so-called business process re-engineering in the early 1990s (Vendramin & Valendue, 2002). Davenport and Short (1990) predicted that IT is a potent means to transform an organization and that an organization achieving organization re-engineering utilizing IT would be poised to succeed in a new era.

improve the process of sharing, distributing, creating, capturing, and understanding of knowledge in the company"(Khandelwal & Gottschalk 2003, Davenport 1998), while ICT plays a vital role in successful knowledge management by promoting communication and cooperation, assisting research and enabling cooperative learning (Khandelwal & Gottschalk, 2003).

In this context, the introduction of ICT accompanies organizational transformation to implement business strategies, bringing changes to factors that may affect worker participation such as production methods and decision-making structures. Hence, it is presumed that the ultimate effect of ICT on participation takes place through such organizational transformation and in this sense ICT can be seen as a factor yielding considerable influence on organizational changes related to ICT and worker participation.

In order to analyze the effect of ICT on participation, this paper employs factors affecting worker participation other than ICT as control variables. Control variables include the firm size (large or small and medium-sized businesses); characteristics of industries (whether the industry is manufacturing, service or ICT industry); labor unions (whether a labor union is established or not); whether going public regulating management values is offered or not; competition environment and competition strategies (market share and the degree of response to demand changes in the market); and organizational change (whether organizational change takes place or not before and after ICT introduction).

3. Analysis Data and Variables

This paper utilizes the 2002 KLI Workplace Survey conducted by the Korea Labor Institute as analysis data. Taken to personnel and labor managers, the survey shows the current status of businesses in comprehensive areas, including management environment; personnel management (employment statistics, employment advertising and recruitment, education and training, merit rating, promotion, compensation, etc.); work organization and worker participation; working hours; age-limit system; license system; informatization/computerization; and industrial relations. The number of effective samples reached as high as a total of 1,900, yet the number of businesses that replied to variables such as computerization-related expenditure and purchase amount of computerization equipment and PCs was merely 559 to 723. This paper limits the number of data effectively used in relation to ICT's impact on participation to approximately 500 businesses mentioned above. We expect therefore some limitation of the regression result.

In an effort to examine relations between ICT diffusion and worker participation, this paper categorized variables based on the aforementioned three types of participation, except variables related to participation through profit sharing, labor unions and labor-management consultation council. The first(I) variable group refers to variables related to information-sharing which are mainly related to management's unilateral action of providing information to workers. They include the number of corporate briefings, whether to publish newsletters on a regular basis, and whether to share management information through management-labor meetings. The second(II) variable group is related to variables on consultations in which workers express their opinions. They include variables such as whether to operate a grievance mechanism and variables related to communication programs between labor and management such as the number of suggestions per worker, the proportion of workers participating in small groups, the number of businesses

holding consultation sessions among employees, intra-electronic bulletin boards,[4] regular dialogue between management and workers in the workplace and the setting up of a hotline. The third(III) variable group is related to autonomous decision-making, and includes variables of the degree of autonomy of a work unit at a workplace regarding workload; work methods; work speed; working hours; work allocation; rotation; training; recruitment of new employees. For the convenience of interpretation, this paper uniformly adjusted the method of some questions in the survey where the bigger the value of variables becomes, the lower the degree of participation becomes to a method where the bigger the value of variables becomes, the higher the degree of participation becomes.

Next, in order to produce participation indicators by integrating variables of each category we normalized each variable X (=CA84…AI101) which belongs to participation types of I, II and III as follows:

$$X = \frac{X - \min}{\max - \min}$$

Through the transformation, each variable has a value between 0 and 1. For example, variables with two criteria of yes and no have a value of either 0 or 1. However, if variables have five point criteria from 1 to 5, each point of 1,2,3,4 and 5 will correspond to 0, 0.25, 0.50, 0.75 and 1, respectively. After the transformation, while each participation variable is given same weight, this paper produced the following four indicators without advance judgment on relative importance of each variable.

Y1: Mean of variables related to information-sharing
Y2: Mean of variables related to consultations
Y3: Mean of variables related to autonomous decision-making
Y123: Mean of Y1, Y2 and Y3

In other words, Y1, Y2 and Y3 refer to information-sharing indicator, consultation indicator and autonomous decision-making indicator, respectively, and Y123 is an overall participation indicator integrating the three indicators. The four indicators are defined as arithmetic means of variables whose values are between 0 and 1, thus the indicators themselves have values between 0 and 1. Work participation variables expressed in workplace panel based on the above-mentioned three types and descriptive statistic of participation indicators are summarized in Table III-1.

[4] Electronic bulletin boards at work may be regarded as a tool to promote information-sharing in a sense that a company's important information is provided instantly to all workers. However, recently, intra-electronic bulletin boards have frequently been used as a tool to provide an opportunity for workers to express their opinions in the form of replies to specific information. In this context, this paper regards intra-electronic bulletin boards as a means for consultations.

<Table III-1> Classification of Participation-related Variables by Type from Workplace Panel and Descriptive Statistic

		Variable symbol	N	Mean	s. d.
Information-sharing	No. of corporate briefings (annual)	CA84	1754	2.08	3.34
	Whether newsletters are published regularly (2 points)	CB12	1781	1.24	0.43
	Whether management information is shared through meetings (2 points)	CB16	1741	1.74	0.44
	Participation indicator related to Information-sharing	Y1	1791	0.34	0.23
Consultations (II)	No. of suggestions made per worker	AI68	1480	4.55	38.38[5]
	Proportion of small group participation (%)	AI76	1472	13.16	28.48
	No. of employee consultation sessions (per year)	CA86	1618	3.41	5.74
	Whether intra-electronic bulletin board has been established (2 points)	CB13	1784	1.54	0.50
	Whether regular dialogue is held between management and workers at workplace (2 points)	CB14	1783	1.79	0.41
	Whether a hotline to management has been set up (2 points)	CB15	1780	1.53	0.50
	Whether grievance mechanism is in place (none=1, yes=2)	CB21	1791	1.60	0.49
	Consultation-related indicator	Y2	1297	0.37	0.19
Decision-making (III)	Degree of autonomous decision-making on workload per work unit (5 points)	AI94	1198	3.02	0.96
	Degree of autonomous decision-making on work method per work unit (5 points)	AI95	1193	3.19	0.95
	Degree of autonomous decision-making on work speed per work unit (5 points)	AI96	1197	3.15	0.92
	Degree of autonomous decision-making on working hours per work unit (5 points)	AI97	1195	3.21	0.99
	Degree of autonomous decision-making on work allocation per work unit (5 points)	AI98	1191	3.23	0.96
	Degree of autonomous decision-making on rotation per work unit (5 points)	AI99	1179	2.82	1.13
	Degree of autonomous decision-making on training per work unit (5 points)	AI100	1183	2.90	0.96
	Degree of autonomous decision-making on recruiting new employees per work unit (5 points)	AI101	1184	2.29	1.03
	Participation indicator related to decision-making at workplace	Y3	1164	0.49	0.18
Total	Comprehensive participation indicator	Y123	999	0.40	0.14

Table III-1 reveals that Y3 is highest and Y1 is lowest, reflecting that in Korean businesses surveyed participation through decision-making processes at the workplace is more vigorous than information-sharing. Participation through consultations occupies a position in the middle.[6]

In this paper, informatization variables are examined in the two aspects of the speed of ICT introduction and the level of ICT. The speed of informatization is defined as a business' total expenditure budget for computerization per person (IC) and the level of informatization is

[5] The standard deviation of the variable 'number of suggestions' is extraordinary high. The workers' suggestions are very frequent at a few firms. But we didn't reject this data because it is feasible.

[6] As stated earlier, classification on three types of participation in this paper is not assumed as such that the degree of participation becomes higher cross-sectionally in the order of information-sharing, consultations and autonomous decision-making

defined as capital stock for ICT per person.[7] Total expenditure for computerization budget refers to expenditure of computerization-related budget for 2001. ICT capital stock refers to the value obtained by adding values of H/W-related equipment such as PCs, main frames and terminals as of late 2001 to three-fold values of annual S/W purchasing cost and labor cost for computer-related manpower for 2001. The reason for tripling S/W purchasing cost and computer-related labor cost to calculate S/W capital stock is that this paper assumes that S/W is used without depreciation for three years and labor cost for computer-related manpower is accumulated as S/W capital stock. Both variables related to informatization have higher significance in correlation when log values are used rather than actual values. Thus, natural log values are used here.

<Table III-2> Descriptive Statistics on ICT-related Variables

	N	Mean	Standard deviation
IC1	723	193.25	1175.86
LIC1(=Log IC)	723	3.23	2.00
KC1	559	331.53	1258.93
LKC1(=Log KC)	558	4.13	1.89

4. Analysis Results

4.1 Overall Businesses

First of all, we analyze the effect of ICT on participation on overall business level. By examining appropriate control variables, we review meaningful correlations between the speed or level of informatization diffusion and the aforementioned three types of indicators.

As stated earlier, participation variables are presumably affected by whether or not the business has a labor union; the firm size (large or small and medium-sized enterprises (SME)); whether the firm has gone public; competition environment and competition strategies (market share and the degree of response to changes in the market); and whether there is organizational change. In a regression equation, not only these control variables but also typical dummy variables such as characteristics of a business (manufacturing/service industry) are considered. Moreover, as for informatization variables, whether a business is part of the information and communication industry was additionally considered as they have close relations to whether a business concerned is an IT company or not.

First, we regression analyzed (Ordinary Least Squares: OLS) models as in (1) and (2).

$$Y = x'\beta \qquad (1)$$

x'= (1, LIC, large firm/SME, manufacturing/service industry, ICT industry, whether or not a

[7] In this paper, the speed and level of informatization are measured by the quantitative indicators of ICT investment rate and ICT capital stock, respectively, not by the speed or level of databasing. Hence, although the speed of informatization or its level are mentioned hereafter, they refer to ICT investment rate and ICT capital stock. As for the basis to define informatization speed as such, note the Bank of Korea (2000) and Hur Jai-joon et al. (2002).

business goes public, labor union, market share, organizational change, response to market demand, etc.)

θ =(θ_0, θ_1 , …)'

Y = Y1, Y2, Y3, Y123

$$Y=x'\theta \quad (2)$$

x'=(1, LKC, large firm/SME, manufacturing/service industry, ICT industry, whether or not a business goes public, labor union, market share, organizational change, response to market demand, etc.)

θ = (θ_0, θ_1 , …)'

Y = Y1, Y2, Y3, Y123

The regression result shows statistically significant plus correlations between the speed of ICT introduction and overall participation variables, which integrated all types of participation (Y123), meaning that the faster the speed of ICT introduced by a business, the greater the participation in the business. Furthermore, all indicators by participation type have statistically significant plus correlation with the pace of ICT introduction.

Meanwhile, the result that excluded organizational change and the degree of flexibility to the market from control variables (Model 2) shows a similar result, except the fact that the value of the estimation variable and statistical significance was slightly higher. (In all participation indicators, Model 1 has higher adjusted R^2 value than Model 1. Analysis hereafter employs only results of Model 1.)

<Table III-3> Regression analysis on ICT introduction pace (LIC) and participation indicators

	Information-sharing (Y1)		Consultations (Y2)		Autonomous decision-making (Y3) [11]		Overall participation (Y123)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	0.1154*	0.192***	0.177***	0.2538***	0.4561***	0.5026***	0.2611***	0.3299***
LIC1	0.0156**	0.0246***	0.012**	0.0183***	0.0169***	0.0208***	0.0094**	0.0145***
sizc	0.1214***	0.1246***	0.0752**	0.0901***	-0.0237	-0.0141	0.0624***	0.0722***
indc1	0.0855	0.0485	0.0466	0.0334	0.0136	-0.0385	0.0472	0.0137
indc2	0.0624	0.0243	0.029	0.0114	0.0117	-0.0446	0.0381	0.0102
indc3	0.0575	0.0298	0.0318	0.0358	-0.0083	0.0055	0.0292	0.0260
shc	-0.0037	0.0085	0.0216	0.0370	-0.0167	0.0009	-0.001	0.0138
unc	0.0139	0.0069	0.0336	0.0173	-0.1134***	-0.1020***	-0.0135	-0.0108
ochange	0.0434*		0.0453**		0.0515**		0.0451***	
flex	0.1157**		0.1394***		0.0027		0.0884***	
mshare	-0.0006	-0.0001	-0.0007*	-0.0002	-0.0006	-0.0003	-0.0006**	-0.0001
F-value	5.21***	6.37***	6.03***	6.19***	4.06***	4.13***	5.51***	4.18***
Adj. R^2	0.126	0.106	0.157	0.111	0.101	0.073	0.156	0.082
N	291	363	271	334	271	317	245	285

Note: ***=1%, **=5%, *=10% refer to significance level

LIC1: ICT introduction pace, sizc: large/SME, indc1: manufacturing industry, indc2: service industry,

indc3: ICT-related business, shc: going public, unc: labor union, ochange: organizational change, flex: flexibility to the market, mshare: market share

If we examine the result by each participation type, the value of the estimation coefficient is relatively higher in participation indicators related to autonomous decision-making at the workplace and information-sharing than in indicators related to consultations. Thus, businesses with a faster speed of ICT introduction have a higher tendency of increase in autonomous decision-making participation than a tendency of increase in consultations by approximately 40%. As for other factors affecting participation, the firm size, organizational change, the degree of flexibility to the market change, and the existence of a labor union show a statistically significant correlation with some of the participation indicators. What is notable is that other control variables with statistical significance all have plus correlations, while control variables of a labor union and market share have minus correlations with workplace participation indicators. Meanwhile, as for correlation with ICT introduction level (LKC), both the overall participation indicators and the participation indicators by type have plus correlation with introduction level, yet the value of coefficient is relatively higher than that of introduction speed.

Especially, only some of the variables comprising specific indicators have statistically significant correlations with speed and level of ICT.

<Table III-4> Regression analysis on correlation between individual variables and speed and level of ICT introduction

	Participation-related variable	Estimation coefficient	
		LIC1	LKC1
Information-sharing (I)	No. of corporate briefings	0.002	0.004
	Whether publish newsletters are published regularly	0.029**	0.063***
	Whether management information is shared through meetings	0.015	0.043**
	Participation indicator related to Information-sharing	0.016**	0.036***
Consultations (II)	No. of suggestions made per worker	-0.002	-0.004
	Proportion of small group participation	0.001	0.0002
	No. of employee consultation sessions	0.004	0.005
	Whether an intra-electronic bulletin board has been established.	0.06***	0.1***
	Whether there is regular dialogue between management and workers at workplace	0.001	-0.019
	Whether a hotline to management has been set up.	0.019	0.036
	Whether a grievance mechanism is in place.	0.016	0.03
	Consultation-related participation indicators.	0.012**	0.015*
Autonomous decision-making (III)	Degree of autonomous decision-making in workload per work unit.	0.01	0.005
	Degree of autonomous decision-making in work method per work unit.	0.024***	0.018
	Degree of autonomous decision-making in work speed per work unit.	0.017**	0.024**
	Degree of autonomous decision-making in working hours per work unit.	0.014	0.016
	Degree of autonomous decision-making in work allocation per work unit.	0.029***	0.031**
	Degree of autonomous decision-making in rotation per work unit	0.013	0.021
	Degree of autonomous decision-making in training per work unit	0.018**	0.019
	Degree of autonomous decision-making in recruiting new employees per work unit	0.008	-0.002
	Participation indicators related to decision-making at workplace	0.017***	0.017*
Total	Overall participation indicator	0.018***	0.019***

Note: ***=1%, **=5%, *=10% refer to significance level.

As Table III-4 indicates, variables which have a statistically significant correlation with ICT introduction speed are limited to whether newsletters are published regularly of the information-sharing variables, whether an intra-electronic bulletin board has been established of the consultation–related variables, and variables on work methods, work allocation and training of the workplace participation variables. Correlation with level of ICT introduction shows a similar result on the whole, thus only some variables have statistically significant correlation.

