

한·미 생산성향상 요인의 비교연구

이 병 찬

A Comparative Study on the Factors
for Productivity Improvement in Korea and America¹⁾

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Abstract

본 연구는 생산성 향상을 위한 효과적인 전략수립을 위하여 한국과 미국을 대상으로 생산성의 향상요인에 관하여 실증분석을 하였다.

이들 두나라의 산업 중에서 섬유, 자동차부품, 컴퓨터, 가전업종을 대상으로 하였다. 생산성에 영향을 미치는 요소로는 문헌연구를 통하여 기술적 요소, 자본 투자요소, 관리기술요소, 노동력요소의 4가지로 나누어 설문조사를 하였다.

연구결과 생산성에 영향을 미치는 중요요소들의 평균값은 양 국가간에 큰 차이가 없는 것으로 나타났다. 다만 재고자산회전율과 시간당 임금의 요소가 집단간 차이가 있는 것으로 나타났다. 업종별 분석에 있어서는 한국의 경우 노동생산성은 컴퓨터산업이 가장 높았으며 가전, 자동차부품, 섬유의 순서이며 미국의 경우 가전, 컴퓨터, 자동차부품, 섬유의 순으로 나타났다.

국가별 중요도 요인의 차이분석을 실시한 결과 관리능력, 불량률, 관리자 근무연수의 요소에서만 두 나라에서 같은 중요도를 나타내었으며 나머지 요소들은 모두 차이가 있는 것으로 나타났다.

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업종별 중요도 요인의 차이 분석을 실시한 결과 섬유업에서만 자동화정도, 노동자들의 교육수준, 노동자들의 근무연수에서 차이가 있는 것으로 나타났다. 설문지 항목중 명목척도에 대한 빈도분석을 실시하였다. 그 결과 요인별, 국가간에는 상호독립성이 존재하였다.

1.Introduction

The increasing competitive and complex business environment forces organizations to reevaluate the way in which they operate under their internal and external limited conditions. The most initiatives of currently prevailing are business re-engineering, bench-marking, total quality management, downsizing etc. in all types and sizes of organizations worldwide.

Nonetheless the most important thing that any organization can and should take is productivity improvement as traditional treatment. The large number of books and conferences on productivity in the last decade clearly indicates the importance of this field.

The prime objective of management can also be defined as the improvement of productivity or efficiency in a limited or restricted available resources. In other words, such a productivity improvement is the fundamental objective of an enterprise as an individual economic unit which performs production activity.

In the research of such productivity, the main efforts have been placed in the measurement for recent decades. Some recent researches are expanded to international comparative studies.

For the improvement of productivity, more important thing is to find out what factors contribute to enhance productivity and to manage the factors efficiently and effectively. The objective of this study is to find out the factors for productivity improvement by comparative study and to enhance the productivity by managing the

factors and allocating restricted resources properly.

2. Productivity as a Competitive Weapon

2.1 Concepts of Productivity

Although so much effort has been dedicated to the study of productivity, there is still confusion about many aspects of productivity, including its definition (Mohanty, 1992). Whatever system is the subject of analysis, there are usually two group of indicators. The first is partial productivity index. This is the ratio of all outputs over one particular input such as labor or capital. Although the definition makes the index easy to understand and evaluate, it also limits its use because of the restriction to only one input. The second is multifactors or total factor productivity index. This is the ratio of all outputs over all inputs rather than only one in the previous index. Even though this index provides a better indication of the contribution of all factors to output variation, it remains difficult to calculate.

There should be a distinction between the two kinds of indices. Especially in the case of a firm that invested substantial amounts of money on new equipment, more output per worker or work hour would be expected. Thus, the productivity by labor index would show increases, but the one by multifactor index will not increase because of capital input increases.

Some studies published in the last decade have contributed to a better understanding of the various issues involved in this difficult but essential subject(Sumanth, 1984)(Sink, 1985). It is believed that the multifactor index could show the performance more integrally, but the partial index doesn't make difference to find out

the factors to contribute to productivity as a result of total business activities.

2.2 Comparing the Productivity Trends

Comparative study for productivity gives us how much our economy goes well and how much our economy is competitive comparing to other countries.

