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2010 Modularization of Korea's Development Experience: Productivity Improvement

2011

MINISTRY OF STRATEGY AND FINANCE

KDI Korea Development Institute

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Preface

In the 21st century, knowledge is one of the key determinants of a country's socio-economic development. In recognition of this fact, the Ministry of Strategy and Finance (MOSF) and the Korea Development Institute (KDI) launched Knowledge Sharing Program (KSP) in 2004. The KSP aims to share Korea's development experience and knowledge to assist socio-economic development of partner countries.

The KSP is comprised of three parts: 1) the systemization and modularization of Korea's development experiences into case studies, 2) policy consultation through knowledge sharing with partner countries, and 3) joint consulting with international organizations. The systemization and modularization of Korea's development experience researches and documents Korea's successful policy experiences, such as the 'Five-Year Economic Development Plan' and 'Saemaul Undong (New Village Movement).' The policy topics are 'systemized' in terms of the background, implementation and outcome, and then, presented as case studies in order to achieve a complete understanding of the actual policies. These systemized policy case studies are further 'modularized' by sector so they can be utilized as concrete examples by partner countries to meet their interests in specific institutions, organizations or projects. For example, Korea's 'Export Promotion Policy' has been prepared as a systemized case study while 'the Establishment of the Export-Import Bank' has been modularized to provide a specific example of Korea's export promotion experience in export financing. The modularization of Korea's development experience traces back to a policy's inception and recapitulates the rationale for its introduction; its main content; and its implementation mechanism. The case studies also evaluate a policy's outcome and draw insights with a global comparative perspective. These case studies include literature reviews, surveys and in-depth interviews with the policy practitioners and experts who participated in the implementation process.

The systemization of Korea's development experience was initiated in 2007 and finished in 2009. Under the new Modularization Project, launched in 2010, the plan has been set out to modularize 100 case studies by sectors and topics in three years.

I would like to take this opportunity to express my sincere gratitude to Project Manager, Dr. Wonhyuk Lim, and all the Korean experts for their immense efforts in successfully completing the '2010 Modularization of Korea's Development Experience.' I am also grateful to Managing Director, Dr. Kwang-Eon Sul, and Program Officer, Ms. Ja-Kyung Hong, the members of the Center for International Development, KDI, for their hard work and dedication to this Program.

I earnestly hope that the final research results will be fully utilized in assisting the development partner countries in the near future.

Oh-Seok Hyun
President
Korea Development Institute

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The Role of Productivity Organization in Korea's Economic Modernization

Chapter 01

The Role of Productivity Organization in Korea's Economic Modernization

Dong-Kyu Choi, Byoung-Tak Cho, Sang Mi Cha
(Korea Productivity Center (KPC))

<Summary>

The present study attempts to describe strategies Korea carried out for rapid economic growth from the perspective of productivity growth. Exhaustion and poverty pervaded in Korea before the economy entered into a developmental track. Overcoming poverty was the cherished desire of Korean people, and priority was placed on achieving economic growth.

The Korea Productivity Center (KPC) was established with the belief that only a rise in productivity could strengthen the Korean economy and that it was the fastest way to welfare enhancement under the leadership of the private sector. The financial sources for improving productivity were appropriated from the contributions of industrial associations and personal donations. Also, operational expenses were met by the support from the government and the international community, including the ILO.

The role of KPC has changed over time. In the late 1950s, when initially founded, KPC strived to support the government's policy of expanding Korea's productive capacity while pursuing import substitution. To do this, the center sought to bring attention on to the importance of productivity by illuminating and disseminating the need for and effect of productivity growth.

In the 1960s, the government pursued the policy of export-led industrialization centering on labor-intensive light manufacturing industries. It utilized human resources which were relatively well educated and in excessive supply. For this purpose, the government established the base for industrialization by formulating the Five-Year Economic Development Plan. KPC contributed

to export expansion by driving the movement of managerial and technical consultancy programs for businesses through foreign technical consultation cooperation. And it provided industrial training programs that enabled firms to utilize managerial techniques. The concept of managerial and technical consultancy was established in Korea at this time.

In the 1970s, as the structure of export goods changed from nondurable goods to durable consumer goods and to labor-intensive intermediate goods, the government pursued an economic policy that fostered the heavy chemical industry. The policy of fostering the heavy chemical industry was aimed at management that emphasized the productive capability through equipment expansion, and hence, put priority on achieving economies of scale rather than on productivity growth. As a result, the productivity movement that might be obtained through management rationalization, quality and R&D was neglected. At this time, the inferior working conditions including low wages and long working hours caused the outburst of labor disputes.

In the early 1980s, Korea suffered negative growth caused by the second oil shock in 1979. Moreover, severe oppression of the labor movement led to labor disputes, and thus, the productivity movement through labor-management cooperation was weakened. The government recognized the need for improving productivity. As a result, the government encouraged huge investments in the heavy chemical industry and carried out industrial rationalization policy. The government attempted to increase productivity, and subsequently, the National Productivity Promotion Convention was held (in June 1981). And an observational study group was dispatched to Japan, a model state of productivity improvement, and studied measures for productivity improvement and labor management cooperation and disseminated their findings to the Korean industries.

In the late 1980s, there was a trend toward strong import regulations imposed by advanced countries and pressure from advanced economies for Korea to open its markets. At the same time, wages increased at a higher pace than productivity in Korea. The government worried about a possible international payment deficit. The government viewed that increasing productivity was the only way to break through the situation. In collaboration with KPC, the government established the Comprehensive Measures for Productivity Improvement and pursued the "Productivity Doubling Movement (1989-93)." This project got traction in the 1990s. And later, the nation faced the financial crisis in 1997, and in response, companies attempted to raise competitiveness by pursuing measures like factory rationalization, standardization, and quality improvement.

Upon the start of the new millennium in the 2000s, when infinite possibilities and uncertainties coexisted, the government focused economic policy on the development of high technology, environmental management and transition toward a knowledge-based economy in search of growth engines to drive future industries. In response, KPC's work also changed, as it developed and disseminated programs on green productivity and knowledge productivity.

Now, KPC is deploying the human-centered productivity movement that integrates industry and humanity. Up to now, productivity movements have been based mainly on the supply side, but recently, a new attempt based on the consumer side has been created. The productivity movement is moving toward creating value for the management, workers and consumers together.

The fruit of the productivity movement can be examined by the rate of productivity increase in value added terms. The annual growth rate averaged 5-6 % during the period from the 1970s to the 1990s. In the 2000s, it has continued to increase at an average of 3.3 %. Korea's rate of labor productivity growth in value added terms was higher than those of the U.S.A (1 %) and Japan (3 % between 1970 and 2000, 2 % in the 2000s). Korea's labor productivity in value added terms in 2007 was $47,536. This was equivalent to 61% of the U.S.A ($77,332) and to 85 % of Japan ($56,226) respectively. During the period between 1980 and 2005, the relative contribution of total factor productivity growth to economic growth was estimated at 3.23% in Korea. Meanwhile the relative contribution of total factor productivity growth was found to be 14.58% in the U.S.A, 7.39% in Japan, 15.23% in the U.K. during the same time period. Those estimations show that the relative contribution of productivity growth to economic growth was lower in Korea relative to other advanced countries.

Korea's experience in productivity movements, which has been promoted specifically by KPC, offers some implications on the establishment of a national productivity organization, the ways in which to fund and operate such an organization, and measures for step-by-step implementation.

First of all, the establishment of a productivity organization should be led by the private sector to ensure independence from the politics and segmentation. To promote nation-wide productivity growth, financial support from the government is recommended.

Secondly, donations from industrial associations are desirable as a source of funding. The Japan model is a good precedent to follow where funds are donated by companies while the productivity movement is supported by the government. It would be reasonable that once the productivity organization is able to stand on its own feet, the government should gradually reduce its financial support, allowing the private organization to take the lead in building trust between the management and workers to work together to improve productivity.

Thirdly, the organization should be based on a system that appeals to businesses, individuals and consumers together. In particular, it is desirable that the main organization body of the productivity movement secure public trust as a neutral third party.

Fourthly, the promotion of productivity growth can be implemented taking the following steps.

Korea's experience indicates that it is important to raise awareness and recognition on why productivity is important and why it has to be driven, with priority placed on both. From the viewpoint of the national economy, long-term policy for productivity should be incorporated in economic policy planning that deals with key industries. A consensus between labor and management has to be reached on sharing the fruits of productivity increases. A productivity movement centered on people has to be carried out. Lastly, the focus of management activities has shifted from being centered on industrial production to end consumers, recognizing the importance of customer satisfaction. In response, the productivity movement should also gradually move toward brining profits to the management, workers and consumers together.

1. Establishment of the Korea Productivity Center

1.1. Situation

1.1.1. Emergence of Productivity Movement

The issue of productivity has been around since the dawn of civilization. The nature, contents and methods of productivity changed following the development of resources and production modes.[1] Productivity has a long history and it exists to resolve the problems of the age.

However, genuine concern over productivity seems to have begun during the Industrial Revolution (1780-1830) and has continued into the early 20th century.[2] Classical economists such as Smith, Ricardo, and Marx have studied productivity and the determination of the productive capability of a state, and this indicates their concern over productivity. Scholars like Harrod and Domar, Denison, Kendric, and Rostow dealt with the issue of factors that influenced economic growth, which led to modern understanding of productivity growth.[3]

1. Korea Productivity Center, *Ten-Year Report on KPC's Activities*, 1967
2. The productivity development period is divided into the period where capitalism is established and the period prior to this based on the Industrial Revolution. In some cases, the latter is viewed as a period of the practical productivity movement. (Korea Productivity Center, "A Study on Productivity Movement Directions by Economic Stage," 1995)
3. Kim, Seong Su, *Consideration of Korean Productivity Movements, the Collection of Social Sciences*, Vol. 4, Kyung Hee University, 1998

The International Labor Organization (ILO), which was established under the labor provisions of the Treaty of Versailles in 1919, brought productivity into the international arena. The ILO influenced the rationalization movement which started in Germany with the attempt to overcome the Great Depression, a crisis capitalism faced between the late 1910s and the early 1920s.

The rationalization movement refers to the spread of US managerial techniques based on scientific management methods throughout Europe after the First World War. The rationalization movement emerged to protect capitalism that developed after the Industrial Revolution. In the phase of monopoly, the ratio of non-variable capital (equipment and machinery) to variable capital (wages) increases rapidly. In the phase of monopoly capitalism, the technological level embodied in the capital goods seldom improves, and thus, the profit increase reaches its limit. It is viewed that there are options of improving technology and strengthening labor to solve this problem. The rationalization efforts in those days sought to raise profits by strengthening labor. This made it impossible for monopolies to survive. In Germany, the rationalization movement was deployed between 1925 and 1928 under post-war economic reconstruction. The main content of the rationalization movement was improving management by adopting the scientific management approach deployed in the U.S.A. After the International Management Congress was held in Prague in 1924 and the International Committee of Scientific Management was established in 1926, the industrial rationalization movement was deployed internationally.

The ILO investigated the impact of management techniques on workers based on the scientific management approach. It greatly contributed to industrial rationalization by preparing guidelines to train workers. Also, the ILO declared the essential elements of productivity growth through the Declaration of Philadelphia in 1944 which called on the world to promote cooperation between labor and management and to implement measures to achieve labor-management cooperation on the socioeconomic preparations and application. It has been viewed that such activities contributed to formulating the productivity concept.

The parent body for productivity movements was established in the 1920s. The Marshall Plan (officially the European Recovery Program) through which America planned to aid the post war recovery of the European economy provided the momentum and the means for the productivity movements in Europe. The damage from the Second World War caused European economic powers to fall behind the U.S.A. Under these circumstances, a productivity organization was implemented through financial and technical aid under the Marshall Plan. New organizations mainly concerning productivity were established in 11 countries among the Organization for European Economic Cooperation (OEEC)[4] member countries.[5]

1.1.1.1. Deployment of Productivity Movements in Europe

Productivity movements refer to the process of disseminating techniques and institutions regarding US production technologies, organization techniques and industrial relations under the Marshall Plan. To facilitate this, the Anglo-American Productivity Council was established in 1948 (renamed the British Productivity Council in 1952) in the U.K. through which the country actively adopted the US management rationalization techniques. In France, Comité National del la Productivité and Association Française Pour Accroissement de Productivité, which mainly operated the observational study mission, initiated activities in 1950. In Germany, Reinchskuratorium für Wirtschaftlichkeit (RKW), which was set up in 1921, was re-established with the new title of Rationaliserungskuratorium der Deutschen Wirtschaft (RDW) in 1950. This period is classified as the first phase of the productivity movement (Satoshi Sasaki, 1996).

As such, European countries demanded support for post war economic recovery. Specifically, an independent body that could deploy productivity movements was required. This organization was composed of representatives of governments and the companies' management and workers. They endeavored to apply theories on productivity to firms and to disseminate productivity ideologies and productivity improvement techniques (Table 1-1). In May 1953, the European Productivity Agency (EPA) was established as a central body for productivity movements in Europe. The EPA was the emergence of an international productivity movement through which information and technology were exchanged. This period has been classified as the second phase of the productivity movement.[6] The productivity movement spread to East Asian countries such as Korea via Japan and formed the basis of movements in this region.

4. The Organization for European Economic Cooperation was set up in April 1948 to unify aid for individual European countries into comprehensive aid for Europe in the process of promoting European recovery programs.
5. Satoshi Sasaki, *The Emergence of Japanese Productivity Improvement Movements and Japanese Study Missions Abroad after World War II*, Management and Information, Vol.8 No.2, 1996, p. 102.
6. Satoshi Sasaki, *The Emergence of Japanese Productivity Improvement Movements and Japanese Study Missions Abroad after World War II*, Management and Information, Vol.8 No.2, 1996

Table 1-1 | Productivity Organizations of European Countries

Nation	Title of Organization	Year of Establishment	Background	Goal	Remarks
U.K.	Committee of Industrial Productivity	December 1947	-After the end of World War II, productivity enhancement was required to recover its status in the world market. -Government needed a measure for efficient use of limited production equipment	-Expansion of production to recover from the war - Application of productivity theories to businesses, Studying and disseminating managerial techniques and skills	Composed of representatives of governments, management and workers
Germany	Der Deutsche Produktitätrat	1952	-After the war, strong productivity activities required to reconstruct the German economy. -Independent body needed that was responsible for studying the specific application and creation of productivity	-Spreading productivity consciousness of firms in a powerful mode -Studying specific application and practical utilization of productivity	Composed of representatives of governments, management and workers
France	Comité National de Productivité	June 1950	-To develop economy, change in the production mode was required -Recognized that the productivity improvement skill is required to modernize the economy	-Enforcing productivity improvement schemes for whole national activities by stirring the productivity ideology -Introducing techniques for productivity improvement	Composed of representatives of governments, management and workers, and academia
Organization for European Economic Cooperation	Agence Européne de productivité	May 1953	-OEEC recognized that the productivity improvement was vital and the basic issue in Western Europe. -Independent and specialized body required to activate the productivity movement	-Supporting productivity activities in member countries - Providing gains from the productivity movement for workers, users and consumers	

Source: Korea Productivity Center, Ten-Year Report on KPC's Activities, 1967.

1.1.1.2. Deployment of Productivity Movements in Asia

Most Asian countries except Japan experienced colonial rule and damage from the Second World War. Asian countries, which gained independence after the Second World War, suffered from poverty and low productivity, and were characterize as agrarian based economies with rigid social classification and limited social and regional mobility. Those countries recognized their economic circumstances and longed for economic development. Productivity movements in the Asian region were influenced by the European Productivity Organization established in 1953.