In sum, through regression analysis, overall participation indicators and participation indicators by each type have a statistically significant correlation with ICT introduction speed. In comparison with other types, participation indicators for autonomous decision-making in the workplace show the greatest correlation. And only specific indicators out of all variables comprising participation indicators have correlation with ICT introduction speed. We can interpret the above results as follows. First, ICT introduction speed is a factor that expands worker participation in overall the business including areas such as information-sharing, consultations and decision-making in the workplace. This also reflects common knowledge that introducing ICT can increase the degree of participation, considering that ICT reduces cost and time in information generation, storage and distribution,. Second, ICT is an explanatory variable as important as firm size and organizational change. Additionally, from the finding that the labor union variable has a significant correlation only with autonomous decision-making(Y3), we can conjecture that labor unions have a tendency to influence decision-making more than information-sharing and consultation. However, it is likely that the minus(-) sign of correlation could be imply that the labor unions make their efforts to raise the level of participation at other domains rather than at workplace. The result that the variable of flexibility to the market is a important explanatory variable of information-sharing(Y1) and consultation(Y2) reflects that the firm should give plenty of information about the market to employees and hear their opinions to adapt swiftly to the changes of the market. Third, considering that there is difference in the participation degree of the three different participation types (In Table III-1 the mean of ICT of participation indicators on decision-making (Y3) is higher than those of other types of participation indicators), the influence of ICT is greater in decision-making indicators than the other two types, indicating that ICT does not play a role in mitigating differences in participation degree among different types. Considering that participation-related indicators (Y1, Y2, Y3) are a point on a continuum from non-participation to full participation, in the long term, in order for decision-making participation (Y3) to function substantively, a sufficient degree of information-sharing (Y1) and consultations (Y2) are necessary. Lower values of Y1 and Y2 than Y3, at least considering the variables of the indicators, leads us to the presumption that participation in decision-making at the workplace functions imperfectly in Korea. Under the circumstances, it is concluded that ICT introduction does not play any role in correcting the imbalances. Fourth, it is interpreted that ICT introduction increases the degree of overall participation not by enhancing all participation means, but by enhancing some of the participation means. In relation to information-sharing and consultations, the higher the speed and level of ICT introduction becomes, exclusively in areas where electronic means are used such as newsletters and intra-electronic bulletin boards, the greater the participation degree

becomes. This can be interpreted that in cases where intra-electronic bulletin boards utilizing networks such as the Internet and Intranet are set up and operated, the majority of business-related information-sharing and consultations are made electronically, reducing the need for existing off-line methods such as employee consultation meetings and grievance mechanisms. As for workplace participation, businesses with a higher speed or level of ICT introduction tend to show a greater degree of participation only in areas of work method, work allocation and training, which are relatively easier to be decided at the workplace than workload, working hours and recruitment.

As seen above, analysis results on overall business levels show that ICT enhances the degree of participation on the whole, and has a positive effect on all three types of participation, contributing to the promotion of decent work through participation.

4.2 Analysis Results by Business Characteristics

It cannot be said with certainty that the effect of ICT introduction speed is similarly applied to all businesses. To explore this issue, in this chapter we classify businesses by their characteristics and calculate estimation coefficients through regression analysis between ICT and participation.

As stated in the introduction, in order to analyze the effect of ICT through participation on decent work, we analyze what effect ICT introduction has on a gap in the participation degree among businesses in different sectors in terms of equity among each sector as well as the effect of ICT introduction on overall participation on the overall business level. To this end, we first compare means of participation-related indicators among groups concerned and then compare estimation coefficients. For instance, in a case where A group's mean of participation indicators is higher than that of B group, if the estimation coefficient of A group is higher than that of B group, it is interpreted that ICT widens a gap in participation degree between groups involved. On the other hand, if the estimation coefficient of A group is smaller than that of B group, it is interpreted that ICT narrows a gap.

1) Large businesses and small and medium-sized enterprises (SME)

When we examine participation-related indicators by dividing businesses into large and small and medium sized enterprises (SME) with criteria of 300 employees, the degree of participation at large companies is exceptionally higher than at SMEs. Such differences are detected in all three types of participation. In particular, differences in information-sharing and consultations are greater than those in decision-making in the workplace.

<Table III-5> Participation-related Indicators by Large Businesses and SMEs

	Large business	SME	Significance test
No. of business	445	1318	
Information-sharing (Y1)	0.458(0.241)	0.303(0.213)	***
Consultations (Y2)	0.477(0.166)	0.335(0.18)	***
Decision-making (Y3)	0.509(0.162)	0.486(0.185)	**
Overall participation (Y123)	0.484(0.128)	0.377(0.133)	***

Note: Figures refer to mean values by each characteristic and figures in parenthesis refer to standard deviation.

Significance test is the result of T-testing on difference in each variable between large businesses and SMEs. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

As shown in Table III-6, the results of regression analysis between ICT introduction speed of large businesses and SMEs, which show a difference in participation level, are that the effect of ICT introduction speed on overall participation indicators is greater(estimation coefficient) in large businesses and statistically more significant than in SMEs.[8] By types of participation, in large businesses ICT introduction speed has a major effect on consultations, while in SMEs participation through information-sharing and decision-making in the workplace is more influenced. We guess that the necessity of expansion of consultation process using ICT is bigger in large enterprise that in SMEs. As for correlation with ICT levels, it is difficult to make a comparison between large businesses and SMEs as in some cases the number of samples falls below 30, a figure necessary to conduct statistically significant regression analysis. Yet, we detect statistically significant correlation in information-sharing and decision-making in the workplace in SMEs.

<Table III-6> Regression analysis between ICT introduction speed and participation variables of large business and SMEs

	Large businesses		Small and medium-sized businesses (LIC)	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	0.008	0.048	0.018**	0.032***
Consultations (Y2)	0.034***	0.018[a]	0.007	0.013
Decision-making (Y3)	0.007	-0.016	0.02***	0.027***
Overall participation (Y123)	0.021**	0.018[a]	0.008	0.019***

Note: ***=1%, **=5%, *=10% refer to significance level.
a: N<30

Meanwhile, considering the overall gap in participation level which exists between large companies and SMEs, ICT is generally expected to broaden a gap in the degree of participation between the two groups. By types of participation, ICT is expected to widen a gap in participation through consultations, while narrowing a gap in participation through decision-making in the workplace.

2) Manufacturing Industry and Service Industry

Next, we conducted an analysis by distinguishing businesses into manufacturing and service industry with types of industry as criteria. Based on participation-related status revealed through workplace panel surveys, in terms of the degree of participation in the manufacturing and service industry, both the overall degree of participation and the degree of participation by each type are slightly higher in the manufacturing industry than the service industry, yet the difference is not so significant. In particular, in terms of participation through decision-making,

[8] In order to show difference in estimation coefficients among groups, statistical testing is necessary in principle. However, as values of estimation coefficients between the two groups are considerably different and there is a clear distinction in statistical significance, statistical testing is not conducted in this paper. (The same rules apply in group comparisons hereafter.)

the difference between the manufacturing and service industries is not statistically significant.

<Table III-7> Participation Indicators for Manufacturing and Service industry

	Manufacturing industry	Service industry	Significance test
No. of businesses	876	777	
Information-sharing (Y1)	0.355(0.225)	0.329(0.236)	**
Consultations (Y2)	0.392(0.189)	0.342(0.18)	***
Decision-making (Y3)	0.492(0.164)	0.498(0.208)	n
Overall participation (Y123)	0.41(0.133)	0.389(0.152)	**

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between manufacturing and service industry. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

If we examine the correlation between the ICT introduction speed and participation-related indicators of the two business groups through regression analysis, it is found that coefficients of the service industry are higher than those of the manufacturing industry on the overall participation level, yet both of them are not statistically significant. By participation types, in terms of participation through decision-making at the workplace, it is statistically significant that businesses with faster ICT introduction speeds tend to have a higher degree of participation in the manufacturing sector than in the service sector. In terms of participation through information-sharing, a statistically significant correlation is shown only in the service industry. In other words, as for information-sharing, businesses with faster ICT introduction tend to have a higher degree of participation in the service sector only. Meanwhile, as for the correlation with ICT introduction levels, businesses with a higher level of ICT introduction tend to have a higher degree of participation through information-sharing in the service industry than in the manufacturing industry.

<Table III-8> Regression Analysis on ICT Introduction Speed and Participation Variables of manufacturing and service industry

	Manufacturing industry		Service industry	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	0.011	0.027**	0.021*	0.042***
Consultations (Y2)	0.011	0.014	0.012	0.014
Decision-making (Y3)	0.017**	0.016	0.015	0.021
Overall participation (Y123)	0.009	0.012	0.015	0.03***

Note: ***=1%, **=5%, *=10% refer to significance level.

Although difference in participation indicators between the manufacturing and service industries is statistically significant, its absolute value is not so significant, and therefore bears no great significance in estimating what direction ICT will affect a gap in the degree of participation between the manufacturing and service industries.

3) ICT industry/Non-ICT industry

Next, concerning the participation of businesses surveyed on the criteria of ICT and non-ICT industry, the participation degree of the ICT industry is considerably higher than that of the non-ICT industry, although there is a problem of representation due to the big difference in the number of businesses which were surveyed. And except for participation through decision-making in the workplace, the differences are all statistically significant. In particular, the differences are particularly great in terms of information-sharing and consultations.

<Table III-9> Participation Indicators for the ICT and Non-ICT Industry

	ICT industry	Non-ICT industry	Significance test
No. of businesses	134	1666	
Information-sharing (Y1)	0.431(0.242)	0.334(0.228)	***
Consultations (Y2)	0.452(0.186)	0.362(0.185)	***
Decision-making (Y3)	0.523(0.194)	0.49(0.177)	n
Overall participation (Y123)	0.449(0.148)	0.399(0.136)	***

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between ICT industry and non-ICT industry. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

It is difficult to compare the correlation between ICT and participation of the two business groups as significant regression analysis is impossible due to the small number of measurement values in the ICT business group. However, as shown in table III-10, there is a clear difference between ICT businesses and non-ICT businesses in terms of the effect of ICT introduction speed on participation, although it is not statistically significant. In businesses which belong to the ICT industry, although not significant statistically, businesses with a faster ICT introduction speed tend to have a lower degree of participation. On the contrary, in the non-ICT industry, ICT introduction speed has statistically significant plus(+) correlation with not only overall participation degree but also all types of participation, reflecting that businesses with faster ICT introduction speed tend to have a higher degree of participation. Analysis utilizing the level of ICT introduction produces similar results as ICT introduction speed on the whole, but in terms of participation through decision-making at the workplace, the ICT industry shows plus correlation, with higher significance level than non-ICT industry. If lack of measurement values is considered, there is no choice but for a limited interpretation thereof. However, correlation between ICT introduction and participation degree as distinctively expressed in the non-ICT industry having a relatively lower participation degree in comparison with that of the ICT industry, could be interpreted that the in the non-ICT industry, which is expected to show low diffusion of ICT, ICT introduction is linked to expansion of participation.

Meanwhile, it is difficult to interpret what effect ICT introduction has on a gap in

participation degree between the ICT industry and non-ICT industry.

<Table III-10> Regression Analysis on ICT Introduction Speed and Participation Variables of ICT Industry and Non-ICT Industry

	ICT industry		Non-ICT industry	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	-0.064*[a]	-0.129*[a]	0.020***	0.042***
Consultations (Y2)	-0.017[a]	0.023[a]	0.013**	0.015*
Decision-making (Y3)	0.032[a]	0.144**[a]	0.016**	0.015*
Overall participation (Y123)	-0.019[a]	-0.011[a]	0.011**	0.02***

Note: ***=1%, **=5%, *=10% refer to significance level
a: n<30

4) Businesses with or without labor unions

Next, we explored what difference exist in the correlation between ICT introduction and participation, depending on whether a business has a labor union or not. Regarding the degree of overall participation, businesses with labor unions have a higher degree of participation than businesses without labor unions. As for types of participation, companies with labor unions have a higher degree of participation in terms of information-sharing and consultations. On the other hand, although the difference is small compared with differences shown in information-sharing and consultations, companies without labor unions show a higher degree of participation in terms of decision-making in the workplace, yet this is not statistically significant.

<Table III-11> Participation Indicators for Businesses with or without Labor Unions

	Business with a labor union	Business without a labor union	Significance test
No. of businesses	682	1119	
Information-sharing (Y1)	0.400(0.252)	0.306(0.209)	***
Consultations (Y2)	0.418(0.188)	0.340(0.18)	***
Decision-making (Y3)	0.485(0.182)	0.497(0.178)	n
Overall participation (Y123)	0.440(0.145)	0.381(0.130)	***

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between businesses with a labor union and businesses without a labor union. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

If we look at the effect of ICT introduction on participation in the two business groups, in terms of overall participation degree, businesses with labor unions which have faster ICT introduction speed tend to have a higher participation degree than businesses without labor unions and the correlation in businesses with labor unions is statistically significant. By participation type, businesses with labor unions, compared with businesses without labor union, show a relatively distinctive correlation in terms of consultations and decision-making in the workplace, and businesses without labor unions show a distinctive correlation in information-

sharing. These results can be interpreted that ICT introduction has a correlation with consultations and decision-making in the workplace, which are more advanced types of participation, in businesses with labor unions compared with businesses without.

The difference in correlations between the two business groups offer implications that ICT introduction is likely to widen a gap in participation between businesses with labor unions and businesses without on the overall level. In terms of types of participation, it is expected that ICT introduction will widen a gap in participation through consultations and yet will narrow a gap in participation through information-sharing. Correlation with the level of ICT introduction shows similar results.

<Table III-12> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with or without a Labor Union

	Businesses with labor unions		Businesses without labor unions	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	-0.0003	0.021	0.021**	0.037***
Consultations (Y2)	0.033***	0.041***	0.002	0.009
Decision-making (Y3)	0.023**	0.014	0.014*	0.018
Overall participation (Y123)	0.019**	0.023*	0.004	0.016**

Note: ***=1%, **=5%, *=10% refer to significance level.

5) Businesses with high or low level of ICT introduction

In analyzing the correlation between ICT introduction and participation, the degree of ICT introduction speed and ICT level can serve as two different criteria for classifying businesses. Among the two standards, the level of ICT introduction is a criterion which can determine the characteristics of a business as it is a result of past investment. On the other hand, ICT introduction speed is related to annual ICT budget expenditure. In this paper, by utilizing quartile, businesses whose ICT capital stock belongs to the upper 50% are defined as businesses with a high level of ICT introduction, and businesses whose ICT capital stock belongs to the lower 50% are defined as businesses with a low level of ICT introduction. As for the degree of participation, businesses with a higher level of ICT introduction had higher participation in terms of both overall participation level and participation indicators by type.

<Table III-13> Participation Indicators for Businesses with High or Low Level of ICT Introduction

	Businesses with high level	Businesses with low level of	Significance test
No. of businesses	279	279	
Information-sharing (Y1)	0.353(0.221)	0.237(0.192)	***
Consultations (Y2)	0.383(0.18)	0.296(0.167)	***
Decision-making (Y3)	0.52(0.184)	0.454(0.182)	***
Overall participation (Y123)	0.421(0.128)	0.332(0.124)	***

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation.

Significance test is the result of T-testing on difference in each variable between businesses with high level of ICT introduction and businesses with low level of ICT introduction. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

In the two business groups, analysis of the correlation between speed of ICT introduction and participation indicators produces statistically insignificant results in most cases. Statistically speaking, it signifies that, unlike initial expectations, in conducting an analysis of the correlation between ICT introduction speed and participation classification of businesses by different levels of ICT introduction does not bear any great significance. We can interpret this result to conclude that the tendency of businesses with a faster speed of ICT introduction to have a higher degree of participation, which was discussed earlier, is detected regardless of the ICT introduction speed of the businesses.