In the 1979 -1993 period, U.S. manufacturing productivity growth was matched or exceeded by 8 of the 12 countries-U.S., Canada, Japan, and 9 Western European nations. In the same period, 14 economies including Korea and Taiwan in addition to the 12 countries mentioned above, recorded increase in unit labor costs.

In order to make analysis more useful, the period is divided by three subperiod : 1979-1985, 1985-1990, 1990-1995. (Greiner, et.al. 1995) These periods are relevant for the analysis of shifts in competitiveness. The trade-weighted value of the dollar rose strongly in 1979-1985 period, and in 1985-1990 period the value reversed and fell down. In 1990-1993 the value remained relatively flat even though the dollar has continued depreciate against the Japanese yen since 1990.

In table 1, U.S. manufacturing productivity increased at an annual rate of 2.4 percent. The productivities of Japan, Belgium, Italy, and United Kingdom increased over 4 percent as an annual rate. In Canada and Denmark the productivity increased at average rate of 1.7 and 1.5 percent, the least rate. In the other economies the productivity increasing rates were in the range of 2 to 3 percent, similar rate to U.S. In the first subperiod 1979-1985, U.S. manufacturing productivity increased only 2 percent at an annual rate, the lowest rate among the 12 economies. Belgium had the highest annual rate of 6.6 percent. In Italy, the productivity growth

rate was 5 percent annually, in Japan 4.6 percent, and in the other countries about 2 1/2 percent to 4 percent.

In the second subperiod 1985-90, U.S. manufacturing productivity grew up from 2 percent to 2.7 percent, compared with the previous period. Japan, France and U.S. had also growth in this period, but in most of the other countries productivity growth declined and dropped.

In the last 1990-93 period, USA manufacturing productivity increased 2.5 percent annually. Italy, Sweden, and United Kingdom enhanced their productivity growth rates to about 4 1/2 percent per year, and Canada and Denmark enhanced their rates to 2 1/2 percent per year. In Japan the productivity rate declined severely from 5 1/2 percent to less than 2 percent per year in this period, and also in France from 3.4 percent to 1.2 percent. In Germany, Netherlands, and Norway the growth rates declined a little too.

In most of economies the productivity gains resulted from a combination of increasing output and decreasing labor input in the observed 1979-1993 period. But Japan had a little increase in labor hours and much bigger increase in output that brought out productivity increase consequently. In some countries such as USA, Canada, Denmark, productivity growth was due more to output growth, and in other countries such as Belgium, France, Germany, Norway, reductions in labor input contributed more to productivity growth.

In the 1990's (1990-1993 period), USA was the only country that the increase in output contributed to productivity growth much more than reductions in labor input. In the other countries all the productivity growth was attained by reductions of hours worked.