Table 1-2 | Productivity Organizations of Asian Countries

Nation	Title of Organization	Year of Establishment	Background	Goal	Remarks
Japan	Japan Productivity Center	March 1955	-Economic reconstruction after the Second World War -Need for a national organization for productivity movement to become an advanced industrialized country	-Dissemination of productivity consciousness, acceleration of productivity movement, Improving the specific knowledge and application of it	Composed of representatives of governments, management and workers (NGO)
The Philippines	Industrial Development Center	February 1955	-Need for the measures of industrial development, economic development and improvement of living	-Deploying productivity improvement movement to particularly develop small businesses	Governmental organization
Taiwan	China Productivity Center	July 1955	-Improvement of all production factors was absolutely needed for economic development and trade promotion. Organization responsible for it was required	-Dissemination of modern technologies to improve the industrial productivity -Technical support for the small businesses -Exploring markets for trade promotion	Composed of representatives of governments, management and workers and academia (NGO)
APO [1]	Asian Productivity Organization	May 1961	-To contribute to the socio-economic development of the Asia-Pacific region by accomplishing productivity improvement through solidarity of Asian countries	- Non-political, non-profit and non-discriminatory intergovernmental organization -Improving productivity and living through cooperation among member countries	Commenced with 8 member countries, presently participated by 20 countries [1]

Note 1: The APO was founded by member countries, such as Taiwan, Hong Kong, India, Japan, Korea, Nepal, Pakistan, the Philippines, and Thailand. Currently, 20 countries participate in this organization.

Source: Korea Productivity Center, *Ten-Year Report on KPC's Activities*, 1967.

Also, US aid to Asian countries such as Japan, the Philippines and Taiwan offered a way to push the productivity movement.[7]

The Philippines established the Industrial Development Center in February 1955; Japan set up the Productivity Center in March 1955; and the Chinese Productivity Center was established in November 1955. The Korea Productivity Center (KPC) was founded in August 1957. With the establishment of the APO, Asian countries commenced to cooperate for improving productivity.

These productivity organizations were established either by the private sector or the government. Occasionally, they were established in collaboration between the private and public sectors. Private leadership was prevalent in Korea, Japan and Taiwan; while the government was active in other 5 countries among the 8 APO founding member countries. But all the organizations, regardless of their characteristics, were subsidized by the governments.

Productivity movements undertaken by Asian countries focused on industrialization, modernization and economic development, with importance put on technology and capital. Asian countries lagged behind Western Europe in technology and capital, which explain the difference in the developmental phase of the economies.[8]

1.1.2. Korea's situation when the productivity movement was introduced

1.1.2.1. Economic Situation in the 1950s

The annual growth rate of Korea's per capita GDP averaged 5.55% from 1950 to 2008. This was higher than those of advanced economies such as the U.S.A. (2.06%), Japan (4.36%), U.K. (2.14%), and France (2.54%) during the same period. While Korea's per capita GDP was $854 in 1950 (as of 1990), the country's per capita GDP was $19,614 in 2008. This is a sharp increase of approximately 23 times. While Korea's per capita GDP was lower than those of the Philippines ($1,070) and Sri Lanka ($1,253) in 1950, Korea achieved rapid development, and as a result, the nation's per capita GDP increased to be 4 times higher than that of Sri Lanka ($4,895) and 9 times higher than the Philippines ($2,926) in 2008.

7. Cho, Myong Gi, "A Study on Productivity Movement Directions by Economic Stage," Korea Productivity Center, 1995
8. Cho, Myong Gi (1995) pointed out the differences in productivity movements between Western European countries and Asian countries as follows: first, the educational and technological levels were low due to the poor economic and industrial base, and thus, labor movement and labor-management relations were immature; second, focus was given to tools rather than to business management and managerial skills; third, studies on human relations were insufficient because of lack of labor movements or labor-management relations; and finally, agriculture took up a large part of the industry because manufacturing did not develop enough.

Table 1-3 | Per Capita GDP of Individual Countries

(Unit: 1990 International Geary-Kkamis Dollars)

Nation	1950	1960	1970	1980	1990	2000	2008	Growth rate (%)
France	5,186	7,398	11,410	14,766	17,647	20,422	22,223	2.54
Germany	3,881	7,705	10,839	14,114	15,929	18,944	20,801	2.94
United Kingdom	6,939	8,645	10,767	12,931	16,430	20,353	23,742	2.14
United States	9,561	11,328	15,030	18,577	23,201	28,467	31,178	2.06
China	448	662	778	1,061	1,871	3,421	6,725	4.78
India	619	753	868	938	1,309	1,892	2,975	2.74
Indonesia	803	1,012	1,181	1,870	2,514	3,276	4,428	2.99
Japan	1,921	3,986	9,714	13,428	18,789	20,738	22,816	4.36
Philippines	1,070	1,476	1,764	2,376	2,197	2,377	2,926	1.75
South Korea	854	1,226	2,167	4,114	8,704	14,375	19,614	5.55
Nepal	496	607	653	652	825	994	1,134	1.43
Sri Lanka	1,253	1,295	1,499	1,830	2,424	3,597	4,895	2.38
Cambodia	482	671	647	828	881	1,148	2,482	2.87
Laos	613	679	748	876	929	1,203	1,669	1.74
Mongolia	435	586	787	1,058	1,332	1,059	1,001	1.45
Vietnam	658	799	735	757	1,025	1,809	2,970	2.63
Jordan	1,663	2,330	2,395	4,480	3,792	4,089	5,702	2.15
Algeria	1,365	2,088	2,249	3,152	2,947	2,863	3,520	1.65
Cameroon	671	832	982	1,192	1,211	1,075	1,212	1.02
Egypt	910	991	1,254	2,069	2,523	2,936	3,725	2.46
Gabon	3,108	4,184	5,869	6,777	4,797	3,844	3,811	0.35
Ghana	1,122	1,378	1,424	1,157	1,062	1,265	1,650	0.67
Kenya	651	726	915	1,051	1,117	1,013	1,098	0.91
Morocco	1,455	1,329	1,616	2,272	2,591	2,652	3,465	1.51
Mozambique	1,133	1,327	1,743	1,220	1,114	1,338	2,160	1.12
Tunisia	1,115	1,343	1,827	2,944	3,335	4,550	6,103	2.97
Uganda	687	713	867	572	585	773	1,008	0.66
World Average	2,111	2,773	3,729	4,512	5,150	6,038	7,614	2.24

Note: including Timor until 1999.
Source: Angus Maddison, *Historical Statistics of the World Economy: 1-2008AD*, (http://www.ggdc.net/maddison).

The Korean economy grew rapidly, but the process of economic development was not smooth. The government of the Republic of Korea was established in 1948. The nation lacked resources to carry out industrial reconstruction policy and low income could not support investment in economic development. Therefore, Korea was dependent on U.S. aid for economic development and industrial reconstruction.[9] The outbreak of the Korean War in 1950 made the situation worse and the nation was left in ruins until a ceasefire agreement was signed between the South and the North in 1953. Korea suffered massive economic damage, resulting in destruction of 42% of production facilities and 46 % of factory buildings. After that, the nation endeavored to reconstruct the destroyed economy.[10] However, Korea's post-war recovery efforts commenced with U.S. aid; while, the government appropriated funds by issuing loans and bonds for industrial reconstruction.

The population of Korea was about 21,178,000 and per capita GNP was estimated at $78.7 in 1954.

Table 1-4 | Per Capita GNP and Population of Korea in the 1950s

	1953	1954	1955	1956	1957
Per Capita GNP ($)	76.1	78.7	81.0	82.3	89.7
Population (in thousands)	20,844	21,178	21,526	21,870	22,220

Source: Park, Jeong-jae, Korea Productivity Center, Korea Economy 100 years, 1971, p.635.

In those days, Korea was basically an agriculture-based economy (67.7% of employed persons were engaged in agriculture in 1957). This meant that Korea's industrial structure relied heavily on the primary industry. As shown in Table 1-5, the primary industry accounted for

Table 1-5 | International Comparisons of GNP Composition of Countries

(Unit: %)

Nation	Year	Primary Industry	Secondary Industry	Tertiary Industry
Korea	1954	43.9	16.6	39.5
	1957	37.8	20.4	41.8
U.S.	1954	5.5	66.2	28.3
U.K.	1954	4.9	66.4	28.7
Germany	1954	11.0	74.5	14.5
Japan	1954	22.2	52.8	25.0
Italy	1954	30.1	65.8	4.1
The Philippines	1954	43.4	36.2	20.4

Source: Ministry of Reconstruction, *Reconstruction White Book*, 1957, p.14.

9. At that time, foreign aid came from the Economic Cooperation Administration according to the 1948 Aid Agreement between Korea and the U.S. Most of this aid was spent on consumer goods, which worked to stabilize people's livelihood.
10. Cho, Myong Gi, A "Study on Productivity Movement Directions by Economic Stage," Korea Productivity Center, 1995

43.9%, the secondary industry for 16.6%, and the tertiary industry for 39.5%, of GNP in 1954. However, the primary industry took up 5.5%, the secondary industry 66.2% and the tertiary industry 28.3%, of the U.S. industrial structure during the same period. This indicates that Korea's industrial base lagged far behind that of the US.

As the nation's industrial structure was still agriculture-based after the Korean War, the government's budget for economic reconstruction was considerably insufficient. From 1953 to 1957, total demand surpassed total supply. This demand surplus was appropriated by foreign aid (Table 1-6). At that time, this was inevitable in reality because Korea could not mobilize investments and financial resources for economic reconstruction and development though people's living standards gradually improved. Under these circumstances, it was imperative to reconstruct Korea's devastated economy and lay the foundation for developing a self-reliant national economy.

Table 1-6 | Composition of Total Supply and Demand

(Unit: %)

	1953	1954	1955	1956	1957
Total supply	100.0	100.0	100.0	100.0	100.0
GNP	84.3	88.2	89.6	87.8	89.6
Net Profit of Goods and Services	3.8	2.7	2.0	1.2	0.8
Foreign Aid	11.9	9.1	8.4	11.0	9.6
Total Demand	100.0	100.0	100.0	100.0	100.0
Private Consumption	85.8	81.3	79.5	77.7	71.8
Total Domestic Investment	5.7	8.9	11.0	12.6	14.9
Ordinary Expenditure of the Government	8.6	10.7	10.3	10.3	11.9
(Statistical Error)	-0.1	-0.9	-0.8	-0.6	+1.4

Source: Ministry of Reconstruction, Reconstruction White Book, 1957, p.20.

1.1.2.2. Economic Policy in the 1950s

Economic development plans were carried forward in most of the countries that gained independence after the Second World War, which had left their economies damaged. The economic development plans were directed to accomplish economic growth, to upgrade the industrial structure and to strengthen cooperation with advanced economies. From a social aspect, they were directed to pursue modernization.

Modernization and overcoming poverty were the main issues of Korea whose economy was destroyed by war. The government attempted to attain economic independence and to this end, it established the "Economic Reconstruction Plan" in the 1950s and "Three-Year Economic Development Plan in 1960."[11]

The government organized the Ministry of Reconstruction for economic reconstruction in February 1955.[12] The Ministry of Reconstruction established the Economic Development Committee under its control and this committee prepared the "Economic Reconstruction Plan" and the "Three-Year Economic Development Plan."[13] The "Three-Year Economic Development Plan" (1960-62) sought to lay the foundation for a self-sustainable economy. And it was viewed that a self-sustainable economy should be attained by improving the balance of payments by improving Korea's productive capability. To accomplish this goal, the government attempted to lessen its dependence on foreign aid for food and to balance demand and supply of agricultural products. And the government attempted to foster small businesses, with the intention of raising the self-sufficiency ratio of daily necessities and expanding employment opportunities. Also, the government tried to pursue a strategy of import substitution and export growth to improve the balance of payments. The government sought to build social infrastructure such as telecommunication, electric power, health and educational facilities without which development could be hindered.

To resolve problems in a systematic manner, however, a series of activities were required to accumulate capital and to foster the management capability. At the time, when the implementation of the economic development plan was at the initial stage, capitalists were incapable of accumulating capital to operate businesses and entrepreneurs had no experience in business management. The government attempted to provide the financial sources for economic reconstruction and achieve technological development through aid from the U.S. At the time, U.S. aid was estimated to reach roughly 10 % of the total supply of the economy.[14]

In this period, the "Labor Union Act" (1953), the "Labor Relations Commission Act" (1953), the "Labor Dispute Act" (1953) and the "Labor Standard Act" (1954) were legislated for the first time in Korea, and the legal basis for labor protection, labor organization and union activities was established.

11. Committee on the Sixty-Year History of the Korean Economy, *the Korean Economy: Six Decades of Growth and Development, Korea Development* Institute, 2010.
12. The Ministry of Reconstruction was reorganized in the Ministry of Planning (1948).
13. The Three-Year Economic Development Plan passed the State Council on April 15 1960. However, its enforcement was delayed due to political instability, and the plan was finally implemented after it was changed to the Five-Year Economic Development Plan in 1962.
14. From 1954 to 1957, the amount of US aid (facilities, raw materials and technical aid) from the International Cooperation Administration surpassed $8.8 billion (Ministry of Reconstruction, *Reconstruction White Book*, 1957, p 224

1.2. Need for Establishment and Objectives

1.2.1. Need for Establishment

Korea opened to Western civilization via Japan before its independence in 1945. Also, the nation adopted knowledge on management and industrial administration for economic modernization, and the intellectual base for productivity movements, from the U.S. and Japan. Especially, intellectuals and business management who adopted productivity initiatives noted the high level of industrial productivity in advanced economies and hoped to acquire the knowledge and apply it to Korean industry. [15]

In those days, the Korean economy relied heavily on foreign aid, but foreign aid gradually decreased while industries began to have interest in internal rationalization. The Ministry of Commerce and Industry and the Ministry of Reconstruction regarded the achievement of economic stabilization and growth based on productivity growth as very important.[16] The founder and chief executive officer of the Korea Productivity Center (KPC) claimed to have built it based on the belief that productivity improvements were the only way to achieve prosperity in Korea. The founding board meeting was held to announce the establishment of the Korea Institute for Productivity Research in June 1957 under the following mandate.:

Mandate of the Korea Institute for Productivity Research[17]

In reconstructing the national economy, investments in production facilities should be continued but this does not guarantee the stable growth of the economy. Hence, as an urgent task, a productivity movement is demanded which has had good results in many countries. Some people say that the productivity movement is not of use and not appropriate for an immature economy. But this claim is merely a result of the misunderstanding of productivity or the failure to capture the essence of modern corporate management.

When we note the trends of the world economy, the U.K. employed a productivity movement by private collaboration between the U.K. and America as a measure to overcome the fund crisis. Germany accomplished the reconstruction of economy from war damages and prosperity through a productivity movement. This movement spread to 16 Western European countries and an intense movement was deployed through a productivity center as a private unit. And recently, the movement is prepared in Asian countries.

15. After witnessing a productivity movement led by the Japan Productivity Center established in 1955, Lee Eun Bok, the founder of KPC, came to note that productivity was the factor causing differences in corporate management.
16. Lee, Eun Bok, Review on Productivity, the 1st Issue, 1958, pp. 76-79
17. Korea Productivity Center, *Ten-Year Report on KPC's Activities*, 1967, p.80

Especially Japan established the Japan Productivity Center as a private body based on the recommendation and financial and technical support by the U.S.A. By utilizing it as the strategic base, Japan accomplished unprecedented economic stability and prosperity, and recently, it is expected to establish the Asian Productivity Organization modeled on the European Productivity Organization.

The productivity movement is not originally directed toward production increase. Rather, the movement aims to expand markets and employment, increase actual wages, enhance the living standards of people, and pursue common interests of the workers, the management and consumers through the reduction in production costs, quality improvement, and the rise in quality and quantity per production factor unit or total unit production. Hence, the movement is an urgently demanded nation-wide project since investment in economic reconstruction has been wasted and encroached by unscientific management of businesses.

As a result of a sincere desire for the movement, the Korea Institute for Productivity Research is now established as a foundation and as a central body to drive fair productivity movements. Through management contribution and united efforts of the government and the people, the Korea Institute for Productivity Research will endeavor to fortify growth of the Korean economy.

1.2.2. Objectives of Establishment

As the main body in charge of the productivity movements, the KPO outlined the basic principles of the productivity movement including:

1. Productivity movements are non-political, non-profit-oriented, and unbiased efforts of the people.
2. Productivity movements serve the interests of the management, workers and consumers.
3. Practical movements for management rationalization, technology innovation, facility modernization and labor-management cooperation
4. Pioneering movements that prevent waste and create new value
5. Movements to realize the belief that today should be better than yesterday and tomorrow should be better than today.