<Table III-14> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with High or Low Level of ICT Introduction

	Business with high level of ICT		Business with low level of ICT	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	0.023	0.045**	-0.003	-0.015
Consultations (Y2)	0.0003	0.019	-0.008	-0.029
Decision-making (Y3)	0.01	0.014	0.031*	0.041
Overall participation (Y123)	-0.0008	0.016	0.001	-0.013

Note: ***=1%, **=5%, *=10% refer to significance level

6) Businesses with High or Low Proportion of Female Workers

The issue of whether ICT can reduce a gap among businesses of different characteristics can also be understood by comparing businesses after classifying them according to their female worker proportion. Businesses with a lower proportion of female workers (businesses whose female worker ratio is lower than 50%) tend to have a higher degree of participation, although the differences between the two business groups are not so significant. The differences are greatest in participation through consultations, which is statistically significant.

<Table III-15> Participation Indicators for Businesses with High or Low Proportion of Female Workers

	Business with high proportion of female workers	Business with low proportion of female workers	Significance test
No. of businesses	641	641	
Information-sharing (Y1)	0.331(0.229)	0.343(0.232)	N
Consultations (Y2)	0.347(0.18)	0.381(0.192)	***
Decision-making (Y3)	0.495(0.177)	0.488(0.191)	N
Overall participation (Y123)	0.394(0.136)	0.409(0.144)	N

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between businesses with high proportion of female workers and businesses with low proportion of female workers. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

As for the result of analysis on ICT introduction speed and participation, it was found that

most of the participation indicators do not show any statistically significant correlation in businesses with a high proportion of female workers. On the other hand, in businesses with a low proportion of female workers both overall participation indicators (Y3) and participation indicators by type show statistically significant plus estimation coefficients. From this, we can interpret that the level of participation increases with faster ICT introduction in businesses with a high proportion of male workers, rather than businesses with a high proportion of female workers. However, as there is no statistically significant gap in the degree of participation between the two business groups with the exception of participation through consultations, it is difficult to make a statistically significant estimation on the effect ICT investment has on the disparity in participation between the two groups. Yet, the difference in participation through consultations is expected to increase with ICT introduction.

<Table III-16> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with High or Low Proportion of Female Workers

	Business with high proportion of female workers		Business with low proportion of female workers	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	-0.003	0.029**	0.035***	0.049***
Consultations (Y2)	0.008	0.02*	0.02*	0.01
Decision-making (Y3)	0.015*	0.013	0.022**	0.026*
Overall participation (Y123)	0.002	0.02**	0.02***	0.021*

Note: ***=1%, **=5%, *=10% refer to significance level.

7) Businesses with fast or slow responses to the market

As stated in the introduction, the recent interest in worker participation has been generated by the need for more flexible and participatory "high-performance" organizations to respond to the rapidly changing corporate environment. Given this, the degree of business response to the market may serve as a good standard in analyzing the effect of ICT on participation. Table III-17 on the participation of businesses classified by the criteria show that, as anticipated, businesses that respond faster to the market tend to have a higher degree of overall participation, and the difference between the two groups is statistically significant. Yet, in terms of participation type, there are considerable differences in participation through information-sharing and consultations, whereas there is little difference in participation through decision-making at the workplace, which is statistically not significant.

<Table III-17> Participation Indicators for Businesses with Prompt or Slow Response to the Market

	Business with prompt response to the market	Business with slow response to the market	Significance test
No. of businesses	631	566	
Information-sharing (Y1)	0.390(0.225)	0.324(0.227	***
Consultations (Y2)	0.423(0.182)	0.354(0.182)	***
Decision-making (Y3)	0.508(0.17)	0.489(0.17)	n
Overall participation (Y123)	0.438(0.128)	0.392(0.136)	***

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between businesses with prompt response to the market and businesses with slow response to the market. ***=1%, **=5%,

*=10% refer to significance level, and n means 'not significant'.

If we examine the correlation between ICT introduction speed and participation indicators of the two business groups, it is revealed that in businesses with prompt responses to the market, faster ICT introduction tends to result in a higher degree of overall participation and the difference between two group is more than double. (Statistical significance is shown only in businesses with prompt responses to the market.) As for correlations by participation type, in terms of participation through information-sharing and decision-making at the workplace, faster ICT introduction tends to lead to a higher degree of participation in businesses with prompt responses to the market, rather than businesses that are slow to respond. (Statistical significance is shown only in businesses with prompt responses to the market.) However, in terms of consultations, businesses with slow responses to the market show a higher degree of participation with faster ICT introduction speed. (Statistical significance is shown only in businesses with slow responses to the market.) These results signify that businesses which are prompt in responding to the market encourage worker participation to a greater degree in order to make flexible responses in the process of which ICT expands information-sharing and participation in decision-making and thereby enhances the overall level of participation.

Meanwhile, it is deduced from these findings that investment in ICT plays a role of widening a gap in participation between the two groups in terms of overall level and information-sharing while reducing a gap in consultations. (it is difficult to make an estimation on decision-making at the workplace as the difference between the two groups in this aspect is not statistically significant.) Analysis results based on the criteria of ICT levels make similar deductions possible.

<Table III-18> Regression Analysis on ICT Introduction Speed and Participation Variables of Businesses with Prompt or Slow Response to the Market

Variable	Business with prompt response to the market		Business with slow response To the market	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	0.024**	0.051***	0.006	0.023*
Consultations (Y2)	0.01	0.012	0.016*	0.013
Decision-making (Y3)	0.029***	0.009	0.006	0.019*
Overall participation (Y123)	0.015**	0.024**	0.006	0.014

Note: ***=1%, **=5%, *=10% refer to significance level.

8) Subcontractors and parent companies

The effect of ICT on decent work may differ, depending on whether a business is a subcontractor belonging to a parent company which has a subcontractor. The reason is as follows. Businesses with subcontractor relations with a parent company have less independence and discretion as they are highly subject to opinions of a parent company in various fields affecting quality of work such as production methods, production amount and working hours. This situation is expected to affect the utilization of ICT.

If we look at the participation level of businesses classified into subcontractors and parent companies, as anticipated, the participation level is lower in subcontractors than in parent companies. By participation type, differences in information-sharing and consultations are relatively big and statistically significant while the difference between the two groups in autonomous decision-making is relatively small and statistically insignificant.

<Table III-19> Participation Indicators for Subcontractors and Parent Companies

	Subcontractor	Parent company	Significance test
No. of businesses	326	355	
Information-sharing (Y1)	0.336 (0.196)	0.417 (0.233)	***
Consultations (Y2)	0.369 (0.169)	0.44 (0.18)	***
Decision-making (Y3)	0.496 (0.180)	0.503 (0.168)	n
Overall participation (Y123)	0.402 (0.128)	0.452 (0.127)	***

Note: Figures refer to mean values by each feature and figures in parenthesis refer to standard deviation. Significance test is the result of T-testing on difference in each variable between subcontractors and parent companies. ***=1%, **=5%, *=10% refer to significance level, and n means 'not significant'.

The regression analysis shows that the effect of ICT introduction speed on participation level is greater in subcontractors whose level of participation is relatively lower. Yet, there are no areas which are statistically significant for both of these business groups. However, estimation coefficients of subcontractors are all statistically significant, except for participation through information-sharing. By participation type, subcontractors show a greater tendency of participation being higher with faster ICT introduction when participation takes place through consultations and decision-making in the workplace rather than through information-sharing. If this result is considered in conjunction with differences in participation level between the two groups, it can be predicted that ICT would reduce a gap between subcontractors and parent companies in the area of participation and that its effect would be greatest in consultations.

Similar results are shown in our analysis of the correlation between ICT introduction and participation.

<Table III-20> Regression Analysis on ICT Introduction Speed and Participation Variables of Subcontractors and Parent Firms

Variable	Subcontractor		Parent firm	
	LIC	LKC	LIC	LKC
Information-sharing (Y1)	0.021	0.039	0.04*	0.051*
Consultations (Y2)	0.027*	0.066***	0.008	-0.011
Decision-making (Y3)	0.053***	0.066***	0.007	-0.004
Overall participation (Y123)	0.028**	0.056***	0.017	0.005

Note: ***=1%, **=5%, *=10% refer to significance level.

5. Summary and Conclusion

5.1 Summary

This paper has discussed the correlation between worker participation and the speed and level of ICT introduction in businesses from a perspective of decent work through regression analysis. Analysis results are summarized as follows:

First of all, on the overall business level, a statistically significant result was produced, showing that businesses with a higher speed of ICT introduction have a higher level of overall participation. Moreover, the result of analysis according to the three participation types of information-sharing, consultations and decision-making in the workplace shows that the speed of ICT introduction and the degree of participation have statistically significant plus(+) correlations in all three areas. Among the three types, the correlation between ICT introduction speed and participation in decision-making was relatively greater than other areas. Meanwhile, only some of the variables comprising specific participation indicators had statistically significant correlations with ICT.

The results of regression analysis on the correlations between ICT introduction (speed and level) and participation by business characteristics showed different aspects according to the different characteristics. When large businesses with a relatively high level of participation are compared with SMEs with a relatively low level of participation, the correlation between ICT introduction speed and participation was greater in large firms than SMEs overall. By participation type, large firms showed a greater tendency of displaying a higher degree of participation in consultations than SMEs when the businesses had a higher level of ICT introduction. Adversely, SMEs showed a greater tendency to display a higher degree of participation in information-sharing and decision-making in the workplace with higher ICT introduction. The differences in correlation between the two groups lead to a prediction that investment in ICT will widen a gap between large businesses and SMEs in terms of participation on overall level and participation through consultations, and that investment in ICT will narrow a gap in terms of information-sharing and decision-making at the workplace.

Between the manufacturing and service industries, the difference in the degree of participation was not so significant and correlation between ICT and participation did not show statistically significant distinct differences.

By contrast, as for comparisons between the ICT industry and the non-ICT industry, there was a significant difference in participation degree and there was also a big difference in correlation between ICT and participation, although not statistically significant due to lack of measurement values. In the ICT industry the degree of participation was higher and, although statistically insignificant, businesses with a higher speed of ICT introduction had a tendency toward a lower degree of participation. On the other hand, in non-ICT industries which showed a relatively low level of participation, there was statistically significant correlation that businesses with higher ICT introduction showed a higher degree of participation. This provides a prediction that diffusion of ICT introduction would have a greater effect on the expansion of participation in the non-ICT industry, which is expected to have a relatively lower level of informatization than the ICT industry. Yet, considering statistical significance, it is difficult to anticipate what effect ICT will have on a gap in participation between ICT industry and non-ICT industry.

Differences were also detected in results of analysis based on classifying businesses

according to criteria of whether they have a labor union or not. Participation degree was higher in businesses with a labor union on the whole, except the degree of participation in decision-making, which is not statistically significant, and a tendency that businesses with a higher speed of ICT have a higher degree of participation on the overall level, was distinctively higher in firms with a labor union. By participation type, in firms with a labor union businesses with a higher speed of ICT tended to have greater degree of participation in consultations and decision-making in the workplace. On the other hand, firms without a labor union showed such a tendency in information-sharing. This can be interpreted that ICT played a role of widening a gap in difference in participation between firms with a labor union and firms without one, yet ICT played a contrary role in information-sharing.

In an analysis where businesses were divided into firms with high level of ICT introduction and firms with a low level of ICT introduction, the former type businesses had a relatively higher degree of participation and there were no statistically significant differences in correlation between ICT introduction speed and participation degree. Thus, it is difficult to make a consistent prediction whether investment in ICT is able to reduce a gap in participation between the two business groups.

When divided into firms with high proportion of female workers and firms with low proportion of female workers, the participation degree was slightly higher in businesses with a low proportion of female workers, yet all the differences were statistically insignificant except for consultations. A tendency that firms with higher ICT introduction speed have a higher degree of participation, which is statistically significant, was detected only in businesses with a low proportion of female workers, indicating that investment in ICT would play a role of widening a gap in participation in the two groups in relation to consultations.

Where businesses were classified on the basis of their speed to respond to the market, firms with a prompt response to the market had a higher degree of participation in both overall participation and participation by type, although the difference in decision-making was not statistically significant. In terms of overall participation, participation through information-sharing and decision-making, plus correlation between ICT introduction speed and participation was greater in businesses with prompt response to the market, indicating that investment in ICT will, with the exception of participation through decision-making, further widens a gap in participation between both business groups.

Lastly, in an analysis where businesses were divided into subcontractors and parent companies, parent companies, in comparison with subcontractors, showed a greater degree of participation both in overall participation and participation by type, although the difference in decision-making was not statistically significant. However, correlation between speed and level of ICT introduction and participation degree was greater in subcontractors which have a low level of participation, indicating that ICT would reduce a gap in participation between parent firms and subcontractors with the exception of decision-making.

5.2 Conclusion

The following conclusions may be drawn if we interpret comprehensively by linking the analysis result on the effect of ICT introduction on decent work through participation in

companies with specific cases detected in actual business settings.

First of all, as for the question of whether ICT can promote decent work from a perspective of participation, we conclude that, based on results from a survey taken among businesses overall, ICT plays a role in enhancing decent work by increasing the absolute degree of participation. However, we can also interpret that worker participation in the firm is influenced by other factors that are not identified here. Thus, ICT could not be a dominant factor.

This was confirmed by our interview with a personnel manager from an ICT service provider, which started as a small venture firm with ten employees seven years ago and developed into a large firm with more than 500 employees.[9] The company had an extremely high level and scope of worker participation, to an extent that information-sharing and consultations take place vigorously through intra-electronic bulletin board; many decisions are made by worker participation; and decisions on annual salary raises are made by a personnel committee where worker representatives participate and the CEO does not intervene in the process. The personnel manager of the firm made the following comments on the company's corporate culture on worker participation:

"I don't believe that our firm's high level of worker participation is attributable to vigorous utilization of ICT. Our firm was a new type of business; thus from the beginning, we placed a priority on worker participation and this was established as corporate practice based on agreement among internal members. ICT only served as a means to efficient operate such a system at a low cost. Let's look at banks. Although they utilize ICT to a great extent, worker participation level is not so high."

As pointed out earlier, such a limited effect of ICT on participation is also linked to a general anticipation that ICT may have an effect on participation and at the same time it can be used as a means of surveillance on workers. A case in point is detected in the firm mentioned above where worker participation is high. The firm operates a call center for Internet shopping mall consultations and the call center is operated by dispatched workers by an employment agency. Their telephone consultations are largely dependent on an information technology system called Computer Telephone Integration (CTI). The system consists of a switchboard and server and has not only a basic function of allocating incoming calls, but also has various recording functions. Telephone consultations are recorded in the form of voice and statistics such as call duration and telephone tapping and intervention of a supervisor as a result of tapping is possible. The supervisor's computer connected to other computers through CTI shows the current state of telephone operators such as calls in progress, temporary vacancies, post-processing and standby. If there is a call in progress, the supervisor's computer indicates call duration and telephone number of a customer and if call duration of a specific telephone operator exceeds three minutes, a part indicating the operator blinks red, thus alerting the supervisor. The supervisor closely observes calls whose duration exceeds three minutes through monitoring and if any problem arises, the supervisor sends recommendations to the operator through a messenger and if the problem is still not resolved, the supervisor intervenes in the telephone conversation to resolve it.

[9] See case study in chapter IV for details.

Within the same company, the corporate culture of voluntary worker participation is not detected in the call center which relies heavily on ICT and overall surveillance and control of the work process through ICT are detected.[10]

Second, types of participation in which ICT introduction has a greater effect on participation through differences in correlations between ICT introduction speed and participation degree are participation through information-sharing and decision-making rather than consultations. This signifies that at present ICT is related to participation through decision-making at the workplace and has a major correlation with enhancement of participation type of information-sharing with unilateral features and has little correlation with enhancement of participation through consultations with interactive features. Third, as for analysis results by business characteristics, the effect of investment in ICT varies by business characteristic and by participation type. This implies that if a firm intends to enhance voluntary production motivation and quality of worker through worker participation by utilizing ICT, it is desirable for a firm to make investment in ICT in consideration of different business characteristics and participation types.