Country	Year	Output per hour	Output	Total	Employment	Hourly compensation	Unit labor costs	
							National currency	USA dollars
United States	1979-85	2	0.7	-1.2	-1.4	.9	4.9	4.9
	1985-90	2.7	2.8	0	-0.1	3.9	1.1	1.1
	1990-93	2.5	1.2	-1.3	-1.9	4.3	1.7	1.7
	1979-93	2.4	1.5	-0.8	-1.1	5.3	2.8	2.8
Canada	1979-85	2.4	1.5	-0.9	-0.8	8.7	6.1	3.4
	1985-90	0.4	1.5	1.1	1.1	4.1	3.7	7.1
	1990-93	2.4	-0.5	-2.8	-3.7	3.6	1.2	-2.1
	1979-93	1.7	1.1	-0.6	-0.8	5.9	4.2	3.5
Japan	1979-85	4.6	5.8	1.1	1.2	4.7	0.1	-1.4
	1985-90	5.4	5.8	0.4	0.8	4.7	-0.7	9.7
	1990-93	1.8	0	-1.7	0.8	4.3	2.5	12
	1979-93	4.3	4.5	0.3	0.9	4.6	0.3	5.3
Korea	1979-85	-	9.1	-	-	-	8.2	-1.9
	1985-90	-	13.2	-	-	-	8.3	12.9
	1990-93	-	6.4	-	-	-	4.6	0.3
	1979-93	-	10	-	-	-	7.5	3.6
Taiwan	1979-85	-	8.3	-	-	-	7.1	5.3
	1985-90	-	7	-	-	-	3.5	12
	1990-93	-	4.3	-	-	-	3	3.7
	1979-93	-	6.9	-	-	-	4.9	7.3
Belgium	1979-85	6.6	3.1	-2.7	-2.7	7.8	1.1	-10.1
	1985-90	2.3	2.5	-0.5	-0.5	3.9	1.5	13.9
	1990-93	3	-1.6	-3.4	-3.4	5.1	2.1	0.9
	1979-93	4.3	1.8	-2.1	-2.1	5.8	1.5	0.3
Denmark	1979-85	2.1	2.9	1	1	8.1	5.9	-5.8
	1985-90	0.1	-0.5	-0.1	-0.1	5.4	5.2	17.2
	1990-93	2.3	0.2	-2.2	-2.2	3.1	0.5	-1.1
	1979-93	1.5	1.1	-0.1	-0.1	6	4.5	2.9
France	1979-85	3	-0.4	-2.3	-2.3	12.7	9.5	-3.4
	1985-90	3.4	2.6	-0.9	-0.9	4.5	1	11.6
	1990-93	1.2	-1.8	-2.9	-2.9	3.7	2.5	1.1
	1979-93	2.8	0.3	-1.9	-1.9	7.8	4.9	2.7
Germany	1979-85	2.1	0.2	-1.1	-1.1	5.9	3.8	-4.1
	1985-90	2.1	2.3	1.1	1.1	4.9	2.8	15.9
	1990-93	1.2	-2.2	-2.1	-2.1	6.3	5.1	4.3
	1979-93	1.9	0.4	-0.5	-0.5	5.7	3.7	4.5
Italy	1979-85	5	1.8	-2.9	-2.9	16.7	11.1	-3.3
	1985-90	2.6	4	0.3	0.3	6.9	4.2	14.3
	1990-93	4.6	-0.7	-4	-4	8.1	3.4	-5.6
	1979-93	4.1	2	-2	-2	11.3	6.9	2.1
Netherlands	1979-85	4.2	1.6	-2.1	-2.1	4.8	0.6	-7.5
	1985-90	1.9	3.1	1.4	1.4	2	0.2	12.9
	1990-93	0.9	-0.9	-1.7	-1.7	4.5	3.5	2.8
	1979-93	2.6	1.6	-0.8	-0.8	3.7	1.1	1.6
Norway	1979-85	2.9	1	-1.8	-1.8	10	6.9	-2.1
	1985-90	2.2	-0.8	-2.7	-2.7	7.9	5.6	12.5
	1990-93	1.5	0.4	-1.6	-1.6	2.8	1.3	-2.9
	1979-93	2.4	0.2	-2.1	-2.1	7.7	5.2	2.7
Sweden	1979-85	3	2.1	-1.2	-1.2	9.6	6.4	-5.2
	1985-90	1.9	1.4	-0.8	-0.8	8.4	6.4	14.6
	1990-93	4.2	-2.5	-7.5	-7.5	3.9	-0.3	-9
	1979-93	2.9	0.9	-2.4	-2.4	7.9	4.9	0.5
United Kingdom	1979-85	4.1	-1.2	-4.6	-4.6	11.5	7.1	-1.3
	1985-90	3.8	3.4	-0.4	-0.4	7.6	3.7	10.5
	1990-93	4.5	-1.6	-5	-5	9.3	4.7	-1.2
	1979-93	4.1	0.4	-3.2	-3.2	9.6	5.4	2.8

- Data not available.

Source : USA Department of Labor

2.3 Exports Increases and Productivity Changes

Statistics on Productivity improvement are used from time to time to gauge the progress of the nation by macroeconomists and national policy specialists. Business management also can use these statistics to boost their organization's performance. These productivity statistics can help explain the rise and fall of nations and industries in the long view.(Thor,1990)