The first principle of the doctrine is the same as the one prescribed in the U.K. and Japan. The second principle emphasizes that it would bring benefits to all members of the society using the term “workers” instead of “employees” in order not to provoke social distinctions based on social strata. The third principle reflects the situation of the establishment by enumerating the areas required to develop the economy. The fourth principle points out the issue of waste prevalent in those days. The fifth point was derived from the declaration of the European Productivity Organization made in the 1950s. It was paraphrased into the simple slogan “We too can prosper!" and later, it was changed to "Let's live in affluence."

Based on these fundamental principles, KPC formulated a "15-year three-stage long-term plan" with its establishment. It also expanded modalities of productivity movements annually according to this plan. At the initial stage (1957-61), it planned to devote its efforts to building the activity system in the areas of outreach, research and overseas cooperation by focusing on cultivating an environment open to modern economic and management. At the second stage (1962-66), it planned to focus on establishing the management and technical service system by expanding industrial training and technical consultancy centered on the dissemination and application of modern techniques of management and technology-driven administration. At the third stage (1966-71), it set goals for completing a higher level of the total productivity activity system by designing the productivity improvement of the whole industry, including areas of distribution services and agriculture.

KPC established the articles of association in 1965 and conducted projects as follow:

① Collection of data on production, marketing, labor, transportation and other management, and studies and guidance on scientific management
② Technical surveys and research on manufacturing
③ Technical surveys and research on construction
④ Research on economic development, industrial policy and industrial location
⑤ Education and training on production, marketing, labor and other management
⑥ Analysis of companies, education and consultancy for productivity improvement
⑦ Dispatching observation missions abroad and inviting foreign experts
⑧ Surveys on the introduction and dissemination of advanced foreign technology
⑨ Establishing libraries, public relations booths and educational units
⑩ Publicizing materials through exhibitions and movies
⑪ Publication of periodicals and others
⑫ Training and consultancy on scientific technology
⑬ Technical guidance on export industries
⑭ Electronic data processing

2. Establishment Process of the Korea Productivity Center

2.1. Decision-Making Process

The establishment of KPC began in the 1950s when founder Lee Eun Bok recognized that Europe succeeded in post-war recovery and Japan continued to prosper through advancements in productivity. Japan established the JPC as a private organization in 1955 with financial and technical support from the U.S.[18]

Founder Lee Eun Bok persuaded the relevant authorities of the need to establish an organization that was responsible for carrying out productivity movements, with the belief that only productivity improvements could pave the way for building economic capability and was the fastest way to welfare enhancement. Together with the academia, he persuaded various sectors of society to participate in this effort. Especially, he succeeded in attaining financial support from companies, including the Korean Association of Bank and Financing, the Korean Association of Electric Power, and the Korean Association of Textile Manufacturers. On June 4, 1957, the founding board meeting was held and it decided to establish KPC as a private organization.

The founding board was mostly composed of scholars,[19] who theoretically acknowledged the need for the movement and its effects, because the government and industry lacked awareness of management rationalization and productivity improvement. Soon after the founding board meeting was held, it asked for the official endorsement of the Ministry of Commerce and Industry; subsequently, the establishment process was completed with the government's approval in August 28, 1957. At the time of its establishment, the organization was called the "Korea Institute for Productivity Research" but renamed the "Korea Productivity Center" on April 1, 1958.

2.2. Implementation of the System

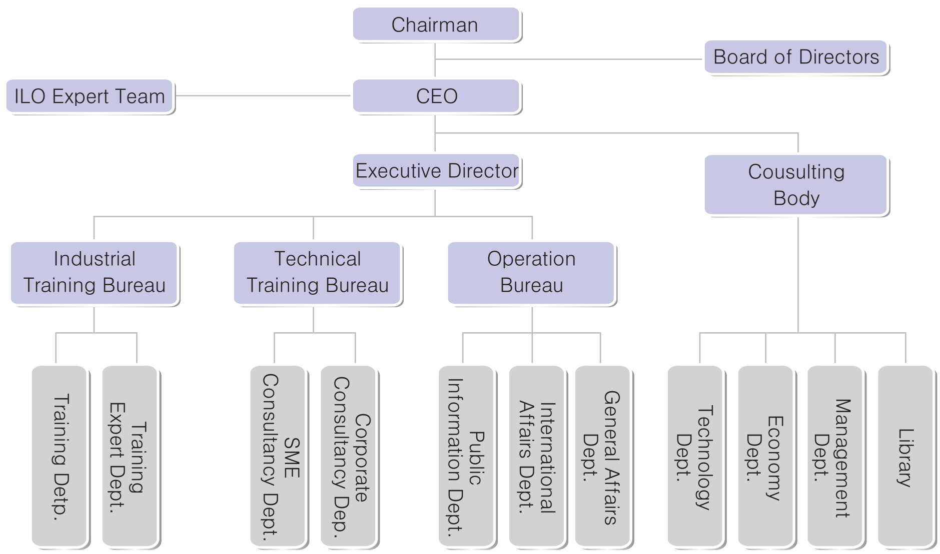
KPC was the starting point of driving the productivity movement in the private sector on a voluntary basis in the late 1950s. It organized itself into three bureaus, one body and 11 departments. At the initial stage of its establishment, the center actively asked the ILO to

18. Korea Productivity Center, *Productivity Book*, 1983, p.27
19. When the institute was set up, six out of 11 board members consisted of scholars, and the rest comprised one enterprise president, two officials from the Korea Chamber of Commerce & Industry, and those from the Bank of Korea and the National Assembly.

provide support for the nation's management modernization. In response, it stationed ILO experts in Korea and set up the "ILO Expert Team" as a separate body in KPC.

The activities of KPC at the beginning were largely composed of personal efforts of founder and CEO Lee Eun Bok. Under his leadership, the principles of productivity movements were prepared and KPC endeavored to formulate a strategy.

Figure 1-1 | Organization of KPC at the Initial Stage



Source: Internal data of KPC.

2.3. Relevant Laws and Regulations

KPC established itself as a private organization in the form of a foundation. The foundation was an appropriate vehicle to drive the productivity movement and ensure it was a nation-wide initiative that was non-political, non-profit-oriented and unbiased. The term "foundation" implies that it is non-profit-oriented. "Non-government" implies that it is independent of the government and free from the influences of politicians and bureaucrats. Not to be biased toward the interests of a particular segment of the society, the organization needed to take the position with the public's interest in mind. Productivity movements could be deployed in line with those of a non-profit public organization.

However, the government amended the organizational status of KPC in 1987 and re-established it as a special corporation based on the "Manufacturing Development Act"[20] which endowed KPC with the function of leading the productivity improvement in Korea's industry.

2.4. Fund Raising

KPC was established as a foundation. And to satisfy the legal requirements of a foundation, funding was required. Funding equivalent to $100,000 (in 1958 exchange rate) was provided by industrial associations that represented electric power companies, banks, and textile manufacturing companies. Other operational expenses were funded by the personal contributions of its members.[21]

As the government approved the establishment of KPC, it offered funding equivalent of $100,000 in 1958 for purpose of educating and training entrepreneurs and business management. KPC could employ new staff members and build an education system with the government's support. Its systematic operation started in January 1958. Operational expenses were also paid for using some of the profits that came from training programs, consultancy work for corporation and membership fees. The average annual revenue surpassed 13.6 billion won in the 1990s and reached 45.7 billion won in the 2000s, as a result of its specialized management consulting services and training. KPC has endeavored to establish a stable revenue base to support itself and has grown continuously. It reached revenues of 82.2 billion won in 2009.

20. The Manufacturing Development Act was enacted in 1986, and the Korea Productivity Center was established in accordance with Article 22 of this act. The act provided momentum for fundamentally changing the basis for industrial policy by avoiding government-led support for particular industries, establishing the base for autonomy of the private sector and seeking support for industries according to functions. (Committee on the Sixty-Year History of the Korean Economy, *the Korean Economy: Six Decades of Growth and Development*, the Korea Development Institute, 2010.
21. At the time, Chairman Lee Hong Sik and Lee Eun Bok, the founders of KPC, made considerable personal contributions (*Thirty-Year History of Korean Productivity Movements*, 1987). Because of this, KPC was characterized as a private organization in its operating methods though it had the characteristics of a public organization in its nature and scope of business. These contradictory elements limited the development of this organization. In contrast, the Japan Productivity Center is more like a public organization since the industries made contributions to its establishment.

3. Roles and Activities of the Korea Productivity Center by Period

3.1. Transition Process of the Korea Productivity Center

3.1.1. Change in the Nature of the Organization

3.1.1.1. Legal Nature of the Korea Productivity Center

KPC was established as a foundation with the government's approval in 1957. But its status as an organization underwent changes. The government enacted the "Manufacturing Development Act" which sought to expand the industrial base; to promote productivity improvement, effective utilization and development of resources, and human resource development; to improve the balance of international payments; and to strengthen the foundation for fostering self-supporting industries. Under this act, KPC was reestablished as a special corporation on July 1, 1986.

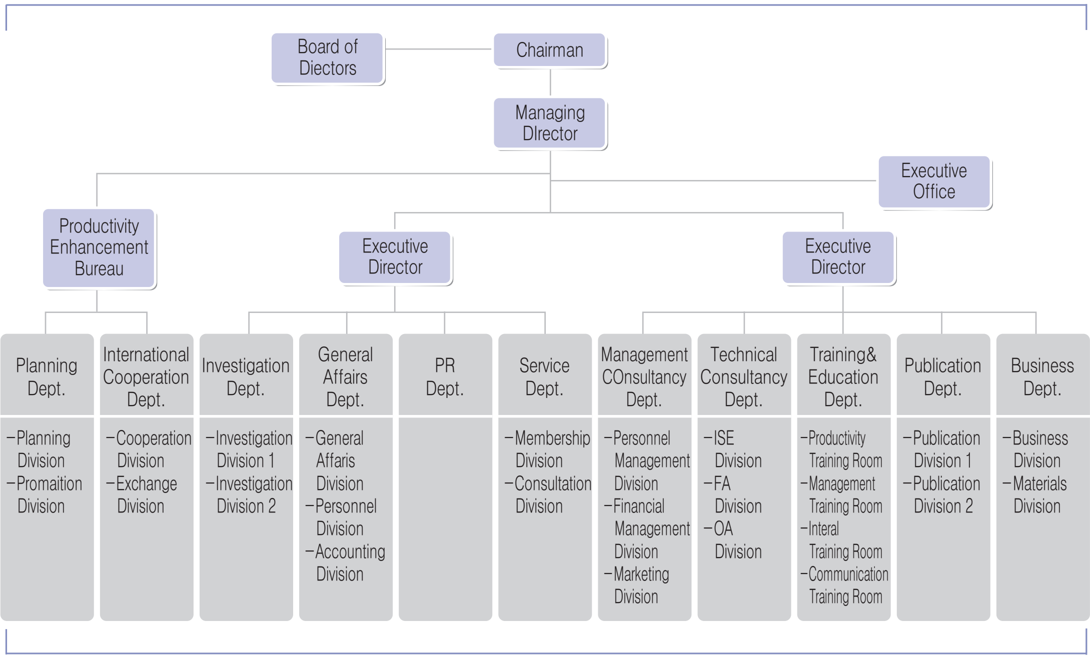
The Korean industry demanded a new strategy to respond to the changing market environment in the wake of the WTO and the financial crisis of the late 1990s. To this end, the government replaced the "Manufacturing Development Act" with the "Industrial Development Ac" to strengthen the competitiveness of Korea's industry and to upgrade the industrial structure in 1999. Presently, the legal status of KPC is as a special corporation under the Ministry of Knowledge Economy under Article 27 of the "Industrial Development Act."

3.1.1.2. Change in the Organizational Structure

When KPC was reestablished as a special corporation in 1986, it was composed of one bureau, nine departments, 14 units and 14 divisions as presented in Figure 1-2. KPC sought to diversify its industry coverage by installing nine departments in parallel.

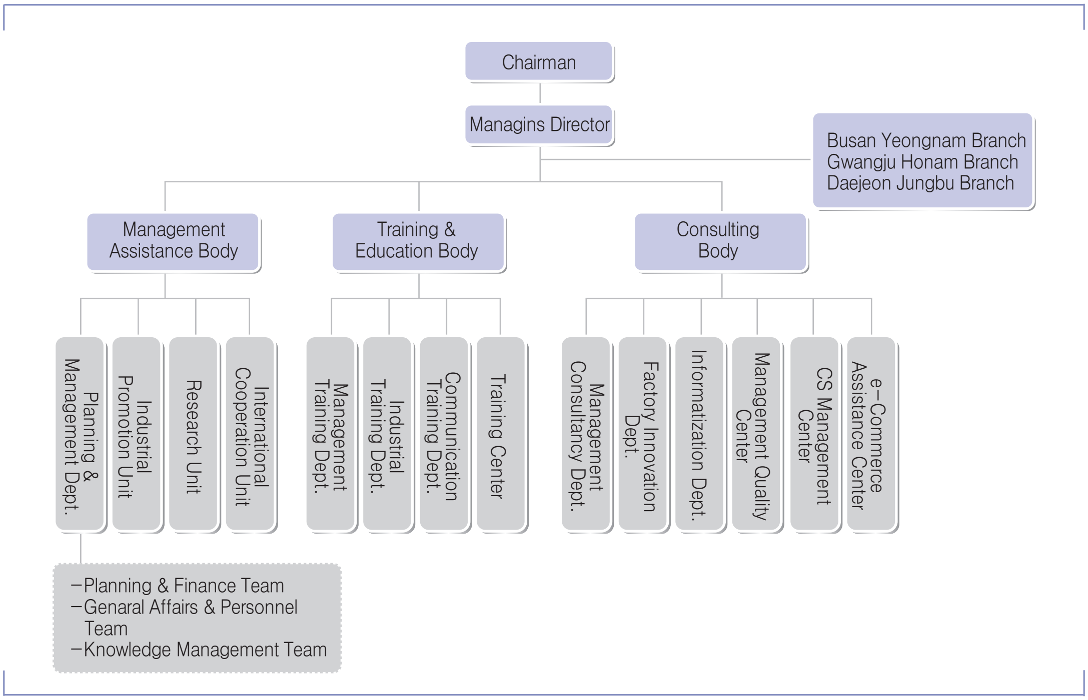
KPC underwent restructuring in the 1990s. In the 2000s, it was revamped into an organization based on two main areas of business, and it performed business effectively under an organizational structure that consisted of three bodies, seven departments, three units, three centers, one training center and three branches.

Figure 1-2 | KPC's Organizational Structure in 1986



Source: Internal data of KPC.

Figure 1-3 | KPC's Organizational Structure in 2000



Source: Internal data of KPC.

As to KPC's staff and board members, it has maintained about 300 employees and has flexibly supplemented its existing personnel when necessary. The staff numbered 145 when KPC was re-established in 1986 as a special corporation, and the number of staff reached the highest level at 384 in 1991, indicating that this was a period when it was most active since its establishment. Still, the conditions at home and abroad demanded the restructuring of the center in the 1990s, and the number of its staff members reached 145 in 2001. The average number of staff members by post in the chronological order is shown in Table 1-7. As of December 2010, KPC employed 303 personnel. Throughout the periods, the number of professional members accounted for more than a half of the total, reaching up to 78% particularly in the 2000s.

Table 1-7 | Average Number of Staff Members by Post

(Unit: person)

Year	Executives	Professional Staff Members	General Staff Members	Total
1980s	2.8	103.3	78.0	184.0
1990s	3.2	153.2	101.3	257.8
2000s	2.5	157.4	45.4	202.6
Dec. 2010	4	222	77	303

Source: Internal data of KPC.

3.1.2. Change in Financial Sources and the Revenue Structure

KPC could attain financial support from the government and the international community such as the UN since it established itself as a non-profit public organization. According to the agreement between the Korean government and the ILO Body for Technical Support, KPC carried out a project for productivity improvement for five years (from September 1962 to August 1967) with $840,000 from the UN Special Fund and $860,000 from the government. This project focused on upgrading the management techniques of administrators, technicians and supervisory groups. It also contributed to expanding the productive capability of facilities, reducing costs and increasing wages.