Next, in regard to a question whether ICT enhances decent work by reducing a gap between different business groups, first, the level of enhancement varies by business characteristic and ICT widens a gap in overall participation level (Y123) between business groups in most classifications which show statistically significant results such as firm size, labor union and response to the market (except for classification of businesses into subcontractors and parent companies). This indicates a possibility that ICT may undermine decent work from a social perspective. By participation type, there are many cases where we can predict that ICT will reduce a gap in participation in information-sharing and decision-making at the workplace and widen a gap in consultations. However, a contrasting result is produced when businesses are divided on the basis of the degree of response to the market, making it difficult to generalize the analysis. Thus, it would be more reasonable to state that various predictions can be made depending on specific business types and participation types.

Based on the aforementioned conclusions, we can draw a comprehensive conclusion as follows: The effect of ICT on the quality of labor through participation is positive within a limited scope and the effect varies depending on the specific environment and characteristics of each firm. From a perspective of social equality, ICT may have a negative effect on the quality of labor.

Lastly, this paper outlines the limitations of this research and the future directions of the research subject.

Although an attempt was made in this paper to investigate the issue of ICT introduction and worker participation from a perspective of decent work, there is still much room for further study. In order to properly analyze participation as one dimension of decent work, there should be not only surveys taken among personnel managers and labor management managers, but also surveys taken among workers of businesses and data on worker commitment to the firm by

[10] It appears that a sense of belonging to the firm of employees dispatched from outside to the call center is lower than that of employees of the firm. Such qualities of telephone operators judged by a supervisor as faithfulness and diligence are more importantly regarded than voices and ability to use PC, reflecting low morale of the operators. The firm concerned is implementing various measures to enhance their satisfaction level and sense of belonging.

different characteristics of workers. The 2002 KLI workplace panel survey does not appear to cover all these aspects. When an additional survey on workers' attitudes and satisfaction levels on participation is conducted, the correlation between participation as a dimension of decent work and new technological advances can be properly explored.

Meanwhile, worker participation in the work process which affects productivity and worker participation in profit-sharing have been a major topic of research for a number of industrial relations scholars (Note Freeman and Lazear 1995, Addison 1997, Fernie and Metcalf 1995, Kim and Feuille 1998, Won, Chang-hee and Kim, Dong-heon 1998). However, this paper only deals with aspects of information-sharing, consultations and autonomous decision-making of work units and their correlation with ICT introduction speed, not covering worker participation in returns-sharing of a firm. Although the 2002 workplace panel survey do cover questions on profit-sharing and employee stock ownership, the number of samples covering these subjects is small and it is even more difficult to find samples which answer both questions on the subjects and ICT-related questions. If surveys covering characteristics of worker participation in profit-sharing in various channels are developed in the future and the response rate on new technology-related indicators rises, a more interesting analysis on new technology, worker participation and firm performance will be possible, advancing from a traditional analysis on worker participation and firm performance.

Furthermore, as shown earlier in a case study, the fact that ICT may be used as a means of surveillance and control over workers constitutes a necessary part for better research on ICT's effect on worker participation at the workplace and to this end additional research on various cases on the subject should be conducted in the future.

IV. Case Analysis

1. Perspective on Decent Work and ICT in the Workplace

It is a well-known fact that the concept of decent work is related to the immense trend of Globalization which is causing unequal results worldwide. In phenomena, however, Globalization is progressing simultaneously with the rapid development and introduction of ICT. Also, the features of Globalization such as the liberation of international trade, the expansion of Foreign Direct Investment and the borderless movement of capital are accelerating and expanding in scope due to the introduction of ICT based on delivery networks. ICT is now acting as a mediator or enabler of the Knowledge Economy which determines our world economy. The generation, storage, sharing and diffusion of knowledge which is key in the Knowledge Economy mostly occurs through ICT whether it takes place between countries, between businesses or within a business. In a macro perspective, such ICT composes the socioeconomic environment of labor. In a micro perspective, ICT is a key factor determining a labor process and is used as a working tool, creating the detailed conditions needed to complete tasks. By enhancing our lives and institutions or threatening them (ILO 2001), ICT is one of the most important factors that can affect the decency of labor and is therefore a main subject of analysis in decent work research.

The impact of ICT on decent work is difficult to generalize transcendentally. Although ICT does have the potential to enhance the quality of work, it is hard to determine the effects it actually has. Whether this potential is realized depends on social decision (ILO 2001), and the results shown from empirical analysis or case studies regarding the issue (Zuboff 1988, Bresnahan et al 2002, Bae Kyu Shik 2003, Rubery&Grimshow 2001) are also divided. There are three possible cases that can be expected. One is of a virtuous cycle, another is of a vicious cycle, and the last is of a polarized situation with both vices and virtues occurring at the same time.

Given the limits and the positive aspect of decent work, there are two perspectives that can exist in analyzing the influence of ICT on decent work. One considers the effect ICT has on the dynamic structure of the various factors composing decent work, and the other considers the impact ICT has on the distribution of decency in labor. Through the case studies, with regard to the first perspective, we take a look at some phenomena in businesses that well-reflect the dynamics such as the corporate decision-making system and the order-giving system, participation, trade-off between working conditions, and the independence of labor, and see how these phenomena occur in relation to ICT. With regard to the second perspective, we look into how ICT affects the distribution of elements that determine decency of work.

2. Target companies of research and research methods

The effect ICT has on decent work within companies can be divided into two depending on the relationship between ICT and company. On the one hand, there are companies that produce ICT-related products and services, and on the other, there are firms that utilize or employ ICT to make their products and services. In order to consider both perspectives, the study selected five

domestic target companies representing both sides: one firm that produces ICT-related products (i.e. mobile communications devices), one which produces ICT services (i.e. portal services), two companies which utilize ICT to produce general products (i.e. automobiles, movie backgrounds), and one company, chosen for reference, which makes film backgrounds manually.

The general information of the companies is shown below.

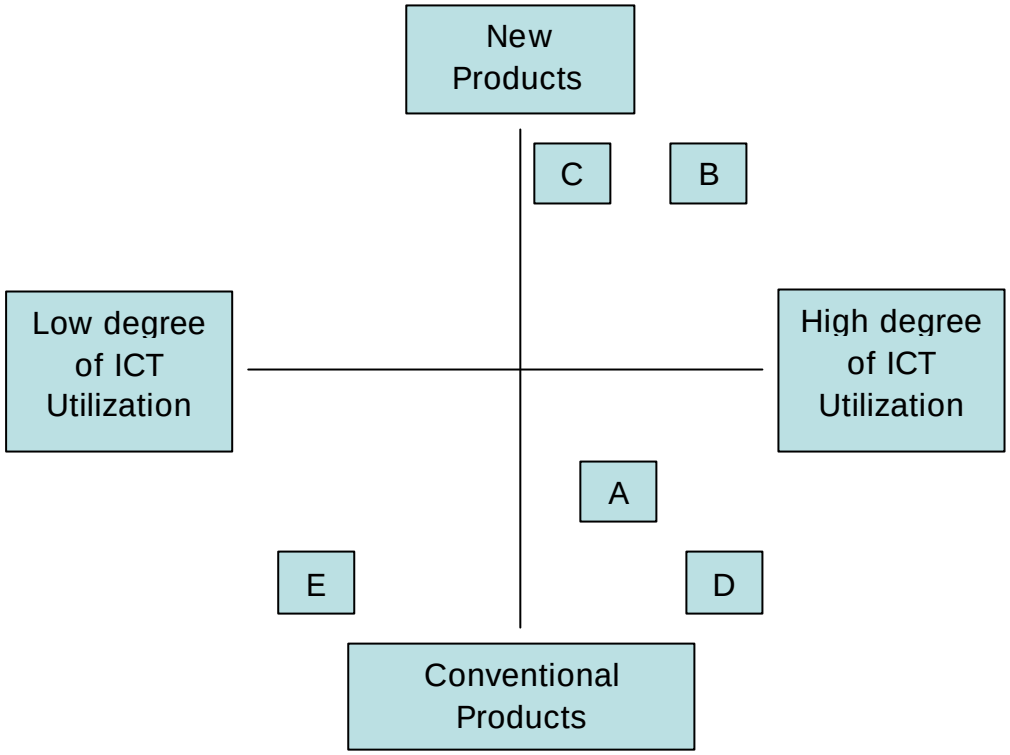
<Table IV-1> General Information on Target Companies

	A	B	C	D	E (Reference Company)
Establishment	Dec. 1944	Dec. 1995	Aug. 2001	Aug. 1998	1995
Number of Employees	30,572	405	50	30	4 + α (temporary workers)
Sales (2002)	14 trillion won	20 billion won	4 billion won	1.3 billion won	500 million won
Main Products	Cars	Internet Portal Services	Mobile Communications Devices	Movie backgrounds using computer graphics	Movie backgrounds using miniatures
Degree of ICT utilization	High degree of ICT utilization, employing computers and networks	High degree of ICT utilization, producing Internet-related services	High degree of ICT utilization, producing communications devices	High degree of utilization, using computers in most of their work	Low degree of utilization, doing most of their work manually

Company A is one of the biggest car manufacturers to use a production management system which utilizes computers in its production of cars, a conventional product; B is a big size company which started off as a venture that produces Internet portal services using ICT; C is a small-medium size company or venture that produces ICT-related hardware such as mobile phones, handheld payment devices(mobile banking terminals), PDAs and Smartphones; D is also a small-medium size firm that produces movie backgrounds, a conventional product, using ICT such as computer graphics; E is a small business similar to a household factory which makes the same products as company D only through the conventional method of miniatures. These five target companies subject to in-depth analysis can be categorized according to the novelty of their main product or service and their level of ICT utilization. The classification can be found in the diagram below.

Surveys conducted on the five companies and in-depth interviews carried out on the managers in charge were mostly used in this study. Given that it is difficult to analyze the effect that ICT has on decent work in the workplace without observing the actual working process, observations on the actual production process were also utilized as a key method of analysis.

<Figure IV-1> Classification of Target Companies



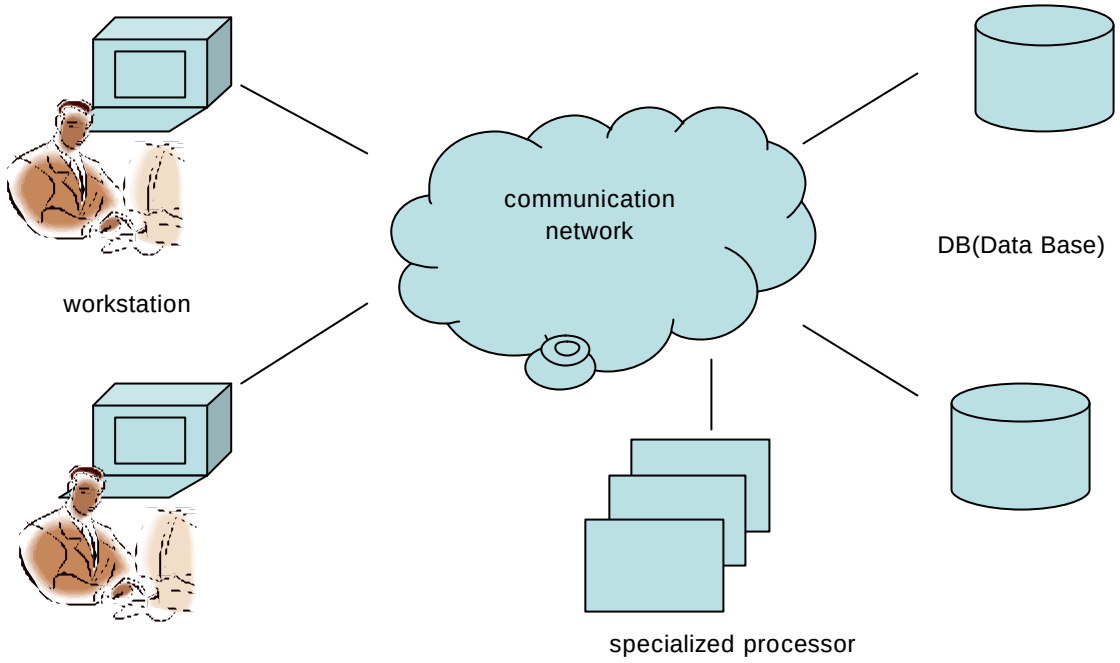
3. The significance of ICT in the workplace and the role of ICT in each company

During our visits to the companies to conduct surveys and observations on the issue of ICT and decent work, one question that we were asked was what ICT exactly referred to. Only after we explained that the PCs and the Internet used in everyday work were examples of ICT would the managers finally grasp the concept and give us explanations of how and to what extent their companies were using ICT.

According to Madnick (1991), ICT[1] in the workplace can be divided into the following categories: 1) Workstations such as Personal Computers that act as entrances in terms of ICT; 2) databases and knowledge bases to which access is shared and dispersed; 3) communications networks that connect devices and enable access to databases; and 4) specially designed processors including main frames, transition processors and super computers (refer to Diagram 4).

[1] Madnick referred to Information Technology.

<Figure IV-2> Elements Comprising ICT



Also, Madnick (1991) lists the following six elements as enablers for ICT: ? hardware and software, the general tools of ICT; ? internal networks and EDI(Electronic Data Interchange) which link devices and enable the delivery of information; ? dispersed DB capabilities which provide easy access to databases; ? Workstations that are ubiquitous, linked to networks and organized hierarchically; ? ICT architecture that acts as an integrated system encompassing devices, networks and databases; and ? the fundamentals for ICT utilization such as effective ICT-related standards, productivity in usage, and support from management as a whole. These four elements of ICT and six enablers can enhance the connectivity of companies to the world outside where today's companies are faced with the forces of globalization, stiff competition, increased level of demand on productivity and a rapidly changing environment (Madnick, 1991).

ICT which is introduced to enhance the connectivity of companies has the innate characteristic to change the work structure, which differentiates it from ICT of the past. ICT has made way for tighter integration across functions and tighter interdependence of activities, and has made it possible to respond more rapidly in real-time. At the same, ICT causes more costly consequences of errors and breakdowns(Osterman 1991).

Because of these features, ICT is not simply a tool that is provided from outside when needed for work but acts as an innate means and method of production which changes organizations and the way work is done. The above mentioned example of managers being unconscious of the ICT around them shows us how innate ICT has become in companies and workplaces.

The role of ICT in the workplace with its capability to change working methods and production methods does not have a set definition. However, it can be divided into the following four categories according to its purpose(Vendramin & Valenduc 2002). First is the most basic category where ICT is used as a facilitator for change. In this case, ICT is used like a tool set of

some sort, adapted to the needs of the user and used for change. The second category is where ICT plays the role of an infrastructure that supports change and is indispensable to the advancement of the organization. As we can see from the example of financial services, ICT has become an essential infrastructure in creating services so much so that the provision of new services is halted if such technology fails to work. ICT can also play a more active role as an inciter to innovation. For example, the advancement of Internet and media-related ICT has led to the creation of a wide variety of innovative multi-media products in the printing industry such as e-books and on-line newspapers. Lastly, the systematic characteristics of ICT enable it to undertake the role of translator, changing abstract organizational structures into concrete ones. An example of ICT as a translator would be integrated systems such as ERP.

When we look at the ways the target companies are related to ICT and categorize the companies using the classification of ICT noted above, we can find a difference between them[2]. First, in companies C and D, ICT is used as working tools to produce mobile phones and movie backgrounds respectively, acting as a facilitator for change under the aforementioned classification. The only difference is that C makes products related to ICT. In company B, ICT both acts as an infrastructure essential to change in that it creates products which cannot be produced without ICT (i.e. portal services), and also as an inciter to innovation in that ICT is used to create innovative products (i.e. Internet-enabled multi-media and electronic-newspapers found in the portals). The ICT used in Company A makes the organizational structure more concrete as the company utilizes an enterprise data management system for production which uses a network linking the company's main computer with production lines of all the plants and even with parts suppliers.