〈Table 2-A Annual Percent Change of Export〉

	Unites States	Canada	Japan	Korea	Taiwan	France	Germany	Italy	United Kingdom
1984	-	-	-	-	-	-	-	-	-
1985	(2.30)	0.76	4.42	3.24	0.93	4.24	8.38	2.92	8.04
1986	3.81	(0.69)	18.97	15.19	29.63	22.76	32.22	27.22	5.48
1987	11.87	8.69	9.74	36.29	34.96	18.85	20.86	19.24	22.65
1988	26.88	19.29	14.50	28.79	13.17	13.08	9.94	9.86	10.88
1989	12.84	4.03	3.473	2.28	9.26	3.13	12.92	9.96	5.37
1990	8.19	4.78	4.99	4.00	1.39	21.43	15.52	21.16	20.89
1991	7.15	(0.37)	9.57	10.57	13.04	1.56	(4.55)	(0.50)	(0.01)
1992	6.27	6.72	7.58	6.57	6.87	8.65	6.81	5.09	2.83
1993	3.71	7.99	6.58	7.33	9.07	(11.06)	(15.10)	-	(4.71)

() : a negative percentage change of growth

〈Table 2-B Annual Percent Change of Import〉

	Unites States	Canada	Japan	Korea	Taiwan	France	Germany	Italy	United Kingdom
1984	-	-	-	-	-	-	-	-	-
1985	1.76	3.67	(4.16)	1.42	(9.14)	3.83	4.83	3.01	4.16
1986	8.46	5.02	(2.24)	1.70	17.30	19.43	20.37	13.32	15.31
1987	11.02	8.31	18.41	28.03	45.84	22.45	19.57	26.45	22.19
1988	8.27	21.73	24.05	28.45	40.81	11.85	9.75	10.25	22.87
1989	7.26	6.28	11.92	18.30	6.60	7.71	17.03	10.41	5.01
1990	4.88	2.88	12.24	13.44	4.72	22.12	21.75	18.93	12.71
1991	(1.87)	1.25	0.79	16.86	15.20	(1.02)	9.07	0.42	(6.54)
1992	8.96	3.60	(1.70)	0.37	13.88	3.48	4.91	3.16	5.61
1993	8.94	7.57	3.60	2.43	10.89	(15.95)	(19.25)	-	(6.91)

() : a negative percentage change of growth

In "The World Economy in the 20th Century", Angus Maddison provides a succinct view of twentieth century and interprets world history through productivity statistics(Maddison,1989). Jackson Grason Jr. and Carla O'Dell depend heavily on productivity trends as evidence of the rise and fall of nations in the past and as a predictor of future rankings in their book "American Business: A Two Minute Warning"(Grayson & O'Dell,1988).

Such a function as productivity can help, contributes to competition (competitiveness) of nations and also to export increases in international trade by providing the companies for comparative advantage around the world.

Table 2-A and Table 2-B indicate annual percentage of exports and imports in G7, Korea, and Taiwan. Table 3 shows annual index of productivity in Korea, Taiwan, and the developed countries (G7).

The annual index of productivity in all countries shows getting increased gradually, but most countries indicates that their percent change in either imports or exports increased until the middle of late 80, but getting started decreased. For example, annual index of productivity in Germany achieved more than 100 in 1984, but the growth rate in Germany range from -15.10% to 32.22% in exports and from -19.25% to 21.75% in imports. The annual index of productivity in Japan has 107.9, which was lower than Germany's in 1984, and it get started higher annual index than Germany's since 1985, and the annual average growth rate of exports in Japan ranges from 3.43% to 18.97%, and imports from -4.16% to 24.05%. Average annual index of productivity in US along with Canada and UK among G7 indicates relatively high growth, while most developed countries (G7) show very unstable growth rate in exports and imports.

〈Table 3. Annual Index of Manufacturing Productivity〉

	Unites States	Canada	Japan	Korea*	Taiwan*	France	Germany	Italy	United Kingdom
1960	-	51.6	18.5	-	-	29.6	37.1	29.3	50.3
1970	-	76.9	50.3	20.2	26.9	58.6	66.4	54.9	72.1
1973	-	91.9	64.4	34.8	46.1	69.4	77.9	65.1	86.2
1984	103.5	116.3	107.9	135.4	126.8	103.9	109	115.7	112.4
1985	106.7	119.8	114.9	145	131.5	107.9	113.4	122.3	116.4
1986	109.5	117.9	113	171.6	152.5	109.7	114.2	123.7	120.6
1987	116.6	119	122.4	203.7	172	111.6	112.7	127.2	126.9
1988	119.2	119.5	129.6	231.1	178.2	119.3	116.7	130	133.5
1989	119.9	120	138.7	240.9	184.8	125.4	120.5	134	138.4
1990	122.1	122	149.1	264.3	184.4	127.6	125.6	139.3	140.1
1991	124.9	122.9	156.9	288.3	196.5	127.1	130.1	143.8	145.3
1992	127.5	128	156.6	303	203.3	131.1	128.5	151	152.3
1993	132	130.9	159.5	318.1	208.9	132.3	130.5	158	159.2
1994	137.4	136.2	164.2	-	-	142.4	140	163.8	165.7