Also, according to the agreement on technical cooperation between KPC and the U.S. Operations Mission (USOM) and Korea, which was responsible for US aid to Korea, KPC carried out consultancy work on technical and managerial areas with financial support from the Agency for International Development and USOM-Korea. This technical consultancy project was separated from the above-mentioned the "Five-Year Productivity Improvement Project" by the UN Special Fund, and it aimed to address problems in the technical area by utilizing American technicians and to upgrade the technology level of the industry in general. Also, KPC nurtured technical experts by educating young technicians with American technicians stationed in KPC.

3.2. Activities and Major Roles of KPC by Period

3.2.1. Initial Stage of Establishment (1957-1961)

In the 1950s, “Land Reform” changed the agricultural production system, laying the base for the development of agricultural sector. It increased the motivation of farmers dramatically, laying the human and technical groundwork for developing the agricultural production capacity. And land reform served as a background for landowners who sold their farmlands by playing the capitalist’s role, which influenced decisively the change of the entire economic structure. It also enabled the farmers who became yeomen to invest in education, which was crucial to upgrading Korea’s labor force that provided fertile ground for industrialization.

The Korean War completely destroyed the material basis of the Korean economy. Therefore, the economy, which lacked resources and technology, was forced to pursue economic development by implementing a strategy of import substitution, importing raw materials and intermediate goods which were required for development as well as reconstruction of the industries for final consumption goods and consumption goods. For import substitution, the Korean government imposed higher tariffs and import quotas in order to restrain imports of non-durable consumption goods, including textiles and groceries. With respect to the items which were not domestically produced and the items which covered only a small fraction of the domestic demand, imports of these goods were allowed based on scarce foreign currencies. But with respect to items that could be domestically produced, payment with foreign currencies was prohibited strictly. These actions led to the acceleration of the import substitution of non-durable consumption goods by promoting the reconstruction and development of textile and food processing industries.

In 1957, KPC was founded to keep pace with the government’s investment in import substitution industries and its policies for increasing productivity. Subsequently, it established a long-term plan to drive the productivity movement, growing its operations every year. During this period, KPC focused on the transfer of modern economic and business know-how. As such, it raised awareness for the need and effects of improving productivity, including the concept of management rationalization. Also, KPC sought to increase understanding of and participation in the movement.

In 1959, KPC sought the help of the ILO by pursuing cooperation. In response, the ILO sent a team to Korea in order to carry out surveys. Eight ILO experts stayed in Korea, during which the government’s support for the movement gained momentum. The fact that commercial banks co-financed the movement, as a national project and in support of the ILO project, boosted the productivity movement as well.

Despite the political and economic instabilities, KPC was able to keep the productivity movement non-political, non-profit-oriented and impartial, laying the foundation for improving productivity focusing on publication, PR, research and international cooperation.

3.2.1.1. Public Relations Activities

KPC launched the monthly magazine *Corporate Management* on December 1957, and published the *Complete Works of Productivity* consisting of 11 volumes in 1960. Also, KPC published seven issues of the weekly newspaper "Productivity" in 1961 but suspended its publication due to the government's policy on newspapers.

On the other hand, the center held business exhibitions in Seoul, Daegu and Incheon, and carried out televised courses with support of the Seoul Central Broadcasting Center (Now KBS). And KPC raised public awareness in management improvement and productivity through seminars, brochures, and courses for the business community. In 1959, KPC established the "College Student Productivity Research Federation" and held the "National College Student Productivity Debate Tournament" as an annual event in order to raise recognition of the productivity movement among students.

In 1958, its corporate consultancy business, which was the first of its kind in the nation, played a pioneering role in Korea which woefully lacked modern management at that time. In 1961, KPC began to provide guidance on the management of pilot factory as part of the government's policy to foster SMEs. Also, KPC took the initiative in driving the productivity boom in Korea, including general companies as well as public companies.

3.2.1.2. Training & Education Activities

As to industrial training, KPC started with the educational course "Practice Management Course" in September 1958, the following year of its foundation. The center received approval for the establishment of an "Executive Institute" in 1959. Then, it systemized all the general affairs, including training programs, course schedules, developing textbooks and inviting lecturers. Particularly, as policies for management rationalization (job analysis and re-education of employees) were strongly promoted in general companies (including national companies) in 1962, the importance of training and education services spread widely. This led to a sharp rise in enrollments. During this period, the number of trainees who graduated from KPC reached 2,444.

3.2.1.3. Productivity Research Activities

As to productivity research activities, KPC first focused on providing information that was required for formulating government policies and corporate management plans. Starting from scratch, this initiative became the basis for Korea's productivity movement. KPC held various workshops, including surveys on the management conditions of companies and conducted analysis and data collection on productivity. In the year following the establishment of KPC, the organization established the "Productivity Research Institute" to focus on these efforts, which led to the recruitment of experts. In the beginning, the institute held seminars almost every day and established and developed the idea of productivity movement.

When the productivity research institute was established, there were a lot of difficulties due to the lack of experts and limited budget, but KPC carried out lots of external research as well as internal self-research activities through active government support and KPC's continuous efforts.

In the beginning period (1957-1961), KPC's productivity research institute conducted eight studies, including "research on productivity movements in other countries, a "study on Korea's economic development and labor union movement," and a "study on establishment of government economic organizations," etc.

3.2.2. The 1960s

In the early 1960s, Korea suffered economic hardship due to rapid population growth, influx of the rural population into cities, unemployment, and so on. The consumer goods manufacturing sector, such as the food processing industries and other textile industries, which grew based on $200-300 million of surplus agricultural products from the U.S. after the Korean War, accounted for 80% of Korea's total manufacturing. However, these industries did not develop their own technology actively; while, reinvestment by capital accumulation was negligible. Moreover, pursuing import substitution-oriented growth was difficult due to the limited domestic market. In addition, foreign currency was badly needed to resolve the international balance of payment deficit that was caused by a gradual reduction in foreign aid.

Therefore, the Korean government attempted to mitigate the balance of payment deficit by adopting an export-led industrialization strategy in labor-intensive light industries. The government believed that Korea had an international comparative advantage in exports of labor-intensive light industrial products due to its surplus of highly-educated workers.

To do this, the government established and implemented the first and the second Five-Year Economic Development Plans, which led to the urgent construction of industrial infrastructure and the foundations for industrialization.

According to the government's economic policy of promoting exports of light industrial products, the productivity movement in 1960s focused on corporate consultancy work, management and technology education and industrial training to utilize new management techniques.

Support from international organizations contributed greatly to KPC's efforts in developing the productivity movement based on international standards. Especially, KPC pursued a project to increase productivity for five years (Sep.1962 to Aug. 1967) which was funded with $840,000 from the "United Nations Special Fund (UNSF)" and $860,000 from the government's budget which was agreed between the Korean government and the ILO in August 1962. Accordingly, KPC expanded its line of work from total industrial training to management consultancy, PR, publishing, and libraries. Also, some seven to eight ILO specialists in business management from each sector came to KPC annually to teach advanced business administration. KPC also received the latest audio and video equipment and books equivalent to tens of thousands of dollars. The center concluded the "Korea-US Technology Agreement" with the "United States Operations Mission in Korea (USOM)" in 1966, and undertook management and technology consultancy services.

On the other hand, KPC studied ways to drive the productivity movement and stabilize labor-management relations as a top priority through its productivity research institute. Also, it promoted labor-management cooperation together with the Federation of Korea Trade Unions (FKTU). It conducted educational-related activities commissioned by the FKTU and established the "Labor-Management Cooperation Committee." Through those activities, KPC expanded the national basis for a productivity movement. In addition, KPC introduced a general-purpose computer for the first time in Korea in June 1967, providing the basis of starting informatization business.

3.2.2.1. Management Consulting Activities

KPC has had a comparative advantage in corporate diagnosis and management consulting services compared with other institutes in terms of tradition and performance. In the late 1960s, the manufacturing structure became more complicated, and thus, competition became fiercer. In response, business consultancy activities were more specifically classified into general business, business management, R&D, marketing, production management, financial management, management of human resources, legal issues, and so on. In addition, KPC introduced the standard cost management system for preparing government and public policies, exports and import substitution products, and public utility charges. Also, KPC actively propagated quality improvement, cost reduction lectures, OR technique, and PERT techniques.

Table 1-8 | Management Consulting Services in the 1960s

(Unit: case)

Year	General Consultancy	Consultancy by Sector	Cost Calculation	Total
1958~59	5	-	-	5
1960	7	-	-	7
1961	2	14	-	16
1962	8	20	-	28
1963	2	51	57	110
1964	9	117	-	126
1965	11	52	6	69
1966	6	19	26	51
1967	2	34	23	59
1968	1	21	65	87
1969	7	96	164	267
Total	60	424	341	825

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

In the 1960s, KPC provided a total of 825 management consultancy services: 60 general consulting services, 424 services on production, finance, marketing, and personal affairs, and 341 services on cost calculation.

3.2.2.2. Training and Education Activities

In the early stages, KPC's training and education programs just introduced foreign business management technology. Starting from the early 1960s, however, it adopted the management techniques of developed countries and applied them to the domestic corporate climate. As a result, KPC specialists began to plan and provide independent and creative industrial training.

The training and education program at the early stage was mainly based on lectures on business practice and lectures by foreign specialists as well as briefing sessions, which were needed to foster management training and education. In 1959, KPC began to expand training and education in other fields as requested by companies, while starting several new business practice courses, including courses for fostering executives, shop management courses, courses for management fellows, and so on. Especially, the training and education programs improved in quality and quantity as the organization separated the training and education activities from its treasury activities supported by the ILO through the UNSF. In the mid-1960s, its activities became more dynamic as KPC sought to address problems in each functional field as well as present solutions in order to set variable training goals for each trainee's levels. In addition, KPC offered free courses, which drew positive reactions from the industry.

KPC's training and education programs benefited 19,014 trainees and offered 581 courses since its establishment to 1969.

Table 1-9 | Training & Education Services in the 1960s

(Unit: course, person)

Year	Treasury Services		Internal Services		Total	
	Course	Trainee	Course	Trainee	Course	Trainee
1958	-	-	22	1,616	22	1,616
1959	-	-	9	437	9	437
1960	-	-	6	265	6	265
1961	-	-	9	479	9	479
1962	-	-	16	788	16	788
1963	28	876	12	494	40	1,370
1964	29	640	21	824	50	1,464
1965	53	1,130	28	948	81	2,078
1966	49	1,203	34	1,250	83	2,453
1967	51	1,386	31	1,144	82	2,530
1968	51	1,466	44	1,879	95	3,363
1969	50	1,193	38	1,608	88	2,261
Total	311	7,984	270	11,120	581	19,104

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

3.2.2.3. International Cooperation Activities

To improve the productivity of domestic firms, KPC introduced and promoted knowledge on the latest professional management and technology, techniques and experience of advanced countries. Also, in close cooperation with overseas institutions specializing in productivity, KPC pursued various projects.

Especially when the Asian Productivity Organization (APO) was established in 1961, KPC joined the APO as a founding member. Thus, it performed several international exchange activities, such as international conferences, inviting technology experts, holding symposiums and seminars, contributing to the introduction of information on foreign industrial technology and management. In addition, KPC established a Japan branch in the early-1960s which supported the exchange of productivity information between Korea and Japan. Also, it dispatched full-time employees to the APO.

KPC could receive assistance and support according to the Korea-US Technology

Agreement concluded with the USOM in 1966. Therefore, American specialists in particular business and technology sector worked in the Daegu and Busan headquarters, and conducted management and technology consultancy services suited to the local context. Also, KPC continuously dispatched large-scale productivity observation groups consisting of representative CEOs from each industry.

In addition, KPC joined the Committee International de I'Organization Scientifique (CIOS) in January 1962, which widened its scope of activities. Dividing its international activities into the ILO, the APO, USOM, and CIOS, KPC carried out various activities, including sending observation groups abroad, holding international conferences and seminars, inviting foreign technology specialists, and dispatching domestic engineers overseas. In 1966, KPC led Asia's productivity movement by taking the chairmanship of the APO.

Table 1-10 | International Cooperation Performance in the 1960s

(Unit: person)

Year	International Conference	Technology Specialist	Symposium & Seminar	Training & Education	Productivity Research	Observation Group	Total
1959	3	-	-	-	-	-	3
1960	5	-	-	-	-	-	5
1961	8	-	-	-	-	-	8
1962	6	2	-	14	2	11	35
1963	13	1	5	13	2	6	40
1964	7	2	11	18	2	1	41
1965	8	2	5	15	2	10	42
1966	7	1	11	10	2	8	39
1967	9	-	2	9	2	10	32
1968	8	1	3	11	2	8	33
1969	8	1	7	4	2	12	34
계	82	10	44	94	16	66	312

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

3.2.2.4. Productivity Research Activities

KPC conducted a variety of productivity research studies through KPC's productivity research institute. It broadened its research fields to include business administration, economics, construction engineering, technology, and so on. Therefore, the outcomes of its research studies were utilized as a basis for planning government policies and corporate strategies at individual firms.

KPC conducted a total of 202 research projects since its establishment to 1969. The contents of the research projects conducted can be summarized as follows:

① Economic research in each sector required for the government establishing policies
② Economic and technology analysis about land development and construction
③ Research on government plans and basic materials for industrial development policies
④ Economic analysis of several government plans and managements
⑤ Measuring economic indicators and statistical research
⑥ Forecasting demand for several products
⑦ Research on domestic and international markets
⑧ Investment planning and analysis of profitability
⑨ Surveying and designing civil engineering and construction projects
⑩ Research on and design of industrial location and complexes
⑪ Research on management strategies and business plans
⑫ High-speed processing and analysis of various statistical data using computers

Table 1-11 | Productivity Research Services in the 1960s

(Unit: case)

Year		1957~61	1962	1963	1964	1965	1966	1967	1968	1969	Total
Government Subsidy		8	7	9	14	22	16	12	14	10	112
Contract	Economy · Business	-	-	1	6	2	7	8	15	11	50
	Engineering · Construction	-	-	-	-	-	4	13	9	14	40
Total		8	7	10	20	24	27	33	38	35	202

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

KPC has conducted analysis on labor productivity and economic forecasts every quarter since 1960. Also, it studied the performance of the government's economic development plans and methods for strengthening Korea-Japan economic cooperation. In addition, KPC conducted annual research in contributing to the formulation of the government's policy to create industrial complexes and foster specialized industries.

3.2.2.5. PR & Publishing Activities

KPC's PR and publishing activities played an important role in enhancing awareness in the corporate sector and the public about productivity and business rationalization from the early stages of its establishment. "Corporate Management" largely contributed to promoting the purposes and directions of productivity movements. In February 1962, KPC published the first issue of *Living Economy*, which discussed how to choose products and how to live a more productive life. The publication of KPC's periodicals numbered 1.31 million copies from its establishment to 1969. Various other works and series were published, including *Business*

Theory and Practice, the first volume of *Complete Works of Productivity*. The subjects of the books were broadened to include the technology sector as well as the management sector. A total of 161,400 copies of 156 books were published in the 1960s.

KPC established the Productivity Award, and widely promoted consumer protection. KPC showed movies and slides about corporate management introduced from the APO and the ILO. Also, it provided free counseling services through various counseling centers.

3.2.2.6. Efforts to Support Small & Medium Business

In order to promote the spread of the productivity movement in local regions, KPC established the Busan-Gyeongnam branch in 1962, four branches more (Choongnam, Gangwon, Jeonnam and Tokyo) in 1964, the Jeonbuk branch in 1965, and the Jeju branch in 1966, and raised the Busan-Gyeongnam branch and Gyeongbuk branch to the status of local headquarters.

3.2.3. The 1970s

In the 1970s, Korea underwent rapid export-led economic growth. As the nation's exports changed from non-durable consumption goods to durable consumption goods and labor-intensive medium goods, the need for domestic production greatly increased for capital goods (machinery and automobiles) and capital-intensive medium goods (steel and petrochemicals). Starting from the 1970s, industrialization in Korea began to focus on the production of medium goods (petrochemicals and steel) and the transport industry (shipbuilding and automobiles).