The main role that ICT plays in each corporation is a key standard that differentiates the companies from one another and the case analysis that follows in this study will also be carried out along these lines.

4. Individual Cases

4.1 The Enterprise Production Data System of Company A & the Disparity between Office Workers and Line Workers

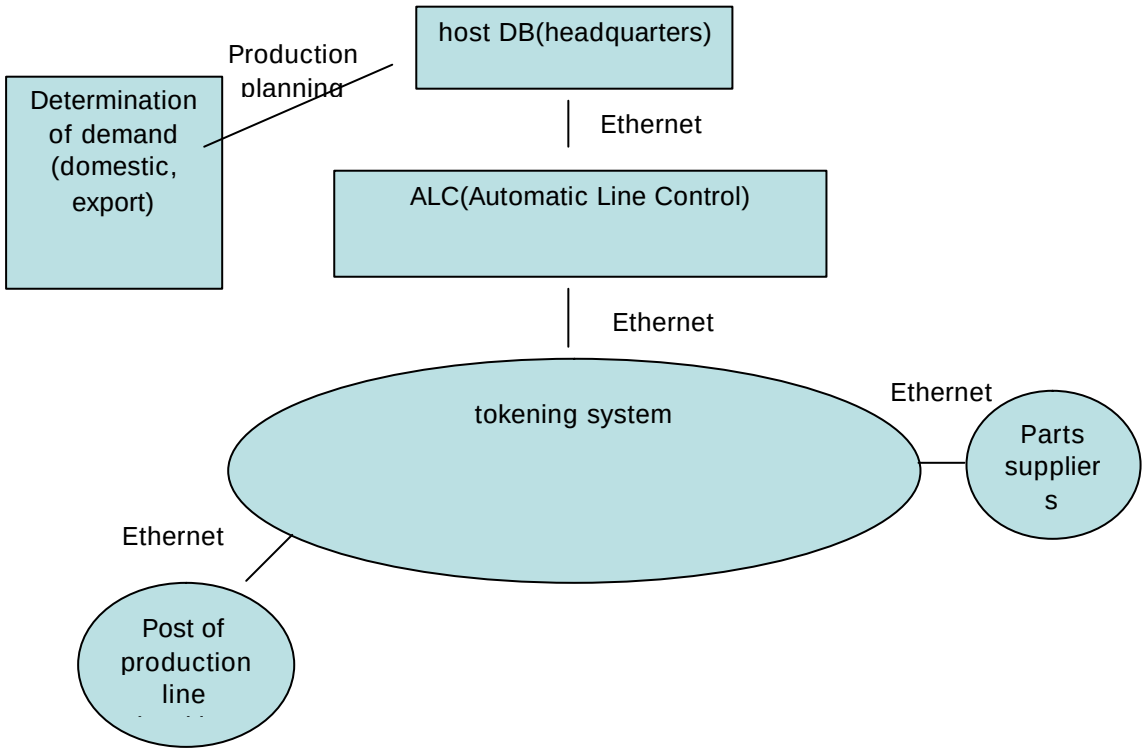
Company A is an auto-maker which manages its entire process, starting from the determination of demand to delivery, with an integrated information system. The overall lay-out of the system is as follows. First of all, the production planning department of the headquarters establishes a production plan based on the demand for their products which is determined by data collected through its distributors worldwide. The established production plan is stored in the host DB of the headquarters and is sent through the Ethernet, a standard specification network, to the ALC (Automatic Line Control) systems installed in every plant both home and abroad. The ALC in the plant we visited is connected to a tokening system which includes not only each post of the production line but also parts suppliers. Working orders are transmitted to

[2] It is difficult to determine the four companies use ICT comprehensively in all fields of business. As previously noted, this is because ICT is a method of production deeply incorporated in the work process, not a mere tool.

each post according to the production plan while at the same time, information on the parts that are needed including the amount and the date of delivery is sent to parts suppliers. Conversely, mistakes or errors that occur at each post are reported to the central system (refer to diagram).

If we look at how information is created, stored and diffused within this system, we can see that information (data on current production, demand, halt of production) is created at each point (distributors, production post) manually (market demand and errors are reported over the phone) by the managers in charge or automatically by sensors that read information moving in and out of each post of the production line. The information created as such in stored in the ALC and the headquarters' Host DB and is diffused through the Ethernet. Employees are given different access to the stored information according to their rank and file. Employees in charge of production management, for instance, can have access to all of the information on the cars that are being made in all of their plants and production lines by simply entering their corporate ID number and name into the system. These employees can see what car is in which line and to what extent it has been completed. A situation board in the office of the production management department displays the target production amount which changes with time by calculating the tack time of each process and the minutes needed for operation. At the same time, the board shows the actual amount of production which is calculated based on real time information that is automatically input by sensors on the production lines mentioned above. The situation board also displays colors to show whether each process is operating normally (green at times of normal operations, red for abnormalities), and when a production line halts operation, both the

<Figure IV-3> The Enterprise Production Data System of Company A



worker responsible for the line stop and the department of production management are required to enter the reason behind the suspension of operations. Company A uses the production system implemented in Mitsubishi Motors of Japan, and the tokening system connecting each work station is that of Mazda.

The ICT used by company A, that is, the Enterprise Production Data System, determines all working methods in the company's plants in all aspects. Not only the A but also A's suppliers who provide parts to the company are affected by it.

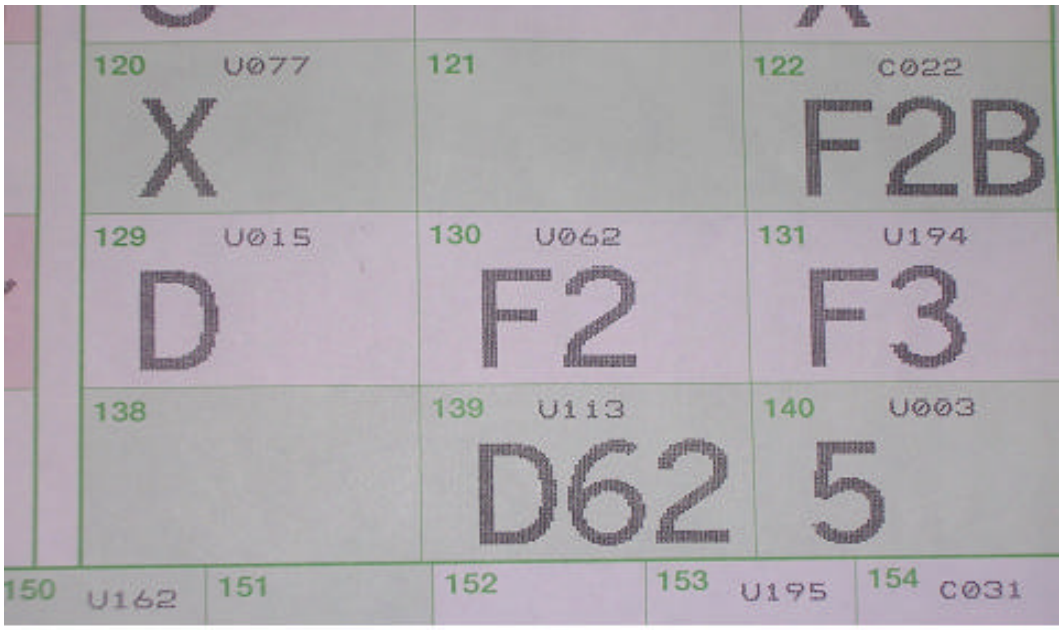
Let's take a more detailed look at how working methods are determined by such technology. Within this system, the work orders determining working methods are made according to the following stages noted below.

1. A production plan is established by the production department of the company headquarters. This plan is cut down into weekly units, and sequences are determined on a daily basis. About three days before the car frame is put in the production line, the vin number of each car is selected.
2. Work orders, which are indicated in 13 digit codes, are made in the headquarters' production department based on the results of stage 1. While car specifications are made in stage 1 for the purpose of sales, work orders are made in stage 2 in the form of production specifications and are made up of information needed for production.
3. In the company's central production system, FSC and 219 data is added to the work orders made in stage 2 and the entire data needed for production in each post is created. FSC (Full Spec Code) is a comprehensive data code of a car and includes the MI (Model Index) which is a code indicating eight features of a car such as the car type, form of the car frame and the engine, as well as the OCN (option combination number) which holds information on the options installed in each vehicle. The 219 code holds additional information regarding options of main parts such as tires or the engine.
4. The comprehensive work data that is compiled as noted is delivered to sub-systems such as the pressing system, welding system, painting system and the assembly system through the ALC (assembly line control) system which is installed in each plant[3]. To the pressing department where car bodies are produced through stamping, the ALC system gives the equipment value needed to move equipment, and to the painting system it provides information on color. Meanwhile, the ALC provides B/C(broadcasting), an assembly order table, to the FMR system which is in charge of the assembly process. (The assembly system is referred to in different ways depending on the type of car, the FMR being just one type of such system.) So when the painted car body comes out of the paint shop, the data on the car is input by scanning a previously attached barcode and the car is trimmed-in to the assembly system after the B/C matches the data that has been output.
5. The B/C output from the assembly system, or in this case the FMR system, is attached to the raised hood. Based on this data is decided what parts will be inserted or attached by whom and where.

[3] Cars are generally produced through the process of pressing (steel panels cut from raw material is used to form the parts that make up the body of the car), welding (the steel panels made in the pressing department are welded together to shape the car body), painting (the car is pained and dried off for protection and appearance of the exterior), and general assembly (parts are assembled and attached).

The picture below shows the B/C.

<Picture IV-1> The B/C of Company A



As shown in the picture, there is a work order code, u062, attached to every serial number from 1 to 154 which represent each process (u062 is related to serial number 130 in the picture). This code is made up of a letter that stands for color and the number representing the part. For example, code u062 refers to part no. 062 which has a '**u**nique color' i.e. does not distinguish color. This code is matched with a value of F2. In this case, the worker on the 130th work post is required to pick a part with an F2 specification amongst the 062 parts and attach it to the car. If we suppose that code u062 refers to the engine, for instance, F2 is a 3000cc engine with the specification '2', and D1 is a 2000cc engine with the specification '1'. If F2 is matched to our u062 code, the worker who received this order would install a 3000cc engine that fits specification '2' where the engine should be. The meanings behind 'D', 'F', '1', '2' and so forth differ depending on the car model and is decided prior to production.

Before an ALC system connected to an enterprise production data system was implemented, data on the car model, the related parts needed for the various options, the characteristics of the parts and so forth was printed out on paper in a matching table and given out to the line workers. This piece of paper included data relevant not only to one individual but other workers as well. The workers also had to keep in mind the model, the importing country and the options of the car lying on their work station. However, with the introduction of ALC, workers now see information related to their post only and receive only simply orders. (Although data concerning other people's work can be seen on the B/C, the information is indicated in the form of a value, for instance 'F2', so other workers do not know the meaning of the code.)

We observed a post to see how data was received and how the job was carried out. The main target of our observation was the torque process which was recommended by the field manager on our request for the most difficult work process. In this process, parts are inserted using wrenches which come in three types; impact, oil-pulse and shut-off. The shut-off method is used

for the main parts such as safety belts and the wrenches stop automatically when reaching a certain level. The reason that this process is difficult is because the bolt's torque has to fit the standard. When various models are in the line and when the defined torque is different for each part, tightening the bolt to fit the part can be strenuous and difficult. However, we found the actual process to be taking place quite easily. First of all, there was a table that had decoded the B/C and it was posted over the work station. This decoded table explained the action that should take place according to the value indicated on the B/C, so all the worker needed to do to complete his job was find the value on the B/C posted on the car and carry out the action written down on the table. Moreover, the actual workers on the scene knew the decoded table by heart and were attaching the parts with just a glance at the B/C to know what wrenches were to be used and how. If the ALC was not providing any value to the workers, they would have to carry out their jobs after considering the various changes that had to be made according to the model and the options. But thanks to the ALC, all the workers had to consider was the B/C value.

The production method managed by the ALC within the enterprise production data system is also related to module production which is highly popular in car making. Modulization is a production method that is being attempted in order to decrease the cost and risk of completed car makers by entrusting the planning, quality management and production of parts to parts suppliers. Although introducing ICT does not necessarily enable such a production method to appear, a developed modulization might be difficult without employing advanced ICT. Especially in the case of parts which have to be attached in regular sequence, different parts with different specifications have to be attached depending on the model and option of the car that appears on the line. As the ALC data system is linked by a network to the systems of its suppliers, suppliers know what module parts will be needed in the future and supply them according to this schedule. For example, instrument panels (the front part of the car interior that includes the dashboard, air-conditioning unit and so forth) which are currently installed as completed modules, have a wide variety of compiling parts depending on the option of the car. If the parts supplier and the plant's ALC are not connected, much time and cost would be needed to assemble the panels through modulization. This would make it difficult to use module production which have to deal with many different models and options[4].

Such a computer and network aided work ordering system and module production make tasks of the production line easier than before. A section chief in charge of production management at company A assessed the work at the assembly line as follows.

The assembly process is simple and therefore gives little room to develop one's capabilities.

This statement is an example of the skill accumulation of individual workers who are in charge of a particular job in the production line under a production system which is automated and controlled by the employment of ICT. The aforementioned simplification of work orders

[4] The recent shift from the simple module assembly outsourcing system mostly used in small production, where the completed auto maker would solely decide the parts, material and price composing the module, to a new system where the responsibility of developing and manufacturing modules is given to suppliers (Jo Chul 2002) would have also been difficult without the close connection in the systems between suppliers and completed car manufacturer.

and modulization of parts production make it difficult for workers to accumulate skill while they reduce the time needed for production and simplify operations. Along with modulization, production control by the ALC within an enterprise production system also makes work simpler and easier, therefore, reducing the difficulty that workers would meet on the job. However, this 'simplification' has also greatly reduced the possibility of workers taking interest in the work of others whereas a worker in a particular post in the past would have had to know the models and options of the cars on the entire line. Such 'isolation' and 'division' limit the amount and level of skill a worker can accumulate. While the introduction of ICT affects line workers as stated above, managers related to system planning and management are demanded higher levels of knowledge and skill than before as systems become more complex and sophisticated. This is an example of the polarization of workers' skills as a result of ICT,, which is important in determining the decency of labor.

4.2 Company B's expansion of workers' participation based on ICT and its limits

Company B is one of the earliest businesses in Korea to provide internet portal services and has shown the fastest growth of such firms. The most impressive feature of this company is the participatory culture amongst the employees with regard to ICT.

In this company, it is not unusual for employees to send e-mails to the CEO directly. One might say that such an atmosphere is possible because the CEO is an entrepreneur in his late 30s who has gone through wind and high water with the rest of the employees since the business was started. Nonetheless, it is not easy for regular employees to communicate through e-mail with the CEO of a company which employs more than 400 people and records an annual revenue of 20 billion won which is quite a large amount for a portal service provider. In this environment, the workers of company B experience an extremely high level of participation and this is exemplified in the following two examples.

The first example is the company's electronic bulletin board which they call the 'open forum'. Not only does company B provide information to the employees through this electronic board[5] but it also actively collects the opinions of the workers and important matters of decision are being settled according to the result of discussions that take place on the bulletin board. The HR manager of the company pointed out that changes in the leave system, the smoking ban, how employees should address each other were all issues that were discussed on the board and were decided based on these discussions. In the case of the leave system, for instance, the company had partially implemented the five day workweek, taking every other Saturday off, and employees were given 24 days leave a year. This was changed to 36 days leave a year, and each individual employee is now allowed to choose between a five-day workweek, every other Saturday off, ten consecutive days leave, or leave used whenever they want. The 'open forum' played a big role in leading this change. Employees first requested a change in the leave system

[5] Other than information on personnel and matters of confidentiality, company B discloses all information on the company Intranet. All employees may take part in any meeting they deem necessary for their job including Board of Directors meetings. All employees are allowed to post information on the Intranet. However, access to information within intranet is different according to the rank of the worker.

on the discussion board and discussed the issue amongst each other. The HR manager then collected the opinions posted on the bulletin board, officially requested a change in the leave system and this issue was put on the board for a month of discussion. The HR department then drew up a draft proposal of the leave system which was decided after a series of off-line discussions through open meetings and so forth.