1983 = 100

- Data not available.

* Productivity data not available ; manufacturing output index is shown.

Since Korea and Taiwan are recently growing rapidly, they are the countries showing the highest growth in productivity which is 318.1 and 208.9 in 1993. A growth rate of imports in Korea has two digits percent changes between 1987 and 1991, and a annual percent change of exports in Korea increased with two digits in 1986, 1987, 1988 and 1991 while showing less than 4% increase in 1989 and 1990. Even though Korea and Taiwan show higher growth rates than the developed countries, the gross amounts of productivity and exports in these two countries show much smaller than those in the developed countries. Thus, it will take a long time for these countries to compare to the developed countries.

Likewise, productivity index in manufacturing in Korea is nearly double until 1988 from 1983 and more than double since 1988. A percent change of imports in Korea is double digit change until 1991

and fairly small percentage change in 1992 and 1993, which is 0.37% and 2.43% respectively. But a growth rate of imports in USA get decreased since 1987 and has a negative percent change in 1991. In terms of a percent change of import, Korea has shown the double digit change from 1986 and 1988 and a single digit change after that time, while percent change of USA get decreased gradually since 1988.

3. The Factors for Improving Productivity

Productivity is defined as a mental state focused on the continuous improvement or progress ; productivity improvement is a condition being improved gradually over times as a result of continuous efforts to make progress. The philosophy of activity for productivity improvement is maximizing the added values through quantitative and qualitative improvements of factors pertinent to production. Therefore, productivity improvement can achieved not through a simple change or complement of one or two factors, but through a comprehensive approach for all factors used as inputs of productivity.

In my previous study on the problem (Lee, 1984). I extensively reviewed the relevant studies published in domestic (References) and abroad sources (References). After selecting comprehensively the relevant factors affecting productivity, I formulated a causal-effect model of productivity and implemented it empirically to the Korean manufacturing industry. According to the study, salary level, employee's ability, modernization and automation of facilities, the number of technicians and their quality, rationalization of process management, and size of facility investment were positively related to improving the productivity, while turnover rate and absentee rate were negatively related to improving the productivity.

Four broad categories of productivity improvement for this study,

based on my previous study and as published by US Department of Labor(1993 and 1995) are following:

3.1 Technology Factor

Technology is identified as one of the most important factors among a corporation's competitiveness factors. New technology changes the production methods of a corporation as well as produces products with the highly added values, resulting in improved productivity.

The technology factor consists of R&D investment amounts, the number of technicians, the number of patents, and the number of technology adaptation.

3.2 Capital Investment Factor

More modernized and automated facilities may improve the productivity. Size of the recent facility investment, the degree of automation, and the capital-equipment rate are considered as key elements for the capital investment factor.

3.3 Managerial Skill Factor.

Even though managerial skill or management style is intangible, it may affect productivity significantly as much as capital investment factors do. Managerial skill factor consists of the number and abilities of managers, leadership style, communication style, and methods and types of corporate innovation.

3.4 Workforce Factor

Education and experience of employee involved directly in production activity. Union activity, turnover rate, and fringe benefits will directly affect productivity.

Despite of some levels of differences among studies, these factors are generally accepted within the academic and industry. Thus, for the purpose of this study, which is to compare the productivity in two countries: Korea and United States, these four factors are selected as important factors affecting productivity³⁾.

4. Research Design and Results

4.1 Research Design

4.1.1 Sampling procedures

Copies of the survey instrument were sent to approximately managers from 3,000 small and medium size corporations in USA and Korea. A cover letter explaining the purpose and importance of the survey was also included. One hundred managers who represented each corporation in USA and one hundred and twenty corporations in Korea were responded. Given economic and time constraints, no follow-up survey was conducted.