At times, focus on human resources development, management modernization and labor-management cooperation were ignored largely due to growth of monopolistic enterprises, which was supported by the government during this period. While pursuing businesses based on achieving economies of scale by expanding facilities, these large companies tended to pay no attention to increasing productivity.

In view of corporate management, the perception that management plans were the exclusive property of national enterprises and large companies faded. More and more, awareness spread that management plans should also be established and operated by SMEs. The companies that could not avoid being swept up by globalization introduced pre-planned business management to forecast and prepare for the future. In addition, business management techniques, which had remained just a theory, were applied to industries. On the other hand, Korean industries experienced rapid growth in production facilities in all sectors, which was the result of increased facility investment as domestic demand rose and exports continuously increased. This was in part due to the fact that Korean companies were driven by business and technological advancements of developed countries in the competitive international environment. Although computerization in the field of inventory management and cost calculation was introduced as a way to improve production facilities, the distribution rate of computers remained low at just 20%. Computers in the 1970s were still in its infancy.

As the Korean industry failed to pay attention to improving productivity in the 1970s, labor disputes increased every year due to poor working conditions, including low wages and long work hours. KPC suffered financial difficulties as it had to carry out its programs on its own without government subsidies. This resulted in the need for conducting new business. Also, this was an important period for KPC, as it was an opportunity to start anew and secure financial independence. KPC's management consultancy work was mostly input-oriented which sought to improve productivity centering on profitable business. As to training and education, cost calculation courses were broadened.

3.2.3.1. Management Consulting Activities

As severe competition between companies and solid technical cooperation with foreign countries took place driven by the government's policy to actively foster export-based companies, the main issues also changed in the overall business fields (marketing, human resources, corporate finance, production management, cost management, and so on). Therefore, KPC introduced a strategic concept in its management consultancy work. The core concept was that organizations should cope with the rapidly-changing external environment through the "adaptation to business climate changes" and the "efficient allocation of resources" to compete and grow in the long run. KPC tried to introduce and apply the latest management techniques from developed countries (mainly from the U.S. and Japan).

Compared with the first half of the 1970s, KPC's management consulting work decreased in the second half. This may have occurred because human resources had been developed to meet demand, and because the number of management consultancy companies had increased. As it turned out, the major reason was that in spite of growing management problems amid rapid economic growth and high inflation, companies had focused mainly on growth itself rather than solving problems by improving productivity.

KPC conducted a total of 685 management consultancy projects in the 1970s.

Table 1-12 | Management Consulting Services in the 1970s

(Unit: case)

Year	General	HR	Corporate Finance	Marketing Management	Production Management	Cost Calculation	Total
1970	16	2	4	6	17	40	85
1971	14	8	13	7	8	20	70
1972	11	-	3	3	2	29	48
1973	5	2	7	2	-	24	40
1974	10	1	4	2	-	34	51
1975	5	1	1	1	10	37	55
1976	3	6	7	1	20	58	95
1977	5	7	3	1	-	48	64
1978	7	4	3	-	-	79	93
1979	4	1	6	3	2	68	84
계	80	32	51	26	59	437	685

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

3.2.3.2. Training & Education Activities

As human resource management system changed from being seniority-based to merit-based in the 1970s, a big issue was developing the capability and utilization of workers. The principles of upgrading manpower should be presented in management and personal affairs policy. Training should seek to foster human capital development as well as improving knowledge and technology. Also, methods for training and its contents should be systemized as well as training should focus on motivating workers. In the 1970s, KPC developed and conducted training and education programs that could help workers adjust to the economic climate and foster high-quality human resources. In 1972, KPC's training and education programs were downsized because support from the ILO suspended and KPC had to conduct its own education programs. However, demand for training and education increased sharply thanks to the growth of the economy and industrial sector. As such, KPC significantly expanded training and education programs after the mid-1970s. As a result, KPC was able to meet the corporate demand by training 31,219 workers in 931 courses.

Table 1-13 | Training & Education Services in the 1970s

(Unit: number, person)

Year	Treasury Services		Internal Services		Total	
	Course	Trainee	Course	Trainee	Course	Trainee
1970	50	1,646	38	1,403	88	3,049
1971	25	738	58	2,050	83	2,788
1972	-	-	59	1,765	59	1,765
1973	-	-	51	1,429	51	1,429
1974	-	-	67	1,516	67	1,516
1975	-	-	114	3,946	114	3,946
1976	-	-	104	3,599	104	3,599
1977	-	-	114	3,374	114	3,374
1978	-	-	126	5,105	126	5,105
1979	-	-	125	4,648	125	4,648
Total	75	2,384	856	28,835	931	31,219

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

3.2.3.3. International Cooperation Activities

KPC promoted international cooperation in the early 1970s with government financial support, which was 60% of the budget. However, KPC began to experience financial pressure in 1973 because the government decreased its support, leaving the center to appropriate its budget to fund some of the international cooperation programs. Still, KPC expanded, and began new research initiatives as the APO in 1973. The KPC's strategy direction also changed from being APO-based to general cooperation-based.

A total of 305 international cooperation programs were offered, and 1,682 people participated in the 1970s. By business sector, KPC held international conferences such as the APO Board and the chief-level Workshop for the National Productivity Organization (NPO). It also provided training courses on project feasibility and industrial and system engineering. KPC invited and dispatched research observation groups such as the corporate management research observation group and the SME observation group, and held symposiums and seminars such as the productivity measurement symposium and the export marketing seminar.

3.2.3.4. Productivity Research Activities

The period of the 1970s were volatile times for the KPC in regards to its research efforts..Research on industrial economy, which had been subsidized by the government until 1972, had to be reduced somewhat because the government suspended support in 1973. This part of KPC was revitalized in the late 1970s as the organization became more specialized. During this period, the stoppage of government support caused financial difficulties which led to massive organizational and business restructurings, such as the dissolution of the existing productivity research institute and the transfer of its research sector to the industrial economy research department and the land development technology department.

Table 1-14 | Productivity Research Services in the 1970s

(Unit: case)

Year		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Total
Government Subsidy		11	13	11	-	-	-	-	-	-	-	35
Internal Budget		-	-	-	4	4	12	18	13	16	12	79
Contract	Economy · Business	9	6	3	3	2	4	9	7	2	4	49
	Engineering · Construction	8	8	5	-	-	-	-	-	-	-	21
Land Development		-	-	-	5	3	3	6	6	4	3	30
Total		28	27	19	12	9	19	33	26	22	19	214

Source: Korea Productivity Center, *Thirty-Year History of Korean Productivity Movements*, 1987.

A total of 219 research studies were conducted in the 1970s. Contents of the research projects can be summarized as follows:

① Research to establish the government's economic policy
② Productivity-related research based on productivity statistics
③ Market and business research by business type
④ Investment planning and feasibility analysis
⑤ Various studies to strengthen the management capabilities of companies
⑥ Surveying technology for civil engineering and construction
⑦ Research required by other industries

3.2.3.5. PR and Publishing Activities

In the 1970s, PR work and publishing were expanded with goal of making a profit and contributing to national industrial development. The magazine "Business Management" played a major role in providing new management information and technique from abroad to industry as a way to promote the industrial development and to contribute to the enhancement of the national welfare during the 1970s. The publication of the monthly magazine "Living Economy," which had focused on the rationalization of the national economy and people's living, ceased in May 1971 after the discontinuation of government support and continuous deficits.

Despite the weak publishing industry, a total of 256,000 copies of 145 new books were published by KPC. The books published by KPC were valued more for quality and quantity rather than profitability. The books were not very profitable because they mainly covered specialized subjects and issues on business management and because the reading audience was limited. As such, the circulation volume for 1st editions was less than 1,000 copies in most cases, which made the cost burden too high. KPC has, however, continued to publish books related to business management considering that the publication of these books and the publicity generated help to promote productivity enhancement movement.

3.2.3.6. Audio-visual Education Activities

KPC began offering audio-visual education from 1972 when the concept of audio-visual education was not popular in the country yet. In 1973, KPC produced seven sets of slides in partnership with the Japan Productivity Center and six sets of audio-visual content using outstanding production technique that was outsourced. KPC received requests to produce audio-visual education materials from large companies which recognized the need for audio-visual education.

In the middle of the 1970s, the corporate sector pushed for qualitative improvements in labor conditions as a means to overcome the economic slowdown caused by the oil shock. To this end, the production of slide sets on consignment basis increased significantly and the level of KPC's technology for the production of audio-visual education materials was recognized at home for its top quality. In the 1970s, KPC produced and supplied a total of 435 sets of audio-visual education materials including slide sets and movies.

3.2.4. The 1980s

The Korean economy experienced very big changes in the 1980s in line with the changes in the world economy. Due to the aftermath of the second oil shock in 1979, advanced countries suffered deficits in their balance of trade, including the U.S., thus leading them to pursue protectionist policies in general. As a result, Korea faced difficult conditions since it was dependent on exports for economic growth, and recorded negative growth rate at the beginning of 1980s. Moreover, the government's suppression of labor rights weakened the productivity movement which depends on labor-management cooperation. There was deterioration in corporate governance and financial corruption became prevalent. Corporation sought government influence and support instead of trying to introduce productivity enhancement methods.

Starting from 1986, however, domestic and overseas economic conditions turned around, and Korea's economy grew rapidly, recording a growth rate of 12.2% as capacity utilization in the industrial sector increased driven by exports. In terms of the balance of trade, Korea's trade deficit significantly increased up until 1980, and then gradually decreased afterwards. Indeed, Korea recorded a surplus in both trade balance and current account balance in 1986. From mid the 1980s, consumer prices significantly stabilized and the unemployment rate remained low, as the domestic economy began to show a desirable development trend.

The period of 1980s has great meaning as a turning point in the history of Korea's productivity enhancement movement. Under difficult domestic and overseas economic conditions at the beginning of 1980s, both the private and public sector recognized that among other things the enhancement of corporate productivity was the most important factor in achieving sustained and stable economic growth and securing international competitiveness. At the time, KPC sent a delegation to Japan, which was known for having achieved high productivity, securing a level of productivity that was three times higher than Korea. The team's mission was to study the productivity enhancement movement in Japan and to learn about their advanced technique. At the same time, the Korean government decided to adopt the issue of productivity enhancement as a major policy task for the 1980s.

In June 1981, the "National Productivity Enhancement Promotion Conference" was held by the Ministry of Commerce and Industry and managed by KPC to encourage productivity enhancement. Over 4,000 people participated in the conference including the Prime Minister, the Minister of Commerce and Industry, various other Ministers, four heads of major economic organizations, representatives of pertinent agencies and large corporations and small and medium enterprises. The "Joint Declaration for Productivity Enhancement" was adopted at the conference as a show of commitment toward productivity enhancement.

In 1986, KPC restarted as a special corporation with the purpose of clarifying the role of government and the direction of government policies in establishing the objectives for the productivity enhancement. It also created an implementation system, defined the functions of productivity related organizations and built-up the system of cooperation with other organizations.

Furthermore, KPC helped corporations promote their own efforts for productivity enhancement. To establish a base for the productivity enhancement movement, KPC tried to instill a mindset on productivity and expand it as a nation-wide movement through education, content development, cultivation of trainers, the expansion of guidance and diagnosis projects and increased opportunities for overseas training.

Since the '6.29 Declaration'[22] in 1987, there were as many as 3,800 cases of labor disputes

22. '6.29 Declaration' is a special declaration which was announced by Noh Tae-Woo who was the representative of the ruling party (Democratic Justice Party) accepting people's request for democracy and revision of the Constitution for direct election of President. After the Declaration, the election of President was changed to democratic method of direct election by people from indirect election up until that time.

which were unparalleled in Korea's history. The labor disputes incapacitated the production capability of corporations. This led corporations to initiate projects on Factory Automation (FA) and Office Automation (OA), and to implement machinery-centered automation projects in full scale to increase productivity. It is important to note that Korea's approach to productivity enhancement differed from advanced countries such as Japan and the U.S. which focused on raising productivity through human capital development efforts. At the time, Korea's productivity enhancement movement included FA and OA focused diagnosis and guidance projects, the distribution of performance needed for labor-management cooperation and industrial rationalization projects.

3.2.4.1. Management Diagnosis and Guidance Activities

Having gone through two oil shocks during 1970s, corporations became more interested in raising productivity and their view on rationalized corporate management became significantly different. The fields covered by management diagnosis and guidance project were expanded to areas such as management policy, human resource management, financial management, marketing management, production management, office automation and factory automation of corporation. These areas became more and more specialized within the field.

Table 1-15 | Performance of Management Diagnosis and Guidance Services in 1980s (Unit: number of items)

Year	Number of Diagnosis & Guidance items
1980	64
1981	53
1982	55
1983	47
1984	44
1985	44
1986	44
1987	34
1988	39
1989	45
Total	469

Source: KPC, "30 years History of Productivity Movements of Korea", 1987,
The Ministry of Commerce and Industry, "Annual Report on Small & Medium Businesses," 1988-1990.

In response to the age of information and automation and the need to enhance the productivity level of corporations remarkably, KPC commenced new initiatives in the areas of factory automation and office automation from 1984. It subsequently established the

Technology Guidance Department in 1986 by separating technology related areas, which included factory automation, office automation and production management, from the existing management diagnosis and guidance service to specialize the area.

The number of management diagnosis and guidance studies conducted by KPC in the 1980s totaled 469, a decrease to some extent from the 1970s.

3.2.4.2. Education and Training Initiatives

In the 1980s, Korea's domestic economy was reorganized toward the heavy chemical industries in response to the trend of international division of labor. That is to say, technology and function intensive industries such as automobile, electronics, shipbuilding, textile and machinery industries were aggressively developed and were the main drivers of Korea's economic development.

Accordingly, in order to formulate policy strategy for facilitating economic development based on the changes in the industrial structure, KPC had to concentrate its efforts on the development of the heavy chemical industry using high industrial technology with emphasis on human resources development together with job creation to reduce poverty. In this regard, KPC led the advancement of technology and drove changes in the industrial structure through the implementation of intensive and specialized industrial education and training programs putting

Table 1-16 | Performance of Education & Training Service in 1980s

(Unit: Person)

Year	National Fund	KPC's own Fund			Total
		Group Education	In-house Education	Home Study	
	#Persons	#Persons	#Persons	#Persons	#Persons
1980	-	1,145	2,511	367	4,023
1981	-	1,261	3,465	504	5,230
1982	1,938	1,305	2,748	4,487	10,478
1983	1,378	1,331	3,696	301	6,706
1984	1,602	883	621	83	3,189
1985	1,865	1,072	898	150	3,985
1986	1,387	1,626	8,394	401	11,808
1987	7,586	1,974	3,529	1,306	14,395
1988	9,457	4,029	3,938	4,429	21,853
1989	2,793	4,100	4,428	5,263	16,584
Total	28,006	18,726	34,228	17,291	98,251

Source: KPC, "30 years History of Productivity Movements of Korea," 1987,
The Ministry of Commerce and Industry, "Annual Report on Small & Medium Businesses," 1988-1990.

emphasis on the generation, retention, allocation and utilization of Korea's labor force.

As government implemented the productivity enhancement movement as a national movement and as a part of its new economic policy from 1981, KPC conducted special education and training seminars on productivity for instructors, guidance staff and the officers of government owned enterprises together with KPC's own programs. KPC funded these programs using special export funds received from KTA, which was provided as a government subsidy, for education and training programs.

In the 1980s, long-term education courses with certification were created in subjects such as Cost Management Consultant, Management Consultant, Production Management Consultant, Management Information Consultant, Marketing Management Consultant and Human Resources Consultant. In addition, specialized and practical education and training programs were conducted.

Also in the 1980s, KPC trained and educated a total of 98,200 industrial workers through group education (open education), in-house education and home study programs.

3.2.4.3. International Cooperation Service

We can say that Korea's corporations and economy recognized the necessity for productivity enhancement movements under active government support during the 1980s. Indeed, the will to accomplish the movement was more strengthened. In addition to that, KPC's international cooperation efforts also made remarkable progress. It is worthwhile to note that technology experts were invited through Technology Expert Service (TES) in cooperation with APO. The APO experts participated under a mutual exchange program between APO member countries. KPC provided assistance in general projects and helped to acquire various technology for productivity enhancement that were focused on the development of domestic industry.