A second example is the establishment and operation of a Personnel Committee. Company B has a Personnel Committee which acts as a Work Council but is extremely different from that of other businesses. The company has made it a main principle to have corporate decisions made through horizontal committees such as the management committee, the personnel committee, the service committee, the technology committee and a voluntarily established planning group. The personnel committee has the company's HR Department chief as chairman and is comprised of four people representing employees and four managers nominated by the chair. Any regular employee is eligible to be selected to represent the workers regardless of his or her rank. The HR manager explained that the reason the personnel committee was established was to prevent discontent among the employees beforehand by having employees representing labor participate in a committee to execute personnel-related work such as restructuring. Basically, the committee plays a role in coordinating two sides of firm: the management and the employees. The biggest authority of the committee, however, is the right of personnel management. Company B has an annual salary system based on strict appraisal of achievement such as multi-source assessment, and decides the annual salary of employees each year based on past performance. Performance appraisal takes place based on an individual's achievement regardless of his or her rank. Company B puts relatively little importance on rank and therefore annual salary is a very important index that shows an individual's capabilities and achievements. Although the final decision concerning annual salaries is made through negotiations with individual employees, performance appraisal and the arrangement of annual salary is made through the personnel committee in which both labor and management take part and from which the CEO is fundamentally excluded (There is no separate box for the CEO to sign in the related documents which means that the CEO's authorization is not required.) This committee is managed by ICT to a large extent. Notices for upcoming meetings and related documentation distributed prior to the meetings are sent out through e-mail or the company's on-line messenger and meeting results are posted on the corporate Intranet.

Then what role is ICT playing in the success of company B's participatory culture? It is a fact that the various forms of participation including the active provision of information, opinion collection and participation in decision making are taking place through ICT. In fact, the active provision of information and discussion that can be seen in the 'open forum' are things that could not have easily come about had it not been for ICT. However, the following statement made by the HR manager shows us that this judgment has its limits.

'I don't think that our workers show a high level of participation just because we use ICT a lot. Being a new form of business, our company put priority on the participation of our employees from the very start. This took root as a corporate decision under the agreement of the inner members, and ICT was just a means to manage this efficiently and cost-effectively. Take a

look at banks. They utilize ICT a lot, but their workers aren't that enthusiastic about participation, are they?'

As such, company B put more importance on the company's situation of having to provide new portal services to Internet users who share a relatively more horizontal culture as a factor determining the corporate culture of participation than on ICT itself. This demonstrates that ICT can have an influence on labor not only through the material aspect of technology but also through the environmental aspect of the ICT market where the tastes of consumers change rapidly and where there is a relatively high level of competition. It is also an example that shows us that businesses within this market are introducing and utilizing ICT at strategic levels to create a high-performance organization based on participation.

The example of company B's call-center which deals with its on-line shopping mall, also gives us an understanding on how limited an influence technology itself has on participation.

Company B has been operating an Internet shopping mall within its portal since December, 1999, and set up its own call center in October of the following year to enhance its customer services by receiving customer inquiries. The center is located in a separate building about 10 minutes by car from company headquarters and is made up not only of company B's employees but also workers from an outsourcing company. Fifteen people from company B's customer support team and some 20 people form the outsourcing firm work at the center. All of the personnel from the outsourcing company are dispatched as agents to receive calls from customers while employees from company B undertake a variety of work including center management, delivery, supplier management and customer phone calls. The employment contracts between company B and the dispatched workers are made between the two companies on a whole, not with the individual workers. All of the dispatched workers are of regular worker status at the outsourcing company, are an average of 27 to 28 years old and have worked at the company for under one year (The employment contract was made in December last year). 70% of the dispatched employees are women. Regarding the current situation of the center, there are about 3,000 inbound calls daily while there are less than an average of five outbound calls a day per person although the number itself is irregular.

The employees work from 9am to 6pm on week days and 9am to 1pm on Saturday, and this is to be extended to 9am to 8pm on week days and 9am to 5pm on Saturday and Sunday. There are also plans to recruit new additional employees when necessary and have these new workers work on shifts after consultation with current employees. Working hours are extended during holidays and at times of delivery accidents, and when this happens, employees dispatched from company B also work late alongside the agents. The workers at the center are given 20 days leave a year which company B plans to increase to 24 days (one day of monthly leave and sanitary leave each) to match the number of days leave given to temporary workers at headquarters. Their work takes place as follows with help from an automated system called CTI(Computer Telephony Integration) and personal computers.

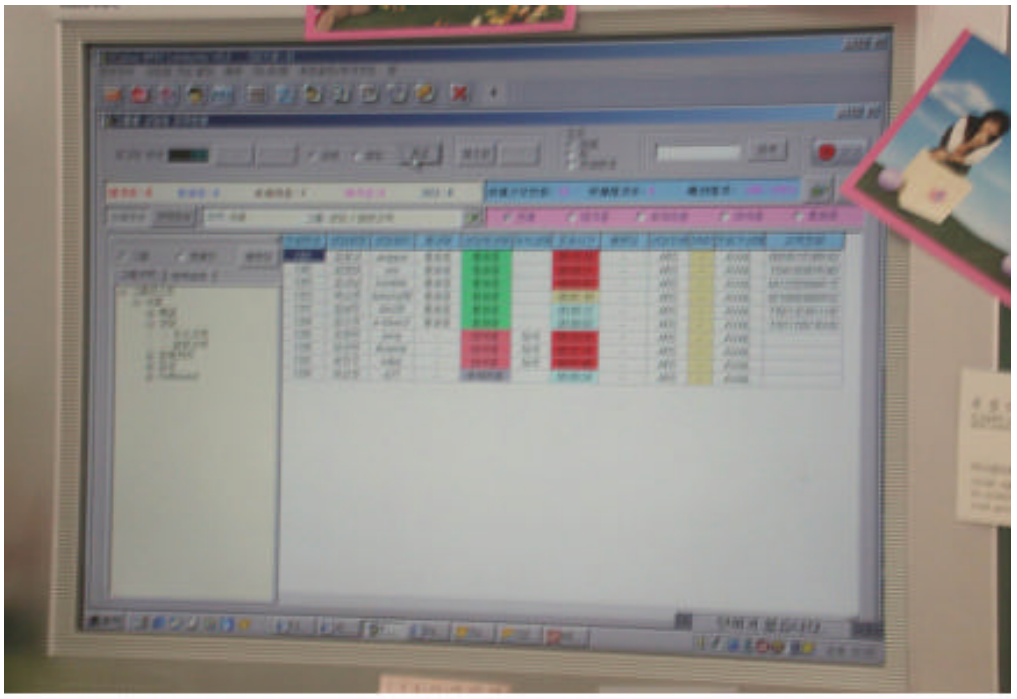
1. A call comes in from a customer.
2. The CTI automatically distributes the call to an agent that is not taking a call. (The callers are required to input their social security number by the automatic response system).
3. The CTI transmits information on past orders made by the caller to the agent to appear on his or her computer screen.

4. When the agent selects the management mode on the screen, it switches to company B management mode to display detailed information on the customer including data on the products the customer has bought or ordered (Data on company B customers are not stored in the CTI for security reasons).
5. The agent answers the inquiry with the displayed information and then hangs up.
   * During the call, the agent does a lot of searching or surfing on the shopping mall to look up the situation of the mall from where the customer ordered the good.
6. The agent categorizes the call according to the inquiry by ticking boxes and writing short notes.
7. After receiving a call, the agent is put on stand by and is required to look into the on-going events and changes on the specific shopping mall that was the main issue of the call.
8. When a new incoming call is received, it is again distributed and a new round of consultation takes place.

The agent sometimes talks to the customer calls while referring to a prepared form called a script. But the script is only limited to basic items and it is therefore difficult to deal with the entire call using the script alone.

As noted above, the irregularly employed agents of company B depend on the CTI system in their work. This system is comprised of a switch solution and a server and is capable of a number of additional functions other than simply distributing calls which is what conventional switch solutions such as ACD and Unpbx did. First, the CTI allows various methods of recording: the call itself is recorded as are related statistics such as the length of the call; managers can listen in on the conversation as it happens and can intervene after monitoring. The manager's computer is also connected to the CTI which displays the current state of each agent

<Picture IV-2> Computer Screen of Manager at Call Center of Company B (CTI System)



on the manager's computer screen as shown below. The screen shows the names and messenger IDs of the agents (the managers communicates with the agents mostly through the company messenger), their current state (whether they are on line, out of their seats, following up on a call or on stand by), the duration of a call and the customer ID number. When a phone call exceeds three minutes, the corresponding cell changes to red to alert the manager who then pays the call keen attention by monitoring it. When the manager finds a problem, he or she immediately sends recommendations to the agent by messenger and when the situation is not resolved even then, the supervisor directly steps in to take the call and clear up the problem.

There are many benefits from using the CTI system pointed out by the field supervisor one of which is enhanced productivity. For one, the number of inbound calls handled by the agents grew. The center was also able to save time, and consequently money, in cases where customers who already sent their inquiries by e-mail made calls; the system would transmit data to the agent receiving the call on whether the customer has sent in an e-mail and if so regarding what matter in order for the agent to deal with both the e-mail and phone inquiries at the same time. Other key benefits of the CTI are that it provides objective data for appraisal by recording the entire consultation process, makes it possible to take immediate measures to accidents that occur during the course of work as supervisors are able to monitor calls, and that it helps to enhance the capabilities of workers as coaching on work is possible.

While company B's call center proactively utilizes ICT to carry out its inquiry service on on-line shopping malls, we cannot find the voluntary culture of participation that can be seen in company B headquarters. It seems that the dispatched workers at the call center have a lower sense of belonging compared to the regular workers of the company. This is reflected in the fact that the supervisors feel that sincerity and diligence are more important qualities of agents than other factors such as voice and computer skills. Company B is making efforts in order to enhance the sense of belonging of the dispatched workers through a number of means: They are given the same gift certificates as regular employees which are provided to boost the morale of the workers. (In the past, they were either given gift certificates worth less or not at all); In the past, the agents would take turns eating lunch in groups because lunch time is one the busiest times of day but now the regular workers receive the calls from 12 to 1pm for the dispatched workers to have lunch; The company messenger which was once used only by regular workers is now accessible to dispatched workers also. The team leader in charge of the call center's management gives his assessment which also shows such efforts of company B.

I believe there is a natural limit to the level of satisfaction that can be felt by them [the dispatched agents]. The outsourcing company has a big role to play in enhancing that satisfaction, and the president of the company comes once a week to the center. In the past, the agents would complain that they felt a lot of discrimination between themselves and the regulars of company B but now they are demanding more accountability from their outsourcing company. I think it is difficult fundamentally for regular and dispatched workers to share a vision. However, we are planning to introduce a system so that dispatched workers can become contract-based workers of our company through screening once we record a higher revenue. We plan to use the CTI for objective appraisals to rate the workers from S to C and provide differential merit pay of 300, 000 to 1,000,000 won which will also be reflected in the appraisal.

As such the call center of company B, a business which has a higher level of participation than others, carries out its operations using the cutting edge technology of CTI within today's Internet-driven market environment. This technology allows greater convenience by enabling e-mail and phone inquiries to be addressed at the same time, the coaching of workers' performance by monitoring calls at all times, and the enhanced quality of services by reflecting objective data on employee's work performance into appraisal. However, we can also find a somewhat contradictory situation as the voluntary participation of the workers cannot but be limited with the entire work process recorded, calls monitored, and managers intervening in the work, greatly decreasing the autonomy of the workers[6].

In the perspective of decent work, such a phenomenon can be interpreted as a trade-off between the factors that make up decent work where there is now a higher possibility to transfer to productive labor with the introduction and utilization of ICT but where the autonomy and participation of workers is limited. It is also an example of the limitations of the effect ICT itself has on participation.

4.3 Core technology of cellular phones, the CDMA & embedded technology, and the trade-off between factors comprising decent work: Company C

Company C is a venture company which produces mobile telecommunication devices such as cellular phones, smart phones, PDAs, and handheld payment devices. First established with the mutual investment of a marketing CEO of large company and an executive director who attended a doctorate course of engineering at the time, the company is advancing with the investment of external institutional investors and is a typical Korean venture carrying out its production and sales activities with the goal to become listed on the KOSDAQ(Korea Securities Dealers Automated Quotation), the Korean equivalent to the NASDAQ in the USA.

The work at the company is carried out with planning followed by design, mechanism design, metallic mould production, test production, inspection and mass-production (which is done through outsourcing). In the initial stage of planning, the function, shape and price of the product to be made is decided on. In the design stage, the exterior of the product is decided on according to the established plan, and in the mechanism design stage, a blueprint is drawn up for the actual operation of the device, considering the exterior, structure and function of the device. In the following stage of metallic mould production, the mould needed for production is made based on the results of the prior stages. Simultaneously with the design and mechanism design stages, the PCB(Printed Circuit Board, the green board seen in the picture) and the Operating System, the brains of a communications device, are designed. The process of producing a single device is called a project and one team is made up to execute a particular project.

The mobile communications services deeply linked to the main products of company C are based on two internationally authorized standards, the CDMA and GSM. The CDMA (Code Division Multiple Access) method is used in most part in the US, while the GSM (Global System for Mobile communication) method is used in Europe and China. Changes in mobile

[6] This contradiction is also found in the study by Bae Kyu Shik and Kang Hae Young (2003).

communications standards such as CDMA and GSM play an extremely important role in the production method of mobile communication devices because these standards determine the specification of related products and thus determine the evolution of related technologies. In the case of the CDMA, for instance, the communications protocol or the technology standard was decided internationally at the Qualcomm Forum and has numerous stages, with the initial 95 A, B form referred to as the 1st generation, the 2000 1-x deemed the 2nd generation, the commonly known IMT-2000 named the 3rd generation and the EVOD/EVDV called the 2.5 generation technology, the interim stage between 2nd and 3rd generation[7]. Generally, technology standards like the CDMA take the form of a single chip in the production of mobile devices and is inserted into the green PCB as a part as can be seen in the picture (refer to picture).

To produce a mobile communications device, another core technology is needed aside from the CDMA technology; the embedded system technology. This can be understood as a technology for the customization of the product that deals with how to design the hardware (i.e. PCB) and develop the software (i.e. operating system) to fit the functions needed in a particular product based on the CDMA chip. In effect, CDMA and embedded system technologies are the core technologies needed to produce mobile communications devices, and because company C purchases its CDMA technology in the form of chips from another company (LG TeleCom), the core technology of company C is the embedded system technology for the customization of products.

<Picture IV-3> CDMA Chip of Company C

<View of cellular phone produced by company C with the back removed. The CDMA chip, with the imprinted Qualcomm logo, can clearly be seen.>

[7] The executive director of company C says the IMT-2000 service, known as the communication of dreams, was delayed because of the following reason.
The 3rd generation IMT-2000 was to start service from 2002 but is being delayed because mobile operators are unwilling to make additional investments into this service. They believe that the past investments made into prior generation standards have failed to realize sufficient benefits.