4.1.2 Survey instrument

3) USA Department of Labor, (Labor Composition and USA Productivity Growth, 1948-92), Dec.1993, Bulletin 2426. indicates technology, utilization of capital, organization of production, managerial skill, investments in R&D as important factors affecting productivity. USA Department of Labor , Bureau of Labor Statistics, (News). Feb.1995.considers new technology, economies of scale, managerial skill, change in the organization of production as important factors affecting productivity.

The data for the study were gathered via survey questionnaires. The questionnaire includes items dealing with general information about each organization, technological factors, capital investment factors, managerial skill factors, workforce factor, and productivity index.

Since translation of the questionnaire into the language of each country is a common recommended research practice, and instrument written in its own language increase the reliability and validity of responses. Survey questionnaires in USA version and Korean version were checked for interpretational differences, leading to non-comparable data for studies in more than one country.

4.1.3 Data collection

Questionnaires were mailed to a random sample (N=2,000), within USA, of members of a national association of professionals related to current research. Of the total questionnaires that were mailed, 100(5%) were returned before the cutoff date specified in the survey form. Of these 61(61%) could be used for data analysis.

Questionnaires were mailed to a random sample (N=1,000), within Korea, of members of a national association of professionals related to current research. Of the total questionnaires that were mailed, 120(12%) were returned before the cutoff date specified in the survey form. Of these 93(77.5%) could be used for data analysis.

4.1.4 Measures of variables

Different determinants may not only influence productivity in an organization intra- and inter-industry in a country, but it also differ from each country's. Therefore, determinants affecting productivity were measured by asking managers in a corporation

whether the specified reason applied in their factors affecting productivity to each of the following different categories. These categories: (1) general information about organization, (2) technological factors, (3) capital investment factors, (4) managerial skill factors, (5) workforce factor, and (6) productivity index.

4.2 Results

4.2.1 Mean of each important factors in Korea and USA

Table 4 shows the means of principal factors which have influence on productivity in two country regardless of the kinds of industry. Employees are weighted by education level. The values of 2-tail significance to t-test for equality of the means are on the right of the table. Only the two factor of inventory turnover and hourly compensation show difference between the means.

According to Table 4, R&D employees in Korea are much more than in USA, but average of total R&D investment in Korea is almost 50% smaller than what US companies invest annually. Hourly compensation in Korea is 5.01 dollar while hourly compensation in USA is 12.82 dollar. And average productivities in Korea and USA are 3127.50 and 18039.94.

〈Table 4. mean of each important factors in Korea and USA〉

	Korea (N=93)	USA (N=61)	Overall (N=154)	2-tail sig.
Employees	269.45	1925	886.12	0.313
Sales Amounts	20.53	193.27	104.74	0.067
R&D Employees	33.45	25.83	22.83	0.626
N of Patents	16.83	115.31	81.87	0.540
R&D Investment	3145.48	6223.61	4598.08	0.203
Facility Investment	19.83	48.10	32.02	0.126
Capital Intensity	6056	116.88	3478.69	0.089
Defective Rate	3.93	3.65	3.83	0.680
Inventory Turnover	15.69	7.74	12.17	0.020
Hourly Compensation	5.01	12.82	8.29	0.000
Productivity	3127.50	18039.94		

4.2.2 Labor Productivity in Each Korean and USA industry.

Labor productivity has come out of dividing total sales amount by the total number of employees. Based on Table 5, the computer industry among four industry in Korea shows the highest labor productivity, which is 231.48 followed by the consumer electronics industry 122.47, and car parts industry, 114.56 and the textile & apparel industry among them has the lowest productivity, which is 89.38. However, the consumer electronics industry among four industry in USA has the highest labor productivity, which is 468.04, followed by the computer industry, 201.50, and car parts industry, 152.76, while textile & apparel industry showing the lowest one, 106.32.