In the 1980s, KPC participated in a total 630 international exchange projects such as international productivity conferences, various seminars and symposiums centered around APO. In 1984, the 26th APO Board of Directors Meeting was held in Seoul to actively promote international cooperation by holding the Asia Productivity Enhancement Symposium in 1985.

3.2.4.4. Research Activities

KPC's research activities were further specialized in 1980s; subsequently, various research projects for the establishment of productivity enhancement policy and for promotion of productivity enhancement movements by individual corporations with government support were conducted. At the same time, the Technical Research Project for National Land Development was shut down simultaneously. In the 1980s, approximately 140 research studies were carried out and major areas of the research projects are as follows:

① Various actual state survey for labor management cooperation
② Research on corporate strategy for business rationalization of corporation
③ Development of productivity enhancement technique and measuring technique
④ International comparison of productivity
⑤ Exploration and distribution of success cases of productivity enhancement
⑥ Basic plan and research related to production
⑦ Research on the reinforcement of competitiveness of small and medium business
⑧ Research on industrial policy tasks for productivity enhancement
⑨ Feasibility analysis on new projects
⑩ Provision of various corporate information and data

Table 1-17 | Number of Research Projects in the 1980s

(Unit: Number of items)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total
Total	16	18	20	16	9	8	10	14	16	12	139

Source: KPC, "30 years History of Productivity Movements of Korea," 1987,
The Ministry of Commerce and Industry, "Annual Report on Small & Medium Businesses," 1988-1990.

3.2.4.5. PR and Publishing Activities

It was difficult at first to secure an audience for the periodical magazine "Corporate" at the beginning of the 1980s but KPC kept on publishing the magazine every month. From the middle of the 1980s, the number of subscriptions to the magazine gradually increased. The monthly magazine "Productivity Newsletter" became a bi-weekly magazine from April of 1986 and its circulation also increased significantly, playing an important part for the promotion of the productivity enhancement movement throughout Korea's industry.

The KPC's book publishing activities were insignificant up until 1985 during which only four new books and new editions of some existing books were published. But from 1986, KPC's book publishing activities became very active with the publication of new books on a wide variety of subjects. In the 1980s, a total of 72,000 copies of 30 new books were published.

3.2.4.6. Audio-visual Education Activities

After having accumulated experience on the delivery of audio-visual content steadily in the 1970s, KPC tried to gradually adapt to the shift in the mode of delivering content from slides to videos entering into 1980s. KPC could not make significant progress in the production and delivery as it concentrated in new facility investment. During the period of the 1980s, KPC produced and supplied a total of 350 kinds of audio-visual education materials (video tapes and slides).

3.2.5. The 1990s

In the 1990s, Korea's domestic economy entered into a phase of full scale expansion as facility investment accelerated up until the mid 1990s; but at the end of 1997, domestic demand such as consumption and investment rapidly fell due to the impact of foreign exchange crisis. Korea recorded a GDP growth rate of -6.7% in 1998. In 1999, however, Korea's corporate sector recovered quickly, and in the 2nd half of 1999, the growth rate increased by 13.0% which was the highest growth rate since 1988. The remarkable increase in economic growth rate was attributed to recovery of domestic demand which fell sharply in the previous year as the optimistic prospect of Korea's economy grew thanks to the recovery of Korea's foreign credit rating and fiscal policy that supported the recovery of foreign trade. In addition to this, Korea's exports became more competitive on the back of the Korean won's devaluation and corporate restructuring, which accelerated the recovery of the business cycle driven by the economic recovery in Southeast Asia and the growing trend of the U.S. economy.

In the latter part of the 1980s, advanced countries introduced strong import controls and pushed for the opening of markets. There was concern on the possibility of Korea's international balance of payment going into a deficit from surplus due to a sharp increase in wages which outpaced the increase in productivity on top of the impact from advanced countries. In order to overcome this, more attention was put on productivity enhancement as a fundamental way to strengthen the competitiveness of Korea's manufacturing industry. Together with these changes, KPC was designated as a special corporation in 1986, and thus from the beginning of the 1990s, KPC actively sought to expand productivity enhancement movement jointly with the government. Demonstrative of KPC's efforts among other things was the "Productivity Doubling Movement" which was jointly initiated by the Ministry of Commerce and Industry and KPC. It was implemented based on the "Comprehensive Measure for doubling Productivity." To implement this movement which aimed to double the amount of added value production per capita, KPC established a mutual cooperative system as a key agency for the productivity enhancement movement by organizing the Civil Implementation Committee for doubling Productivity which included representatives from pertinent organizations for productivity, academia and industry.

As a major project for doubling productivity, KPC declared the 1st week of July of every year as the "Week of Productivity" and sought the active participation of corporations by recommending that they present a success case model of productivity enhancement. The goal was to disseminate success cases in the 3 areas of automation, production management and management rationalization through seminars at the major industrial complexes and publications, at the same time, KPC sought to assist companies that wanted to participate by providing diagnosis and guidance.

In order to instill the individual corporation's desire to implement productivity enhancement movement, KPC requested that the nation-wide Chamber of Commerce and the industrial complexes which are under direct supervision to recommend cases of excellent productivity examples by a corporation. The success cases were screened, selected, and designated as "Superior Productivity Corporation" by the Ministry of Commerce and Industry. The most outstanding case was awarded the "Grand Prix for Productivity."

KPC also held "Productivity Doubling Promotion Conferences" centering around industrial complexes in Seoul and respective their region. Slogans and PR movies on productivity enhancement were disseminated and PR campaigns through TV and radio advertisements for as many as 100 spots were conducted.

In 1998, KPC established the National Customer Satisfaction Index (NCSI) project which measures customer satisfaction on major domestic commodities, services and public sector based on international criteria. The index provides basic data for the enhancement of national competitiveness.

In summary, the productivity doubling movements played a central role in productivity enhancement movements in the 1990s before the foreign exchange crisis. After the foreign exchange crisis, KPC focused on diagnosis, guidance and education activities to enhance competitiveness through factory rationalization, standardization and quality enhancement to overcome the crisis and corporate management through productivity enhancement.

3.2.5.1. Automation Efforts

KPC recognized that raising competitiveness through increased investment in automation is a shortcut to sustained economic growth, and therefore, introduced activities for factory automation, office automation and factory management rationalization through education, diagnosis, guidance, research and the operation of permanent exhibition hall for automation machineries.

3.2.5.2. Management Diagnosis and Guidance Activities

When requested by a corporation, KPC conducted a diagnostic assessment of each area within the corporation and performed management diagnosis and guidance in the areas of human resources organization, financial, marketing and production management to promote productivity enhancement by offering guidance on management technique suitable for improving the problems. Research projects which derived optimum plans for making policy and for connecting corporation's decision making process were actively carried out based on academic study.

And the consulting for whole process for operation of the informatization plan for the establishment of office innovation and information system utilizing information and technology was performed together with 100PPM and Six-sigma diagnosis and guidance. Including all the above projects, a total of 1,049 projects were performed in the 1990s.

Table 1-18 | Performance of Management Diagnosis and Guidance Activities in the 1990s

(Unit: Number of items)

Year	Number of Items for Diagnosis and Guidance
1990	40
1991	69
1992	80
1993	40
1994	98
1995	118
1996	129
1997	197
1998	137
1999	141
Total	1,049

Source: The Ministry of Commerce & Industry, "Annual Report on Small & Medium Business" 1991-2000, Internal data of KPC.

3.2.5.3. Training & Education Activities

To support the productivity enhancement in the industrial sector through efficient development of human resources, KPC continuously expanded education and training activities at industrial sites to upgrade the professional manpower in terms of size through the development and provision of professional education programs in the 1990s. KPC tried to efficiently cope with the serious shortage in industrial manpower by conducting education and training to foster the industrial manpower in various areas including management, automation and information. KPC promoted the basic theory on productivity enhancement.

KPC was able to train and educate approximately 326,300 workers in the 1990s.

Table 1-19 | Performance of Education & Training Activities in the 1990s

(Unit: Person)

Year	Government Subsidy Project	KPC's own Project			Total
		Group Education	In-House Education	Home Study	
	# Persons	# Persons	# Persons	# Persons	# Persons
1990	1,500	4,700	8,500	8,000	22,700
1991	1,508	4748	10,916	8,150	25,322
1992	1,452	5,204	6,776	7,463	20,985
1993	-	5,623	8,032	8,242	21,897
1994	-	12,968	19,482	8,856	41,306
1995	-	11,665	16,530	9,306	37,501
1996	-	14,036	19,805	9,543	43,384
1997	-	15,038	15,052	13,010	43,100
1998	-	10,873	10,447	12,403	33,723
1999	-	9,900	14,432	12,045	36,377
Total	4,460	94,755	129,972	97,018	326,295

Source: The Ministry of Commerce & Industry, "Annual Report on Small & Medium Business," 1991-2000, Internal data of KPC.

3.2.5.4. Research Activities

KPC published various research reports on management and economics and productivity that included related statistical data in establishing the government's industrial policy and corporations' management strategy. In 1991, KPC modified the method of formulating the existing productivity index so that more accurate statistical data on productivity can be calculated through the research of "Labor productivity index reformation method." In this regard, the index formation method of advanced countries and views from all walks of life were gathered together.

3.2.5.5. International Cooperation Activities

After joining the APO on behalf of the government of Korea which is a founding member, KPC intensified activities on advanced management, technical method and information supply through APO cooperative efforts to promote productivity enhancement and economic development in Asia. It also held international symposiums and seminars for the exchange of state-of-the-art productivity enhancement techniques and information, dispatched research inspection tour groups and invited specialized technicians.

3.2.5.6. PR, Publishing and Information Data Supply Activities

To provide relevant information required by corporations, KPC has steadily published books on specialized economic and business management technique. In the 1990s, KPC also published periodicals including the “Corporate”, “Productivity” and “Productivity Newspaper” regularly.

KPC has been active in publishing books, in which some books including “Companies will go bankrupt unless managers change” became a bestselling book in the social science field for a long period of time.

Through the delivery of visual educational content, KPC has produced various videos for productivity enhancement such as “Lifetime design for office workers” and slide materials.

3.2.5.7. Announcement of National Customer Satisfaction Index (NCSI)

National Customer Satisfaction Index (NCSI) is an index which was developed by KPC jointly with the University of Michigan in the U.S. The index is calculated based on the level a customer’s satisfaction for a product that is directly used by the customer, which provides direct evaluation on the quality and service of the product. The products evaluated were produced and sold domestically and overseas. .KPC is providing national competitiveness enhancement plan by comparing, analyzing, evaluating and announcing customer satisfaction levels for various areas including the manufacturing industry, transportation / communication / public services, retail business, financing / insurance business and public administration / government service.

3.2.5.8. Other Support Initiatives for Small & Medium Business

KPC actively implemented a variety of policies aimed at fostering the development of small and medium companies. In the first place, KPC promoted the establishment of small and medium companies through the Korea Corporate Consulting Co., Ltd., the affiliated corporation of KPC. Then it implemented general projects for fostering and developing small and medium companies. The projects started from the stage of business feasibility review to the establishment of procedures, the provision of information and the arrangement of funding so that the newly established companies could grow healthy and sound.

KPC’s Certification Institute Co., Ltd., the affiliated corporation of KPC, is engaged screening and monitoring ISO9000/ISO14000 certification. Also, KPC’s B Books Co., Ltd. supports the productivity enhancement of corporations by publishing various books in the fields of economics, business management and technology.

In October, 1989, KPC opened the Preliminary Venturing School under the sponsorship of the Ministry of Commerce and Industry. The school fostered approximately 1,100 preliminary venture founders, promoting the prevention of social losses by avoiding initial failure after founding, the activation of venture founding through information exchanges between venture founders, policy makers and pertinent government agencies and the enhancement of business management capability for non-professional preliminary venture founders.

On behalf of the government, KPC was in charge of the "Certificate of Productivity Enhancement Facility Investment." It supported the efforts of small and medium companies to make investments for process improvement, automation, replacement of worn-out facilities and investment for advanced technology facilities, so that they could to benefit from corporate tax exemptions for the investments.

Besides the above, KPC screened and made recommendations on companies which qualified for government funds such as industrial development fund and national investment fund so that the companies could achieve productivity enhancement through automation. And for the support of local small and medium companies, KPC established branch offices in Busan, Gwangju and Daejeon and provided educational programs, consulting and ISO certification through the branches.

3.2.6. The 2000s

Beginning in the 2000s, growth in the Korean economy somewhat slowed due to a slump in exports and facility investment on the back of a slowdown of the world economy. But Korea's GDP growth rate picked up to 7% again from 2002 as consumption started to increase due to low interest policy and rebound in exports. In 2003, Korea's economic growth rate slowed down again due to a drop in domestic consumption and facility investment. From 2004, exports continued to increase and domestic demand also recovered, resulting in a growth rate of 5% in 2007.

In 2008, however, world economy fell into a severe recession due the global financial crisis which was caused by the sub-prime mortgage crisis in the U.S. The Korean economy ended up recording a growth rate of 2.2% due to weak domestic demand and slowdown in exports. But in the later part of 2009, the Korean economy bounced back on back of active operation of fiscal and currency credit policy and improved export conditions.

In the 2000s, the government implemented policies to move toward a knowledge based economy by increasing investment in state-of-the-art technology development, the exploration of new growth engines and environmental management. Accordingly, the direction of productivity enhancement movement shifted as well.

KPC has promoted a nation-wide productivity enhancement movement to lead Korea into the 21st century where infinite possibilities and uncertainties coexist. It also has supported industrial development and strengthened the international competitiveness of small and medium companies through the development and delivery of new management innovation technique and programs for the intensification of corporate constitution.

In particular, KPC has been supporting corporations by intensively developing future oriented consulting techniques and education and training programs suitable for this digital age. It is also providing them so that corporations can actively cope with the global economic environment. To accomplish this, KPC identified corporations and individuals that showed superior performance in productivity enhancement and awarded those that achieved productivity enhancement to instill the importance of productivity in the corporate mindset and encourage laborers' participation. In addition, KPC has been trying to play a leading role in identifying outstanding domestic and overseas cases of success, and subsequently, disseminating the outstanding case studies to the pertinent industries while contributing to the enhancement of industrial competitiveness by providing online corporate productivity diagnosis to corporations.

As a major initiative, the "Productivity Grand Prix" award to corporations and recognized excellence in productivity enhancement was implemented under the new name of "National Productivity Grand Prix" in line with the revised Industrial Development Act in 2004. The awards were given not only to corporations but also to top-level managers, officers and employees of corporations who demonstrated outstanding performance by actively promoting productivity enhancement and management innovation movements in their organizations. Based on recommendations, KPC selected and awarded top achievers with the "Workers of Merit for Productivity Enhancement." The "National Productivity Innovation Conference" was held every year, in which representatives from labor, management and government participated to promote the national productivity movement.

In line with the revision of the Industrial Development Act in 2004, the Productivity Management System (PMS) certification system was legislated, and thus, KPC developed the criteria for PMS screening and implemented certification system based on the entrustment of the Ministry of Industry and Resources. From January 2006, KPC carried out a range of efforts including: the diffusion and support of PMS for small and medium companies; developing a screening system for certification and upgrading of manpower, production and distribution of manuals with criteria for the certification screening system; the development of standard model for innovation implementation for small and medium business; and presentation of success cases for the introduction of the certification system.

Furthermore, the "Productivity Innovation Service (e-PRINS)," which is online management consulting service to support management innovation for small and medium companies through productivity enhancement, was opened from 2007.

To support the productivity enhancement of individuals and organizations utilizing information technology, the Information Technology Qualification (ITQ) certification, a national accredited system to evaluate information processing capability objectively was implemented to enhance information utilization capability of industrial manpower. We have continuously provided useful information such as the latest data related to productivity, major statistics, instructions on educational and training, and online consulting through KPC's website.

During this period, the focus on management and economy was shifted from being production-driven system to one that is customer (consumer)-centric. Accordingly, KPC also introduced the National Customer Satisfaction Index (NCSI), National Brand Competitiveness Index (NBCI) and Dow Jones Sustainability Index (DJSI). In addition, it expanded its efforts in existing diagnosis and guidance and education programs.