At company C, changes in the CDMA technology and embedded technology as well as the process to adapt to such changes has an effect on the numerous elements that comprise the decency of work. These implications can be divided into the effects on the employment structure and the work process. First, regarding the employment structure, CDMA technology has led to a preference for career workers and caused discrimination between career workers and new recruits, acting as a stumbling block for new recruits to gradually acquire skill over the course of work. CDMA, the technology standard which is the core technology of the mobile communications devices produced by company C, is assessed to be a highly difficult technology which can be learned after college graduation within one's career. As CDMA is such a difficult technology and as related technologies advance with changes in the CDMA standard, the demand for career workers has increased in this field as oppose to new recruits fresh out of college, leading to an increased preference for those with careers at times of recruitment. This blocks new recruits from entering and participating in the labor market and has an adverse effect on their development and improvement of skills. In case of company C, for instance, all technology related personnel are selected from a pool of career workers only.

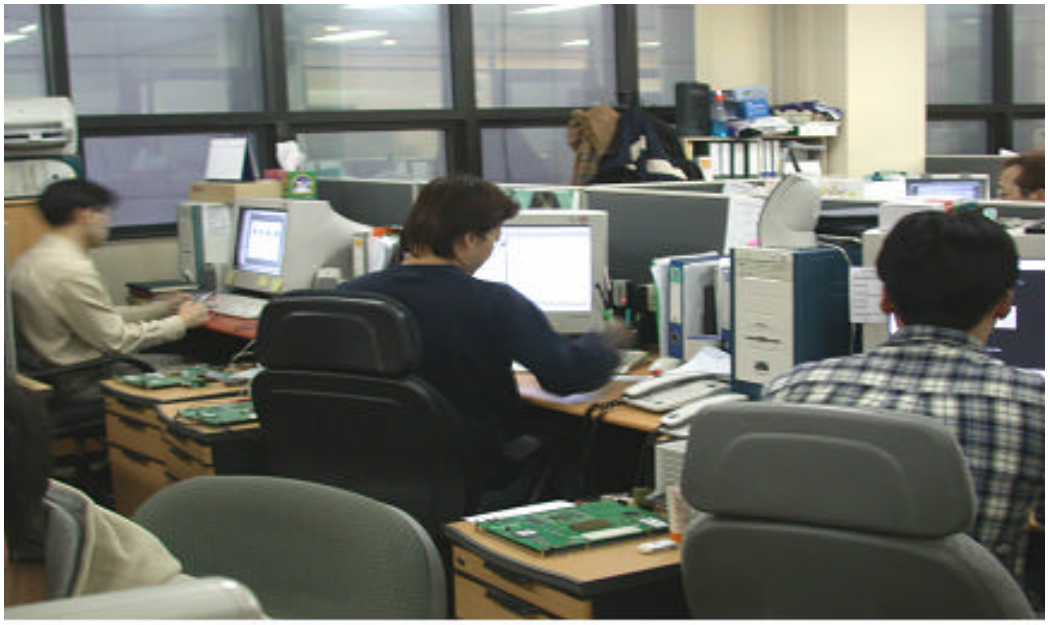
Second, regarding the effect of technology on the work process, we can find that work is highly affected in the process of modifying of technologies and correcting bugs which frequently show up in the process of making a new product when a new technology is introduced. The development, changes and introduction of ICT demand workers to adapt to a new environment of work. The occurrence of bugs and the correction of these errors, or debugging, is in itself an exemplification of adaptation within the production process. In company C, the workers generally upload the bugs they find during work or assessment on a electronic board prepared on the intranet either by themselves or by sending the bug to another worker in charge of collecting such errors[8]. Those who see a bug on the board that they are in charge of make immediate modifications if they can and notify the debugging on the board, and bugs that take time to fix are grouped together and solved through discussions at meetings. By the way, the Smartphone development project named the C project conducted in 2003 recorded more bugs than any other project. The executive director of the company states that they used a CDMA chip that was not widely used at the time as they had to realize many additional functions in a small Smartphone and that they had to develop new software to get the related applications to work, during which many bugs turned up. He added that the test period of the Smartphone was prolonged because of the bugs and that the work process took longer because of the longer testing, modifying, supplementing and reassessing, causing additional work compared to previous models developed by the company. However, the bug discovery and debugging process is taken into consideration when drawing up the plans for development and production. But a greater number of bugs being discovered than previously expected means that extra labor has to be injected, translating into harder work and psychological stress for the workers given the fact that they usually work against a deadline for development or delivery. This is also directly linked to the decency of labor.

Within such a situation, company C has the longest working hours of the target companies. The company has no set working hours. Although employees are required to be in the office by

[8] There are engineers who are in charge of finding bugs, but all employees can post a notice if they find one.

9:30am, there is no set time at which they leave. From December 2002 to July 2003, the executive director of this company received 73 e-mails from employees of which 23 were sent after 7:30pm, six after 10:00 pm, and two after midnight which were sent by the R&D department. The director says that the majority of the 50 or so employees work nights after having dinner and nobody thinks of this to be unusual. In particular, the workers at the R&D department have longer working hours than others. Though they worked long hours at the office, their working environment was not good compared to other companies (refer to picture 3) and their wage level was relatively lower than competing businesses.

<Picture IV-4> View of Office Place of Company C



<As can be seen in the picture, there were circuit boards under inspection next to each of the desks clustered together. The office was filled with mechanical noises made when a circuit board was being inspected and the monitors showed whether the inspection was finding any unusual signs>

However, the new CDMA and embedded technologies were not simply giving dissatisfaction to the workers. The new technologies were giving company C new opportunities. The mobile communications part of the company is a quickly growing field. After its establishment in 2001, the company first recorded a revenue of 4 billion won in 2002 producing mobile payment devices after two years of development and then succeeded in recording a10 billion won revenue in 2003 from smart phone exports. Having singed a contract worth close to 100 billion won in 2003 with a Chinese corporation, the company is expecting to make spectacular growth in 2004 and is planning to get listed on the KOSDAQ market. However, the communications device manufacturing industry is experiencing fierce competition to grab such opportunities and companies such as company C which have started as small ventures have their employees devoting all their efforts to survive this situation. The greatest hope of the workers at company C is either that the revenue increases and the company gets listed on the stock market, increasing their stock value (this is a hope of a handful of employees) or that the company grows into a large corporation. They believe that long and extended working hours and unfavorable working environments are factors that can be tolerated to this end.

The example of company C is one that shows us that even though ever changing ICT increases the intensity of work and extends working hours, thus undermining the decency of labor, it also expands the opportunities to succeed in the market and increase the workers' future values, replacing short-term adverse working conditions with a long-term vision.

4.4 Using ICT as a Tool for Creative Expression: Company D vs Company E

Companies D and E both deal with movie backgrounds although company D produces such backgrounds with ICT, using computer graphics technology, while company E makes its backgrounds the traditional way using miniatures. The use of computer graphics is a digital method of work as digitalized film is used and computers and graphic-related programs are utilized. The use of miniatures, on the other hand, is analog using three dimensional models made with tools. Through this case, by comparing the two target companies, we aim to analyze what effect the introduction and utilization of ICT has on decent work in making products that have similar roles (both products of the companies are used as backgrounds in movies).

1) The Relation between CG and Miniatures in Movie Production

Computer graphics and miniatures share the similarity that they are made to look like reality and are used in movies. However, they are different in the actual way they are used in films. Before computer graphic technology was introduced, matte painting and miniatures were used in producing movies to create scene that could not be shot. But now, most movies are made using computer graphics and in some cases, miniatures are not used at all but the movie is produced with computer graphics alone. However, computer graphics and miniatures are supplementary to each other in many cases: for example, when shooting a scene with a large screen that displays the situation of the world's main military bases, the scene can be shot with the screen made using a miniature and the display on the screen can be added after the shoot using computer graphics.

2) Difference in Working Environment

Company D is located in the southern business district of Seoul. Although there are windows in the office, the curtains are drawn to make a dark atmosphere in order that the sunlight does not reflect off the computer screens. The office has air-conditioning and heating which is vital not only for the workers but for the computers. Most of the work is being done individually at the personal computers. On the other hand, company E is located in a quiet rural district of Yangpyonggun, Kyunggi Province. The work is done in a warehouse which is used as the workplace and the cement floors and large crude doorway gives you the sense that the workplace is out of doors. Most of the work is done as a common operation except for a few cases where individual tasks are needed (refer to picture 4).

<Picture 5> Working Environment of Companies D and E

<This is a picture of the office of company D. The windows are covered to block the sunlight. The office appeared much brighter than it was because the picture was taken with the flash. Therefore this picture was handled with an editor and darkened similar to the actual appearance of the office. As the picture shows, computers and programs are used in the work as well as various pictures or sources>

<This is an image of company E's workplace which was built as a warehouse. A variety of tools used in making miniatures can be seen and the window to the top allows sunlight into the room. There are no work stations for individual use but the work is done together with workers surrounding the object of work(cabin in the picture)>

3) Difference in Working Tools

Companies D and E show the biggest differences in the tools used in their work. The workers of Company D use hardware and software such as computers and graphic programs to create backgrounds, insert special effects and add colors to the forms and figures made for the movies whereas in company E they make miniatures manually using such tools as hammers, saws, rulers, plans, chisels and brushes to make their form and add color.

4) Difference in Method of Work

The method of work that takes place in such different environments with such different tools was also starkly different. Generally, the computer graphics work in company D takes place along these lines; ? First, an opening meeting is held where the workers watch the movie film on camera to grasp the general flow of the movie, ? then the manager and team leader distribute the tasks after consultation, ? the work is carried out and is followed by a final inspection. When a film is shot, the Concept Design of the computer graphic to be coated onto is made by the computer graphic director (Of course, the basic idea of the film director is the most important during this job). After the initial sketch of the plan is made through the Concept Design and the work orders are given, the workers or the team leader sometimes give feedback on the computer graphic director's plan and express the difficulties they face realizing the plan and the original plan is sometimes changed. The work orders are either given in great detail or not depending on the movie. For example, when dealing with an underwater scene, the worker may be told that the sea is a certain depth rather than being told to express the sea water in a particular tone. The information and knowledge that are used in deciding how to express a certain image are not accumulated and shared by all workers but stored in the individual's head and his personal computer. The data that is stored in the computer beforehand (ex: cars, trains, the sea, mountains, the sky etc.) is called source data. However, as the many scenes of a film are divided between many workers, common standards are decided on through prior meetings before the work is initiated. Even while the work is in progress, meetings are held throughout the week whenever it is deemed necessary to check up on the progress. When each stage of the work is completed through this process, the workers, middle manager, computer graphics director and the film director hold a viewing of each stage and the results of this inspection are once again reflected in the work by modifying or supplementing.

The work is done in a different manner in company E. While computer graphics is a follow-up process that takes place using the movie film that has already been shot, the creation of miniatures takes place before the film is shot because the miniatures that are made are used as the background or as properties. This is a factor that makes work with miniatures fundamentally different from that using computer graphics. First, the workers need to read the scenario and design the parts that are needed. The design stage can be referred to as a plan as it is similar to system design in that the general background is designed followed by the details. The workers also take part in the planning process as it requires knowledge of the materials to be used as well as intuition. After the design stage is completed, then detailed planning takes place of which the form is mainly drawings done by hand. A practice piece, called a study, is made according to the drawing in a smaller size than the final model and then it is decided where to continue with this particular plan through assessment of the study. The study is modified and

remade again and again until it is found satisfactory. When a satisfactory study model is made, it is enlarged to create the real model. As it becomes more difficult to change miniatures as the work enters its final stages, the head of company E or the film producer makes assessments on the miniatures whenever needed. The ideas of the film producer regarding filming, special effects and martial arts are reflected in the process. Also, the workers have frequent and sufficient discussions on the work regarding the texture of the miniatures and the effects.

Although computer graphics and miniatures are both cooperative work related to design that are needed in film production, the way the work is done is different in the following ways.

- The reference used by the workers in their work is different. In the case of computer graphics, the basic reference is the sources stored in the computers or found in other films or magazines with which the workers carry out their work using previously set programs, whereas the texture or feeling of the object models are the main reference used in making miniatures.
- The method of cooperation in the work process is different. When doing work with computer graphics, the director, manager and team leader first decide on the work orders to be given after which work is done individually on each scene and collected together at the final stage of the work. Therefore, there is hardly any horizontal cooperation between the workers during the work. The work is done differently with miniatures, however, with most of the work done in horizontal cooperation after the initial design and planning stages except for the few cases where work is done independently.
- The decision making process is different. At company D, the basic concepts are decided by the director, manager and team leader and work is later distributed according to such decision, while at company E, the concepts are decided and work distributed together because of the characteristic of the work.
- Though both put importance on time, the focus of importance is different. While work involving computer graphics is affected by the speed of the equipment such as CPU speed, work using miniatures is greatly affected by the speed of the workers.
- There is also a difference in the way the two methods reach the final results. The computer graphics method undergoes trial and error to find the best fitting effect whereas the miniature method is carried out after thorough planning although simulations are sometimes done.

5) The Effect of ICT on Decency of Work: Worker or Artists?

When we compare companies D and E from the perspective of the impact of ICT on decent work, we can project that there is higher possibility of company D witnessing a greater decency of labor in terms of the working conditions: Superficially, the workers at company D are office workers, working in an office complete with air-conditioning and heating located in Seoul and using computers as tools for their work. On the other hand, the employees at company E can be referred to as blue collar workers, working in a workplace built like a warehouse located in the rural area and using paint and hammers to make their products. Even when considering the wages, we can see that the average wage of workers in computer graphics is higher than those who make miniatures. Below is a table comparing the average wages of both occupations in the US as a whole and in California. If we compare the two occupations, we can see that graphic

designers enjoy better conditions compared to miniature manufacturers in almost all aspects. The head of company E says that this disparity is much greater in Korea than in the US.

<Table IV-2> Comparison of average wages between graphic designers and miniature manufacturers in the US (as of 2001)

	US		California	
	Min/Max 10%	median	Min/Max 10%	Median
Graphic Designer	21,700-61,000	36,000	24,200-71,400	40,700
Decoration & Display Designer	16,200-59,300	33,400	20,200-70,400	43,900
Miniature manufacturer (metal&plastic)	17,200-61,400	36,800	19,500-57,600	38,900
Miniature manufacturer (wood)	16,300-47,400	25,000	14,700-44,100	20,900

reference : US ONET (www.online.onet.org)

However, in order to compare the effect ICT has on decent labor in the two companies, the central role that ICT plays in the firms has to be considered. As we can see from the examples noted above, the role and function of ICT in the film manufacturing industry is quite different from that in other companies we have looked at. That is to say, ICT is used in other industries mostly for repetitive or dangerous work, and to increase productivity whereas in this particular industry, ICT or computer graphics is used to express creative thought into images. This factor needs to be considered when analyzing the impact of ICT on decent labor in this industry. The head of company E gave the following statement.

I think the difference between computer graphics and miniatures is that of an operator and a designer. Of course, the social recognition towards graphic designers is better [than that of miniature manufacturers], because people working with computer graphics work behind desks and don't have to get their hands dirty with paint. In our company, the middle managers including team leaders come to work at 9 to 10am and leave at around 7 to 8pm and receive a monthly salary of about 2 million won when they choose to take every other Saturday off. Computer graphic designers of the same rank earn about 30 to 40 million won a year. Computer graphics go through a lot of trial and error while miniature require much creativity. It makes your mind strong. The difference between the two jobs is that one looks at models three dimensionally and the other looks at them two dimensionally. Miniatures demand creativity, we make study models and starting from this, we make the real thing all the time considering the texture and the effects. The graphic designer, meanwhile, tries out a lot of stuff with the pictures that he has, an uncreative process.

This statement sheds light on another aspect that we were not able to see when merely comparing the working conditions as it makes us consider how ICT is used in creative work.

First, the use of ICT and computer graphics technology in producing film backgrounds changes the relationship between the object of work and the worker. Producing film backgrounds is a process of communication between the object and the creator as the creator makes a form and gives it color to realize the final result. When doing work with computer

graphics, the graphic designer sees the changes that he makes to the object of his work using a digitalized program which is displayed on his two dimensional screen[9]. However, working with miniatures takes place three dimensionally with the worker making real changes to the model and responding to the changes that take place. Also, endless trial and error is possible with computer graphics as the designer can modify any change to the form, color or effect if it does not suit him and this can take place any number of times if there is enough time. However, the number of modifications that can be made to miniatures is limited because much time and cost is needed in order to change a miniature that has already been made and painted. Because of this, a higher level of conception is needed in the initial stages of work compared to computer graphics. This aspect of miniature making can enhance the creativity of the work compared to graphics and can give the worker the feeling that he is a creative artist rather than an operator.