〈Table 5. Labor Productivity in Each Korean and USA industry〉

	Korea(N=89)	USA(N=58)	Overall(N=147)
Textile & Apparel	89.38 N=25	106.32 N=20	97 N=45
Car Parts	114.56 N=39	152.76 N=16	123 N=55
Computer	231.48 N=7	201.50 N=11	213.50 N=18
Comsumer Electronics	122.47 N=18	468.04 N=11	174.3 N=29

4.2.3 T-test on the importance factor

In order to find out factors for improving the productivity of each country, Mean-Whitney test was used.

〈Table 6. T-test of importance factor〉

Factor	USA	Korea	2-tailed Pro.
Employees	47.52	62.15	0.0163
N of Patents	31.39	46.98	0.0020
R&D Investment	57.03	37.18	0.0004
Facility Investment	87.77	39.21	0.0000
Automation Level	64.22	79.62	0.0256
Capital Intensity	83.25	32.83	0.0000
Management Capacity*	80.59	75.47	0.4859
Labor Force*	88.34	70.39	0.0142
Innovative Managerial Skill	41.22	62.63	0.0004
Defective Rate	65.17	68.07	0.6757
Inventory Turnover	43.91	57.42	0.0203
Service Period with Manager**	84.28	73.05	0.1263
Service Period with Employees**	88.79	70.10	0.0104

* Management capacity, labor force are weighted by education level.

** Service period is weighted by working years.

Judging from table 6, the factors of management capacity, defective rate, and service period with manager which had high level of significance showed no difference and in both countries the importance was to be on the same level. However the other factors were found to show difference.

4.2.4 T-test on productivity factors according to the types of industry in Korea and USA.

T-test was used to analyze the difference of productivity improvement factor according to the types of industry in Korea and USA. Above all, Levene's test for equality of variance was conducted and p-value was obtained, next t-test for equality of means was examined.

<Table 7. Results in t-test according to the type of industry in Korea and USA (p-value, 2-tail sig.)

Factors		Textiles & Apparel	Car Parts	Computer	Consumer Electronics
TF	R&D Employees	(0.05, 0.287)	(0.001, 0.268)	(0.244, 0.097)	(0.652, 0.937)
	N of Patents	(0.016, 0.496)	(0.005, 0.346)	(0.111, 0.295)	(0.614, 0.937)
CIF	Facility Investment	(0.019, 0.168)	(0.000, 0.162)	(0.076, 0.253)	(0.013, 0.340)
	Automation Levels	(0.231, 0.002)	(0.521, 0.762)	(0.480, 0.473)	(0.316, 0.101)
	Capital Intensity	(0.036, 0.191)	(0.007, 0.262)	(0.029, 0.146)	(0.017, 0.063)
MSF	Management Capacity	(0.278, 0.669)	(0.006, 0.191)	(0.628, 0.602)	(0.411, 0.606)
	Service Period with Manager	(0.365, 0.452)	(0.000, 0.166)	(0.029, 0.436)	(0.255, 0.471)
WF	Labor Force	(0.003, 0.018)	(0.000, 0.067)	(0.150, 0.472)	(0.123, 0.408)
	Service Period with Employees	(0.000, 0.008)	(0.000, 0.081)	(0.085, 0.484)	(0.213, 0.363)

TF : Technical Factors,

CIF : Capital Investment Factors

MSF : Managerial Skill Factors

WF : Workforce Factors

In case p-value was higher than 0.05, neither of the difference was significant and if the value of 2-tail significance was higher than 0.05, the means of the two countries are equal on the 5% of significance level. For example, it can be concluded that with the department of R&D, the number of employees of one country was not different from that of the other. On the basis of table, only in case of textiles and apparel were automation level, labor force, service period with employees found to show difference.

4.2.5 Frequency Analysis

In the frequency analysis as to automation level, χ^2 -value of pearson was 3.60, DF was 3, and p was 0.31. This suggests that there is no relation between automation levels depending on the countries. Neither likelihood nor Mantel test is significant on the five percent of significance level.

〈Table 8. Automation Level〉

Count Tot Pct	USA	Korea	Row Total
Heavily Manual	11 7.5%	8 5.5%	19 13.0%
Somewhat Manual	8 5.5%	11 7.5%	19 13.0%
Half-half	21 14.4%	33 22.6%	54 37.0%
Heavily Automatic	18 12.3%	36 24.7%	54 37.0%
Column Total	58 39.7%	88 60.3%	146 100.0%

As the respective values of Phi, Cramer's V and Contingency Coefficient were under 0.16 in the analysis, there are very little correlations between the variables which confirms that these two variables are independent of each other.