3.2.6.1. Consulting (Management Diagnosis and Guidance) Activities

KPC has been providing professional and comprehensive consulting services by measuring the performance of corporations based on the expertise and experiences derived from advanced theory which were introduced since management consulting was introduced for the first time domestically. KPC has also been involved in consulting activities in the public sector by contributing to the formulation of public policy, rate calculation and cost calculation, which require objectivity to ensure public confidence.

Table 1-20 | Performance of Management Diagnosis & Guidance Service in 2000s (Unit: Number of items)

Year	Number of Items for Diagnosis & Guidance
2000	84
2001	66
2002	95
2003	145
2004	144
2005	118
2006	135
2007	133
2008	210
2009	249
Total	1,379

Source: Internal data of KPC.

From 1986, KPC established the Management Information Service (MIS) with an objective of corporate productivity enhancement utilizing information technology and strengthening corporate competitiveness by supporting the establishment of work handling capabilities and IT systems utilizing information technology to promptly cope with the changes in the management environment brought on by the digital age, KPC has also been consulting small and medium companies on IT innovation by assisting them in developing corporate IT plan, standardization of IT systems, the introduction and establishment of ERP as well as PI related consulting and the establishment of productivity supporting system for organization and individual through IT-centered organization innovation.

KPC actively conducted as many as total 1,370 consulting assessments in 2000s.

3.2.6.2. Education and Training Activities

KPC plans to cultivate high quality and specialized human resources by conducting site case based education in order to enhance professional capability of Korea's manpower, a source for corporate competitiveness. While systematically developing educational courses by identifying the educational demands of the new management environment, KPC has provided education programs in the categories of open functional education, in-house education, home study education and CEO management innovation education. It has conducted education programs to cultivate practical management capability to cope with the changes in domestic and overseas

Table 1-21 | Performance of Education & Training Activities in 2000s

(Unit: Persons)

Year	KPC's Own Services			Total
	Group Education	In-House Education	Home Study Education	# Persons
	# Persons	# Persons	# Persons	
2000	11,660	18,802	16,460	46,922
2001	13,981	11,246	13,031	38,258
2002	16,390	17,240	15,881	49,511
2003	19,174	19,078	16,955	55,207
2004	21,820	20,445	14,700	66,965
2005	25,029	45,937	57,191	128,157
2006	30,321	62,453	39,203	131,977
2007	34,366	56,569	38,438	129,373
2008	34,395	70,556	27,925	132,876
2009	36,825	108,472	47,328	192,625
Total	243,961	430,798	287,112	971,871

Source: Internal data of KPC.

management environment and professional knowledge application capability in the field of quality innovation.

KPC's education and training efforts have continued to expand, having trained and educated a total of approximately 970 thousand people in the 2000s.

3.2.6.3. Research Activities

KPC has been measuring the level of the Korean industry's production efficiency and technology enhancement by collecting and publishing labor productivity statistics and conducting labor productivity analysis on listed corporations. These assessments serve as the basis for the formulation of companies' financial plan, management strategy and wage policy. KPC has also conducted research studies on major tasks related to productivity enhancement and management innovation so that corporations can utilize it as basic data for production efficiency enhancement, technology investment and performance based distribution. KPC has been carrying out research on the enhancement of corporation's competitiveness by offering case studies of advanced countries, which have been revised in the context of Korea.

KPC has been contributing to the standardization and development of a scientific system for corporate management by establishing models for management system development plan and management improvement and boosting corporations' interest in the systemization of management through the development and distribution of management productivity model of international level for the improvement of management system and qualitative enhancement of productivity enhancement movements so that small and medium companies can cope with new management environment actively.

3.2.6.4. International Cooperation Activities

After joining the APO on behalf of the Korean government, KPC intensified its efforts on advanced management, technical method and information supply service through not only cooperative works with the APO to promote productivity enhancement and economic development of Asia but also international symposiums and seminars to exchange state-of-the-art productivity enhancement techniques and information. It also participated in the promoting research inspection tours overseas and the invitation of specialized technicians from abroad.

3.2.6.5. Announcement of National Customer Satisfaction Index (NCSI) and National Brand Competitiveness Index (NBCI)

The National Customer Satisfaction Index (NCSI) is an index which was developed by KPC jointly with the University of Michigan in of the U.S. The index is calculated based on the level a customer's satisfaction for a product that this is directly used by the customer, which makes directly evaluates the quality and service of the product. The products evaluated were produced and sold domestically and overseas. KPC is providing national competitiveness enhancement plan by comparing, analyzing, evaluating and announcing customer satisfaction levels for various areas including the manufacturing industry, transportation / communication / public services, retail business, financing / insurance business and public administration / government service.

In the 2000s, KPC has been conducting surveys on NCSI for approximately 230 domestic and overseas corporations every year, and has announced the results on a quarterly basis through reports and various mass media.

Table 1-22 | Performance of NCSI Service Implementation in 2000s

(Unit: Corporation)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Survey Target Corporation	213	239	216	219	215	218	226	229	241	245
Survey Target Industry	n/a		49	49	51	51	53	51	56	46

Source: Internal data of KPC.

The National Brand Competitiveness Index (NBCI) is an index that measures the final brand's competitiveness based on brand awareness and corporations' image formed through marketing and weight for the establishment of relationship. KPC has announced the indices for the products and services of corporations every year since 2004.

3.2.6.6. Other Small and Medium Business Support Programs

KPC is implementing support programs for the development of small and medium companies. First of all, KPC has introduced an Aptitude Test and academic research projects through its affiliated Social Capability Development Institute to support the healthy growth of small and medium companies. KPC is also taking a leading role in strengthening Korea's competitiveness by offering life-long education to reinforce individuals' competitiveness.

The affiliated KPC Certification Institute tracks and monitors the certification system and provides post management service for ISO9000 (Quality Management System) / QS9000 (Automobile Parts Area) / ISO14000 (Environment Management System) / TL9000 (Information Communication Area) / IMS (Informatization Management System). The Institute has introduced and is implementing a One-Stop Service for certification for the first time in Korea so that small and medium companies can obtain the necessary certifications in the most efficient manner. In this regard, KPC provides post management service to ensure a stable system, and the retention and development of product certifications even after obtaining certifications.

The Information & Culture Institute, an affiliate of KPC, offers good quality information that small and medium companies require by publishing various books in the fields of economy, management and technology. It also publishes education materials and a monthly magazine, the "Business Journal," which offers content on the venture capital market including a guide and potential ventures, analysis comparing the industries of advanced countries and reports on current economic trends.

KPC operates the "KPC Membership" system which offers free consulting service on overall management, various research reports, productivity information and recent management information including audio-visual data. The system also arranges participation in special seminars, study groups for businessmen and various overseas seminars and symposiums organized by APO together with discount benefits for various education and consulting programs.

KPC also opened branch offices in Busan, Gwangju, Daegu and Daejeon to expand support for small and medium companies and to promote the regional economy by providing education and consulting programs.

KPC established a Training Institute which can accommodate the training sessions of small and medium companies, seminars and workshops, providing an optimum education environment for education and training.

3.3. KPC's Latest Productivity Enhancement Movements

3.3.1. Status of KPC and its major Functions

Currently, KPC continues to be a special corporation under the Ministry of Knowledge and Economy which was established per Article 32 of the Industry Development Act for the purpose of efficient and systematic implementation of productivity enhancement. Major activities of KPC are as follows:

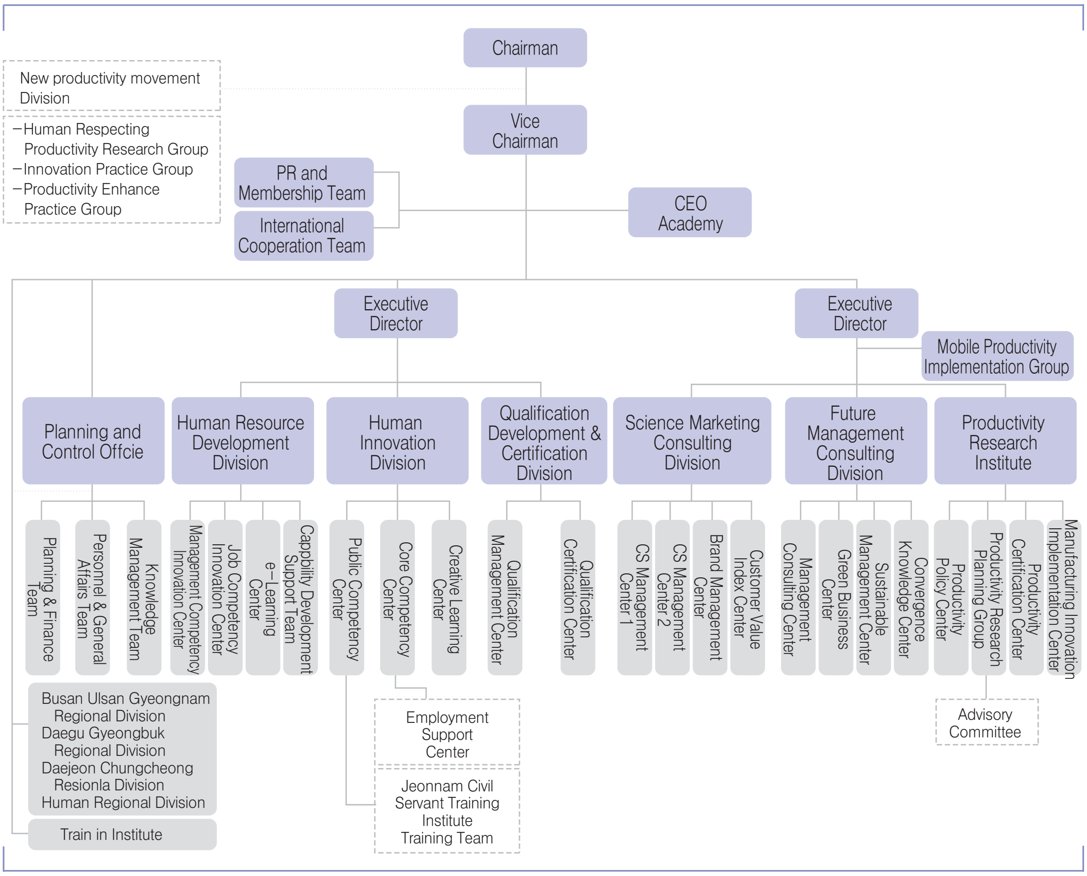
- Consulting Activities
- Education and training Activities
- Index Activities
- Research Activities
- Development and distribution of productivity enhancement technique including automation

and informatization

- Government initiatives for productivity enhancement
- Administrative support for the Asia Productivity Organization (APO)
- Managing initiatives on research, consulting, education and training and technology development and facilities on factory automation, office automation, factory management rationalization and logistics rationalization
- Accreditation for the government's Information Technology Qualification (ITQ)
- Production and publishing of audio-visual materials, periodicals and books on productivity enhancement and management
- Technical surveys and research related to productivity enhancement
- Operation of KPC membership system
- PR service and specialized technical assistance for productivity enhancement

As of December 2010, KPC's organization was comprised of six Divisions, 28 Offices/Department/Centers, four Regional Divisions, and a Training Institute.

Figure 1-4 | Organization Chart of KPC



3.3.2. Human-Centered New Productivity Enhancement Movement

Recently, KPC has been rolling out the "Human-centered Productivity Enhancement Movement" which brings together industry and society with people at its center to cope with the transition toward a knowledge economy and innovation driven economy. As people and knowledge are the drivers of productivity enhancement, the core of the movement is to maximize productivity increases based on joint efforts between labor and management instead of based on the reduction of existing manpower and capital so as to fairly distribute the gains.

KPC established the "New Productivity Enhancement Division" and "Productivity Research Institute" in 2009 and has dedicated ten professionals to revive the productivity infrastructure and to reinforce its capabilities as a National Productivity Think Tank for formulating human-centered productivity enhancement theory and policy proposals on national productivity enhancement.

As a part of such efforts, KPC initiated a free education program called "The cultivation of New Pioneer for Productivity" from 2009 and has been carrying out human resource development to play a leading role in the productivity enhancement of small and medium companies by promoting human-centered productivity enhancement movements while initiating discussions on the need for productivity enhancement and formulating a plan with experts from industry, academia, research institutes and labor. KPC has been building up international cooperation for productivity between productivity organizations from Korea, Japan and Singapore.

Last year, KPC presented the issue of Sustainable Management and Green Productivity as national agenda in order to establish a fundamental philosophy of productivity based on the enhancement of the quality of living and prosperity.

First, KPC announced the "Dow Jones Sustainable Management Index (DJSI Korea)" in October 2009, the first index of a national unit in the world to distribute the issue through solidarity activity with pertinent domestic and overseas organizations. DJSI is a Sustainable Management Index and was developed in 1999 jointly by Dow Jones (Dow Jones Index) of the U.S.,which provides worldwide financial information, and SAM of Switzerland, which is a global leading corporation in the field of evaluating sustainability and investment. The index has been deemed credible by the world and has secured the public's confidence. DJSI Korea is having a positive influence on changing the perception of corporations and promoting the concept of productivity for the enhancement of sustainable living quality. To this end, it is supporting the following: building up infrastructure to convert to sustainable development system, activation of Social Responsibility Investment (SRI) market and the enhancement of corporations' transparency by presenting clear criteria based on the evaluation of corporation's sustainability for representative corporations of Korea.

Together with the above, KPC is developing and distributing the concept and theory of Green Productivity to theoretically back up Low Carbon Green Growth, major world issue, and to lead the global shift toward a Green paradigm in the future. KPC is also distributing the concept of low carbon Green Growth domestically through various methods such as the development of curriculum for Green Growth education and emergence of Green Logistics business.

3.3.3. Efforts in Promoting a Culture of Productivity

KPC supported corporations to adopt methods of encouraging and promoting productivity enhancement by publishing case studies on productivity enhancement called the "Story of Productivity Enhancement at Site from Cases".

To help corporations as well as the general public access information more easily and to feel more comfortable about productivity, KPC has published and distributed a book entitled "Human Respect Productivity for Sustainable Society." In January 2011, KPC plans to hold the "Youth Frontier Camp for the Productivity" which is composed of a variety of programs to foster a culture open to productivity among the youth in middle and high schools as early as possible.

Furthermore, KPC is trying to increase the general public's openness on the issue of productivity by providing various statistical data on productivity, information and research results including a quarterly productivity index and international productivity comparison. It has created an easy way to access the information through a menu for "Productivity Information Coaching Corner" in KPC's Internet homepage.[23]

From 2009, KPC has conducted the "Survey on productivity mind for the enhancement of national productivity" every year for people working in the private and public sector to measure the perception on productivity by area and position and activity level. The results of the research are used in formulating policy and business plans to help in enhancing understanding on productivity and to promote actual productivity enhancement activity.

23. Homepage of KPC address: http://www.kpc.or.kr

3.3.4. Diffusion of Productivity Enhancement Movements through International Networks such as APO

KPC has been actively engaged in the exchange of productivity related information and manpower with the countries in Asia through mutual cooperative works as a member of APO every year. From April 2010, KPC assumed the chairmanship for the Board of Directors of APO and has been carrying out the role of coordinator.

Recently KPC entered into a comprehensive MOU with APO member countries including Japan, Singapore, Vietnam, Laos and Thailand. The MOU outlines common interests and offers a cooperation plan for joint research studies and development projects, information exchange, benchmarking and development of education programs on productivity, to build up global network for productivity enhancement among APO member countries.

Moreover, on the back of concluding a MOU on the promotion of mutual cooperation for productivity enhancement with Tunisia in May 2010, KPC entered into a MOU with Pan-African Productivity Association in December 2010. KPC plans to play a leading role in promoting the productivity enhancement in Africa while providing necessary supports.

4. Results

4.1. Quantitative Outcomes

4.1.1. Productivity Enhancement in the National Economy

Since the foundation of KPC in 1957, Korea has consistently promoted various productivity movements, achieving $47,536 of value-added labor productivity in 2007 ($48,332 in 2008). This amount is equivalent to only 61% and 85% of those of the U.S. and Japan, respectively.