Next, we can note a great difference between the tools used in the work of the two companies. The graphic designers click on their mouses and type on their keyboards to modify the scenes that have already been filmed. The main means of such modification are the sources stored in the computers. These sources are also used in making miniatures but not directly. In this case, the sources are projected into the object through conceptualization and this conceived concept is realized using manual tools such as hammers and spray paint.

The differences regarding the workers' relationship with the object as well as the tools that are used in work create differences in the autonomy of the worker which is also an element of decent work. It can be said that the workers in company E have a greater sense of autonomy and think of themselves as masters of their own work in comparison to the graphic designers in company D as they use sources for conceptualization and work with actual models and witness the changes take place. Therefore, the workers at company E have a situation where their work is inseparable from conception, and such autonomy in labor can enhance the decency of work.

5. Conclusion of Case Study

This study has thus far taken a look at the impact of ICT on decent work within five target companies.

The first case concerned company A which managed its entire production process with an enterprise production data system where we saw that ICT could hinder low-skilled workers from accumulating skill while demanding more knowledge and skill from high-skill workers, hinting at a possible disparity in skill accumulation between the manager level and the line workers.

The second case concerned company B which produced a new ICT service, i.e. the Internet portal service, where ICT was in active use and the participation of the employees very high. Through the analysis of this case, we found that ICT is not a prerequisite that automatically creates a culture of participation but a mere factor, that the environment of the ICT industry is demanding the company to change into a high-performance organization, that ICT is playing a strategic role by reducing such costs.

[9] Although three dimensional programs can show moving effects in 3D, it can only be seen through a second dimensional monitor.

Through the case of company C, a manufacturer of handhelds such as cellular phones, we could also find a similar situation where the information and communications industry and market characteristics were affecting the decency of work in the company. The ICT industry environment, where ICT provides more opportunities such as access to new markets but also increases the demand for higher technological capabilities and creates an increasingly fierce competition, was causing a growing disparity between new recruits and career workers in the company, and elements comprising decent work were being traded off. In return for tolerating short-term inconveniences in their working conditions such as prolonged working hours and relatively lower wages compared to competing firms, the employees wanted the company to see an increase in its revenue and get listed on the KOSDAQ so that their incomes would increase from stock valuation and also for the company to become a large size company to raise their social positions.

The case study of companies D and E, two firms which were both producing movie backgrounds through different means, showed that introducing ICT can create better working conditions and produce higher wages, but also that the use of ICT in the creative process of movie background making changed artists into operators. This is an example which shows that the effect of ICT on decent work can take place in a completely different dimension depending on the uniqueness of the product, in this case, being movie backgrounds and making the production process one of creation.

It would be difficult to generalize the case analysis of the five companies given the number of companies studied and the scope of ICT which was used as a subject for analysis. Nonetheless, we can see come up with the following common phenomena.

First, the impact ICT has on decent work differs according to the product of each company and the production process. In Company B, which boasts a high level of worker participation, the core factor linked to participation is not the active employment of ICT itself but the Internet portal services it creates and the Internet over which the services are provided. The high level of participation at company C was not found in company A which uses ICT in the form of an enterprise data system to manufacture cars through the conventional method of mass production, nor in company C, the handheld manufacturer, or company D which creates the conventional movie backgrounds through computer graphics. A culture of participation based on ICT took root in company B because of environmental factors and the fact that providing Internet portal services demands creative ideas on the part of the workers to provide new services. This proves that the characteristic of the product and the market environment are important factors that need to be considered when discussing the issue of ICT and decent work.

Second, we could see that ICT caused or widened a gap between certain groups. The enterprise production data system of company A increased the disparity between office workers and line workers on the production lines in terms of knowledge and skill accumulation. The growing importance of CDMA and Embedded technologies led to a preference of career workers in company, creating a wider gap in employment opportunities and skill between new recruits and career workers.

Third, ICT is affecting the trade-off of elements that comprise decent work and this effect differs according to the conditions of each company and industry. In the case of the ICT-related company C, the employees were willing to give up elements of decent labor such as wages and

working hours for the future value of the business. In the case of company A, a non-ICT-related corporation, the simplification of work and reduced working hours (this excludes actual working hours which includes aftertime) enhanced the decency of work while also undermined decent work by reducing the opportunities to accumulate skill. Company B, which is required to provide Internet portal services in the current market, was able to develop a culture of participation by actively incorporating ICT into its work, but the diffusion of information increased the amount of data individual employees have to acquire, so now workers have to devote more time into their work. The HR manager of company B made the following statement on such an effect of ICT.

Introducing ICT does increase participation by saving costs and time but also increases the workload because each individual finds himself with more to do.

V. Conclusion

Thus far this report has explained the current situation related to ICT in Korea such as ICT production, use, consumption and investment and has looked at how the various macro indices that can indicate Decent Work have changed in the past ten years. We have also compared the trends between these indices and ICT and looked at their correlation. Using survey data on companies, the study analyzed the effect the introduction and usage of ICT has on worker participation, and also analyzed the effect ICT has on decent work in the actual workplace by looking at the cases of five target companies selected for the study by their size (large size company/small size company) and their relevance to ICT (ICT producer/ICT user). Through our national and corporate-level analysis, we were able to deduce a number of limited albeit significant conclusions.

First, it is difficult to reach a single conclusion on the effects of ICT on decent work which can be applied generally and consistently to all sectors. In our general analysis in the macro perspective, we found that the individual factors comprising decent work were affected differently by ICT. In our analysis of businesses based on worker participation, we found that ICT had a different implication on participation depending on the characteristic of the company. Even in our case analysis of five target companies, we could see a trade-off between the factors composing decent work depending on the situation of each corporation.

Such particularity which can be found in the effect of ICT on decent work is a due result in some aspect given the multi-faceted aspect of ICT and decent work, the key subjects of this study. This particularity can also be expected when we consider that ICT is not a simple tool that makes work easy but is a motivator that fundamentally changes the way we work.

As decent work is comprised of various elements, ICT can have different implications on the individual elements of decent work. For example, we can find a trade-off between adequate working hours and adequate wages in the workplace. There are trends in our public policy to strengthen social security to supplement for lost employment security on the understanding that taking away labor market regulations increases the possibility of creating more jobs as it gives companies the opportunity to easily adapt to their external environment in which rapid developments in ICT create rapid market changes. It is therefore hard to generalize the effects of ICT because the many factors that make up decent work are not affected in the same way by ICT.

Second, ICT harbors the possibility of creating disparity between countries, companies and certain groups in its effect on the decency of work. In other words, in cases where ICT is used to enhance the decency of work, the results may not be fairly distributed and such disparity is an important factor to be considered in analyzing the effects of ICT on decent work. The study found evidence that ICT could undermine equality, one of the social definitions of decent work: the analysis of the effects of ICT on participation showed that the introduction and usage of ICT could widen the gap between large and small companies in their level of participation; and the case study showed that ICT caused a disparity between skilled and non-skilled workers in their opportunities to accumulate skill as well as between career workers and new recruits in employment opportunities. Also, the digital divide that exists across gender, age brackets, regions and occupations hints that even the positive effects of ICT on the decency of work can

result in differences between certain groups. This is an inevitable phenomena that will take place for a significant period of time with the spread of general purpose technology like ICT which affects the economy on a whole.

Based on such conclusions, we can reach the following policy considerations. First, in order for the spread of ICT to translate to enhanced decency of work in our society, we need to grasp an overall understanding of the characteristics composing decent work and come up with a public choice that will supplement the adverse effects. It would be noteworthy for the discussions and decisions on ICT policy to consider the case of North European countries[1] where deregulation is implemented in order to enhance labor market flexibility and supplemented with the strengthening of social security networks.

Second, in order for all parties to enjoy the fair distribution of enhanced decency of work as a result of ICT implementation, ICT has to foster the capabilities and knowledge of the workers and thus increase their employability in the labor market. To meet this end, we need policies to enhance the ICT capabilities of workers through job training as well as strengthened measures to promote their understanding on knowledge and data and support their capabilities. We also need to systematically support life long education so that the people can effectively employ ICT, knowledge and information to develop their capabilities in an evolving environment. We also need to resolve the disparity between the urban and rural areas in terms of ICT accessibility through policy support.

ICT itself has many merits including efficiency, convenience and transparency, making it superior to any other technology in that it enables the creation, accumulation and sharing of knowledge and information. Therefore, ICT definitely has the potential to positively affect the decency of work. However, ICT only gains such a comparative superiority and realizes its potential through the strategies set through discussions by the players that make up our businesses, society and countries. In this sense, social discussion and the selection of concrete strategies is important in the use of ICT to expand decent work.

[1] See the Danish case(ILO 2003).

VI. Reference

<In Korean>

Ahn, Joyup (2000), "Information Society and Digital Divide", in Cheon et al. *Digital Economy and Human resources*, chap. 5, KLI.

Bae, Kyu-sik and Kang (2003), New Labor Relations in the Knowledge-based Industries, KLI.

Bank of Korea (2000), "Effect of Growth of IT Industry on Productivity," *Survey Statistics Monthly*, October edition, pp.25-48, Industrial Analysis Team, Survey Bureau .

Cheon Byung-you(2001), "Information and Communication Technologies and Wage", Kang et al. *Information and Communication Technologies and the Labor Market*, chap. 3, KLI.

Cheon Byung-you et al.(2000), *Digital Economy and Human resources*,, KLI.

Cheon Byung-you and Kim (2003), *Digital Economy and Job Creation*, KLI.

Cho, chul(2002), "The trend and implication of the automobile parts industry in the world", The automobile industry and industrial relations in the world, KLRI/KLI.

Hur, Jai-joon, Lee, Young-soo and Suh, Hwan-ju (2002), "Information and Communication Technology and Skilled Labor," Korea Labor Institute.

Hur, Jai-joon et al.(2003), "Information and Communication Technologies and Wage inequality", KLI-KAEA Joint Seminar, Seoul.

Kim, Dong-bae and Lee, Gyeong-muk (2002), "Factors affecting Worker Participation and its Outcome," Korea Labor Institute

Lee Wonduck and Yu (1997), *A study on Participative Management: Comparaison between Korean Firms and U.S. Firms*, KLI.

Ministry of Labor, *Report on Industrial Accident and disease*.

Ministry of Labor, *Survey on wage structure*.

National Statistical Office, *Annual Report on the Economically Active Population Survey*

Park, W.S. and Nho (2000), "The characteristics and problems of the human resources management in Venture Business", in Cheon et al. *Digital Economy and Human resources*, chap. 5, KLI.

Won, Chang-hee and Kim, Dong-hun (1998), "Labor Unions and Productivity Effect of Labor-Management Council", *Journal of Korean Labor Economics*, Vol.21, No.1, pp.177-194

<In English or in French>

Addison, John T. et al. (1997), Worker Participation and Firm Performance: Evidence from Germany and Britain, mimeo, November.

Anker Richard et al. (2002), "Measuring Decent Work with Statistical Indicators", Working Paper No.2, Geneva: ILO.

Autor, David H., Lawrence F. Katz and Alan B. Krueger (1998), "Computing Inequality: Have Computers Changed the Labor Market?", *Quarterly Journal of Economics*, Vol.113, No.4, pp.1169-1213.

Berman, Eli, John Bound and Stephen Machin (1998), "Implications of Skill-biased

Technological Change: International Evidence" *Quarterly Journal of Economics*, Vol.113, No.4, pp.1245-1279.

Bresnahan, Timothy, Erik Brynjofsson and Lorin Hitt (2002) "Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-level Evidence", *Quarterly Journal of Economics*, Vol.CXVII, February, pp.339-376.

Dachler H.P. & B. Wilpert (1978), "Conceptional Dimensions and Boundaries of Participation in Organizations: A Critical Evaluation", Administrative Science Quarterly 23(1): pp. 1-39.

Davenport Thomas H. & James E. Short (1990), "The New Industrial Engineering; Information Technology and Business Process Redesign", *Sloan Management Review*, Summer, Vol.31, No.4, pp.11-27.

Davenport, T.H., Long, D.W.D. & Beers, M.C.(1998) "Successful knowledge management projects," *Sloan Management Review*, Winter, pp. 43-57.

Fernie, Sue and David Metcalf (1995), "Participation, Contingent Pay, Representation and Workplace Performance: Evidence from Great Britain," *British Journal of Industrial Relations*, Vol.33, No.3, pp.379-415.

Freeman, B. Richard and Edward P. Lazear (1995), "An Economic Analysis of Works Councils", in Joel Rogers and Wolfgang Streeck (eds.) *Works Councils: Consultation, Representation, and Cooperation in Industrial Relations*, Chicago: The University of Chicago Press.

Frenkel Stephen J. et al.(1999), *On the front line Organization of work in the Information Economy*, Cornell University Press.

Gittleman M. et al. (1998), " "Flexible" Workplace Practices: Evidence from a Nationally Representative Survey", *Industrial and Labor Relations Review*, Vol.52, No.1, pp.99-115.

Hepple Bob (2001), "Equality and empowerment for decent work", *International Labor Review* Vol. 140 pp.5-18.

ILO (1999), *Decent Work. Report of the Director-General of the ILO to the 87th Session of the International Labour Conference.* Geneva.

ILO(1999) *Decent Work* Report of the Director-General International Labour Conference, Geneva.

ILO(2002) "Towards a policy framework for decent work", *International Review*, vol. 141 pp.161-174.

ILO(2003), *Decent work in Denmark*, Geneva.

Khandelwal & Gottschalk (2003), "Information Technology Support for Interorganizational Knowledge Transfer: An Empirical Study of Law firms in Norway and Australia," Information Resources Management Journal, Vol.16, No.1, Jan-Mar., pp. 14-23,

Kim, Dong-Heon and Peter Feuille (1998), "Works Councils in Korea: Implications for Employee Representation in the United States", *Proceedings of the 50th Annual Meeting of the Industrial Relations Research Association* (January 3-5, Chicago), pp.146-154.

Levine & Tyson(1990), "Participation, Productivity and the Firm's Environment", in A.S. Blinder(ed.), Paying for Productivity, Washington, D.C.: The Brooking Institution, pp.183-237.

Machin, Stephen and John Van Reenen (1998), "Technology and Changes in Skill Structure: Evidence from Seven OECD Countries", *Quarterly Journal of Economics*, Vol.113, pp.1215-1244.

Madnick S.E.(1991), "The Information Technology Platform", in *The Corporation of the 1990s Information Technology and Organizational Transformation*, Morton Michael S. Scott(ed), Oxford University Press.

Osterman P.(1991), "The Impact of IT on Jobs and Skills", in *The Corporation of the 1990s Information Technology and Organizational Transformation*, Morton Michael S. Scott(ed), Oxford University Press.

OECD (2000), *Measuring the ICT Sector 2000*, Paris: OECD.

Parks S.(1995), "Improving Workplace Performance; Historical and Theoretical Context," *Monthly Labor Review* 118(5), pp. 18-28.

Rubery J. & D. Grimshaw(2001), "The Employment Challenges associated with ICT: The Problem of Job Quality", Background paper for ILO(2001) *Life at Work in the Information Economy*.

Vendramin P. & Valenduc G.(2002), Technologies et Flexibilité Editions Liaisons, Paris.

Whitfield K. & M. Poole (1997), "Organizing Employment for High Performance; Theories, Evidence and Policy," *Organizational Studies* Vol. 18, No.5, pp.745-764

Zuboff S.(1988), In the Age of the Smart machine The Future of Work and Power, BasicBooks.