<Table 9. Innovation Experience>

Count Tot. Pct	USA	Korea	Row Total
No	36 25.4%	32 22.5%	68 47.9%
Yes	20 14.1%	54 38.0%	74 52.1%
Column Total	56 39.4%	86 60.6%	142 100.0%

As χ^2 -value of pearson was 9.96 and p was 0.002, it implies that there is no relation between innovation of production systems depending on the countries.

<Table 10. Leadership Style>

Count Tot. Pct	Korea	USA	Row Total
Autocratic	14 10.0%	20 14.3%	34 24.3%
Democratic	28 20.0%	11 7.9%	39 27.9%
Laissez-Faire Style	11 7.9%	56 40.0%	67 47.9%
Column Total	53 37.9%	87 62.1%	140 100.0%

As χ^2 -value of pearson was 32.34 and p was 0.000, it implies that there is no relation between leadership style and country. But correlation Phi, Cramer's V and Contingency Coefficient were about of medium level for the respective values of them, there is comparatively high relation between the variables.

Table 11. Communication Style

Count Tot. Pct	USA	Korea	Row Total
Up-down	14 9.7%	23 15.9%	37 25.5%
Two-ways	39 26.9%	12 8.3%	51 35.2%
Bottom-up	3 2.1%	54 37.2%	57 39.3%
Column Total	56 38.6%	89 61.4%	145 100.0%

As χ^2 -value of pearson was 57.59 and p was 0.000, it implies that there is no relation between communication style depending on the countries. But correlation Phi, Cramer's V and Contingency Coefficient were about of medium level for the respective values of them were over 0.53, so we can say that there is comparatively high relation between the variables.

<Table 12. Union for Employees>

Count Tot. Pct	USA	Korea	Row Total
No	46 33.1%	65 46.8%	111 79.9%
Yes	14 10.1%	14 10.1%	28 20.1%
Column Total	60 43.2%	79 56.8%	139 100.0%

As χ^2 -value of pearson was 0.67 and p was 0.4139, it is possible to say that there is no relation between union for employees depending on the countries.

5. Conclusion

The prime objective of management can also be defined as the improvement of productivity or efficiency in a limited or restricted available resources. In other words, such a productivity improvement is the fundamental objective of an enterprise as an individual economic unit which performs production activity. In the research of such productivity, the main efforts have been placed in the measurement for recent decades.

Because productivity growth allows the corporation to reinforce its competitiveness, exports' growth contributes to the economic growth of the country, eventually resulting in an important way to reinforce the international competitiveness of the country.

This study tried to find out what are important factors for the establishing of optimal strategy of productivity improvement by comparing two countries: Korea and USA. The better understanding for the critical factors affecting productivity would allow management to make a proper strategy for improving productivity and to keep its competitiveness in the global or international market.

Even though this study has some limitations such as the numbers and scopes of data collection and potential measurement errors, the principal findings are as follows: (1) the data indicate significant evidence for the examination of multi-factors (2) both two countries have its own significant factors affecting productivity, either in statistically significant or not and (3) better implementing strategies in improving productivity would give competitive advantages.

The most important thing that any organization can and should take is productivity improvement as traditional treatment. The large number of books and conferences on productivity in the last decade clearly indicates the importance of this field.

Some recent researches are expanded to international comparative

studies. Therefore, productivity improvement can be achieved through a comprehensive approach for all factors used as inputs of productivity, rather than through a simple change or complement of one or two factors.

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저 자 소 개

이 병 찬 : 이병찬은 현재 계명대학교 경영대학 경영학과 교수로 재직중이다. 서울대학교, 및 경북대학교에서 경영학석사, 및 경영학박사 학위를 취득하였고, University of Nebraska-Lincoln 및 Long Island University에서 초빙교수 및 객원교수를 역임하였으며 현재 계명대학교 경영대학 원장에 재임하고 있다. 주요관심분야는 생산성향상, 생산전략, 품질경영, 및 기업경영윤리 등이다.