Table 1-23 | Comparison of Annual Average Value-Added Labor Productivity (2000 PPP Applied)

(Unit US $, %)

Period	Nation	Annual Average Value-Added Labor Productivity	Index	Annual Growth Rate
1970s ('70-'79)	Korea	9,795	100.0	6.1
	Italy	39,080	399.0	3.2
	Japan	27,901	284.9	3.9
	U.S.	48,282	492.9	1.3
1980s ('80-'89)	Korea	17,205	100.0	5.9
	Italy	49,350	286.8	2.0
	Japan	37,219	216.3	2.9
	U.S.	53,549	311.2	1.3
1990s ('90-'99)	Korea	29,890	100.0	5.1
	Italy	58,989	197.4	1.3
	Japan	46,370	155.1	1.1
	U.S.	62,743	209.9	1.9
2000s ('00-'07)	Korea	42,521	100.0	3.3
	Italy	62,659	147.4	0.1
	Japan	52,804	124.2	2.0
	U.S.	73,875	173.7	1.4
2007	Korea	47,536	100.0	3.8
	Italy	62,617	131.7	0.2
	Japan	56,226	118.3	2.0
	U.S.	77,332	162.7	0.9

Note: The OECD National Accounts of OECD Countries Data used.
Source: Korea Productivity Center, *International Comparisons of Productivity*, 2010.

According to Table 1-23, however, Korea's value-added labor productivity improved over 4.8 times in 2007 compared with the 1970s ($9,795). This was also higher compared to the U.S., Japan, and Italy, where productivity increased by 1.6, 2, and 1.6 times of respectively. As seen in table, Korea achieved a higher annual growth rate of over 5% compared with Japan and Italy (3%) and the U.S. (1%). However, Korea's growth rate has gradually decreased in the 21st century. The Korean economy recorded an annual growth rate of 6.1%, 5.9%, and 5.1% in the 1970s, 1980s, and 1990s, while it recorded only 3.3% in the 2000s. In comparison, the US growth rate of productivity is low compared with Korea, but it steadily increased (1.3~1.9%) during the same period.

Table 1-24 | International Comparisons of Growth Rates of Total Factor Productivity of the Industries (1981-2005)

(Unit: %)

	Gross Output	Labor	Capital	Energy	Material	Service	TFP
Korea							
81~'90	10.03	0.87	2.54	0.63	4.17	1.69	0.11
91~'00	7.04	0.58	1.79	0.42	2.58	1.30	0.37
01~'05	5.38	0.49	0.93	0.28	2.23	1.15	0.31
81~'05	7.90	0.68	1.92	0.48	3.14	1.43	0.26
01~'08	5.15	0.36	0.90	0.34	2.05	1.19	0.30
81~'08	7.57	0.62	1.80	0.48	3.00	1.41	0.26
U.S.							
81~'90	2.50	0.71	0.71	- 0.08	0.34	0.61	0.21
91~'00	3.51	0.68	0.82	0.04	0.83	0.80	0.34
01~'05	1.78	-0.01	0.55	- 0.13	-0.07	0.54	0.91
81~'05	2.76	0.56	0.72	- 0.04	0.45	0.67	0.40
Japan							
81~'90	4.19	0.35	1.19	0.04	1.27	0.80	0.54
91~'00	1.18	-0.11	0.84	0.04	0.04	0.51	-0.15
01~'05	0.87	-0.17	0.60	0.01	0.05	0.30	0.08
81~'05	2.32	0.06	0.93	0.04	0.53	0.58	0.17
France							
81~'90	2.54	0.10	0.36	- 0.16	0.68	0.74	0.82
91~'00	2.45	0.26	0.40	0.04	0.61	0.77	0.37
01~'05	1.65	0.16	0.41	0.05	0.13	0.68	0.21
81~'05	2.33	0.18	0.38	-0.04	0.54	0.74	0.52
Italy							
81~'90	2.91	0.40	0.48	0.02	1.03	0.66	0.33
91~'00	2.39	0.06	0.40	0.02	0.47	1.14	0.30
01~'05	1.00	0.27	0.40	0.05	0.16	0.51	-0.39
81~'05	2.32	0.24	0.43	0.02	0.63	0.82	0.17
U.K.							
81~'90	1.47	0.13	0.63	0.13	-0.17	0.34	0.41
91~'00	3.22	0.17	0.65	0.18	1.02	0.82	0.38
01~'05	2.29	0.41	0.50	-0.12	0.22	1.08	0.20
81~'05	2.33	0.20	0.61	0.10	0.38	0.68	0.36

Source: Korea Productivity Center, *International Comparisons of Productivity*, 2010.

Table 1-25 | International Comparisons of Contribution by Input Factors and Total Factor Productivity of the Industries to Output

(Unit: %)

	Gross Output	Labor	Capital	Energy	Material	Service	TFP
Korea							
81~'90	100	8.72	25.36	6.32	41.59	16.91	1.11
91~'00	100	8.30	25.40	6.02	36.59	18.41	5.29
01~'05	100	9.08	17.20	5.15	41.48	21.37	5.71
81~'05	100	8.62	24.26	6.05	39.79	18.05	3.23
01~'08	100	7.05	17.48	6.66	39.86	23.15	5.81
81~'08	100	8.25	23.84	6.29	39.59	18.62	3.42
U.S.							
81~'90	100	28.49	28.30	-3.14	13.65	24.28	8.41
91~'00	100	19.41	23.31	1.28	23.62	22.68	9.70
01~'05	100	-0.57	30.63	-7.35	-3.94	30.14	51.10
81~'05	100	20.12	26.07	-1.44	16.44	24.22	14.58
Japan							
81~'90	100	8.26	28.40	1.07	30.33	19.09	12.86
91~'00	100	-9.04	71.18	3.79	3.03	43.68	-12.65
01~'05	100	-19.60	69.04	1.70	5.51	34.42	8.93
81~'05	100	2.67	40.11	1.67	22.94	25.23	7.39
France							
81~'90	100	4.05	14.03	-6.39	26.76	29.19	32.36
91~'00	100	10.56	16.17	1.55	25.03	31.55	15.15
01~'05	100	9.51	25.12	3.10	7.95	41.33	12.99
81~'05	100	7.57	16.50	-1.69	23.36	31.91	22.35
Italy							
81~'90	100	13.61	16.38	0.58	35.54	22.64	11.25
91~'00	100	2.63	16.60	0.79	19.54	47.80	12.65
01~'05	100	27.08	40.20	4.72	15.58	51.32	-38.89
81~'05	100	10.24	18.52	1.02	27.23	35.47	7.52
U.K.							
81~'90	100	8.72	43.15	8.58	-11.30	23.17	27.68
91~'00	100	5.35	20.10	5.58	31.63	25.41	11.93
01~'05	100	17.98	22.01	-5.43	9.55	47.32	8.57
81~'05	100	8.68	26.27	4.17	16.50	29.14	15.23

Source: Korea Productivity Center, *International Comparisons of Productivity*, 2010.

Table 1-24 shows Korea's productivity enhancement trend based on technology advancement.[24] The increase in the gross output rate was 7.90% between 1981 and 2005 (7.57% between 1981 and 2008). Also, the growth rates of various input factors was 0.68% for labor, 1.92% for capital, 0.48% for energy, 3.14% for material, 1.32% for service, and 0.26% for total factor productivity. On the other hand, the increase in the gross output rates of the U.S. and Britain were 2-3% lower than that of Korea during the same period, but the increase in total factor productivity of these two countries was higher than that of Korea. This shows that Korea's economic growth still depends on input factors rather than on productivity growth driven by technology advancement.

Table 1-25 shows how much input factors and total factor productivity contribute to Korea's output growth. The contribution rate of total factor productivity to gross output is 3.23%(3.42% between 1981 and 2008), which is considerably lower than those of other nations - 14.58% of the U.S. 7.39% of Japan, 15.23% of Britain, 22.35% of France, and 7.52% of Italy.

The growth in gross output for the entire industry has gradually slowed down (10.03% in the 1980s, 7.04% in the 1990s, 5.38% between 2001 and 2005, and 5.15% between 2001 and 2008). Along with the decreasing growth rate of gross output, the rate of input (labor, capital, energy, and materials) has also dropped. Due to the decreasing growth rate of gross output, total factor productivity also has fallen relatively.

The rate of contribution by the increase in total factor productivity to output was 1.11% in the 1980s and 5.29% in the 1990s, but it increased to 5.71% between 2001 and 2005 (5.81% between 2001 and 2008). This shows that contribution by labor and services to output has slightly increased, while the rate of contribution by capital and energy to output has decreased.

A decrease in the rate of contribution to gross output by total factor productivity also appears in France and the U.K., while those of U.S. and Japan dramatically increased between 2001 and 2005 compared with the 1990s. Since the 1980s, the rate of contribution to gross output by total factor productivity in Korea has gradually increased, but the absolute level is still lower than the U.S. and Japan. This is because economic growth of the U.S. is driven mainly by enhancement of efficiency rather than by input factors, compared with Korea.

In the 2000s, the increase in Korea's total factor productivity slowed down compared with the 1990s, and the rate of contribution to gross output by total factor productivity slightly increased during the same period. This shows a distinct difference in contribution to gross output by total factor productivity between the U.S. and Korea. Therefore, it is necessary to

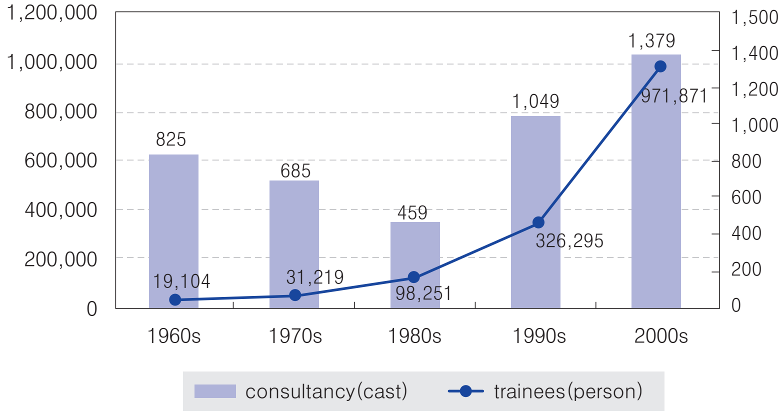
24. Total factor productivity was calculated by gross output growth accounting (Korea Productivity Center, *International Comparisons of Total Factor Productivity*, 2010).

make more efforts to increase productivity.

4.1.2. Assessing the Performance of the Korea Productivity Center

Since its establishment in 1957, KPC has implemented a variety of initiatives and measures to enhance productivity efficiently and systematically. The major efforts of KPC include management consulting and training and education. The accumulated outcomes of its efforts are presented in Figure 1-5 by period.

Figure 1-5 | Business Performance of the Korea Productivity Center



KPC adopted the concept of management consulting in the 1960s and has provided this service actively. During the 1970s and 1980s, KPC's consulting work slowed slightly, but it was revitalized again in the 1990s with 1,370 consulting projects conducted in the 2000s. KPC has conducted a total of 4,400 management consulting projects since its establishment.

KPC's education and training initiatives have consistently increased, educating and training a total of 1,440,000 industrial workers since its foundation.

Furthermore, KPC has published the "Best Practices in Productivity Enhancement" by assessing and presenting outstanding enterprises in productivity enhancement. The increasing number of enterprises listed in the "Best Practices in Productivity Enhancement" and certified in the Productivity Management System (PMS) shows that individual enterprises have steadily implemented productivity enhancement movements, reflecting the tangible outcomes achieved by KPC.

4.2. Qualitative Assessment

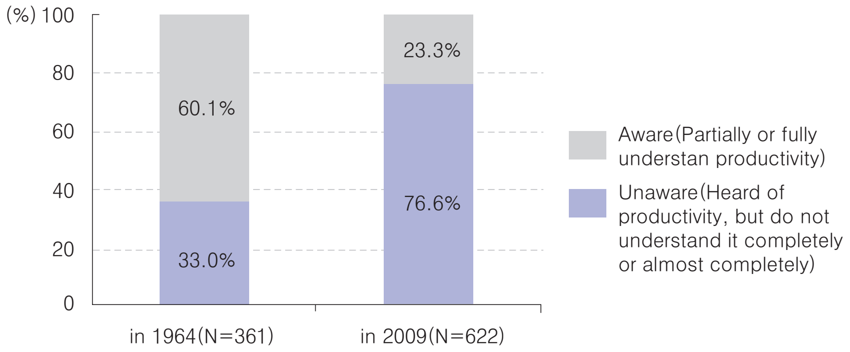
4.2.1. Change in Productivity Awareness

KPC has taken the lead in nationwide productivity enhancement movements by providing management training, productivity enhancement seminars, mass media promotion, and resources. Workers need to understand the concept of productivity enhancement. That is because the difference in awareness of productivity can affect the productivity enhancement in the industry.

According to a survey of 361 workers conducted by KPC in 1964, the rate of workers who understood the productivity concept was only 33%, and more than a half of the workers were not aware of the productivity concept (Figure 1-6). However, according to the 2009 "Survey on Productivity Mindset for National Productivity Enhancement," about 77% of the 622 surveyed workers understood the productivity concept.

This considerable rise in productivity awareness can be explained as the result of productivity movements, training efforts, and promotion initiatives, directly and indirectly, carried out by KPC. Source: Korea Productivity Center, Condition of Productivity Activities by Korean Enterprises, 1964,

Figure 1-6 | Korean Workers' Awareness of Productivity

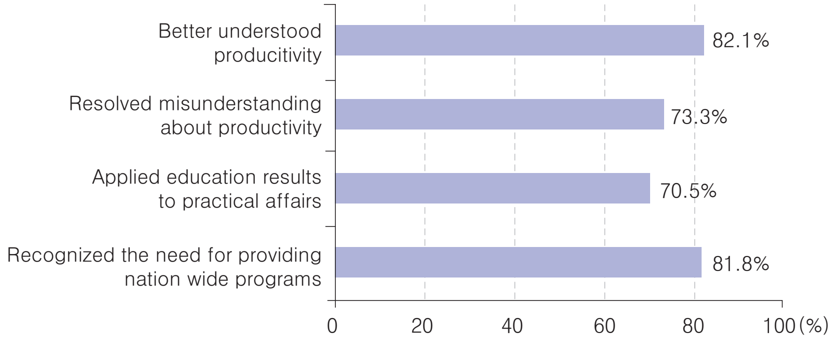


Source: Korea Productivity Center, *Condition of Productivity Activities by Korean Enterprises*, 1964
Korea Productivity Center, *Survey on Productivity Mindset for National Productivity Enhancement*, 2009.

Korea Productivity Center, Survey on Productivity Mindset for National Productivity Enhancement, 2009

KPC's "New Productivity Enhancement Pioneer Cultivation" is a special program provided 4-5 times a year free of charge to help get a better understanding of the productivity enhancement and learning methodology. According to a survey in 2009, most of the trainees (57 persons surveyed) stated that they had a better understanding of productivity (Figure 1-7).

Figure 1-7 | Effects of New Productivity Enhancement Pioneer Cultivation Programs



Source: Korea Productivity Center, *Survey on Productivity Mindset for National Productivity Enhancement*, 2009.

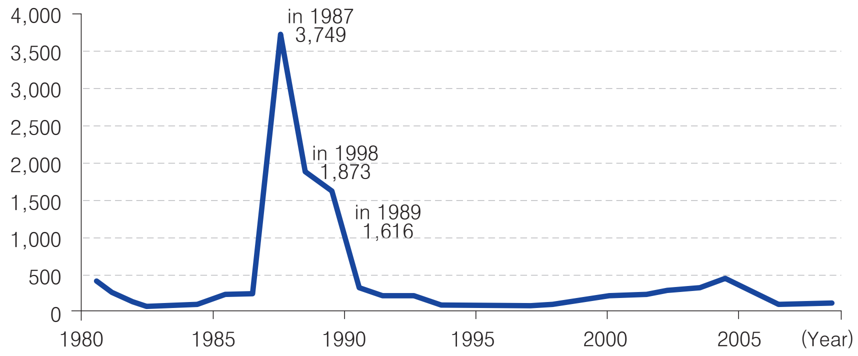
Also, 70% of those who answered the survey said that they would practically use the contents of the programs, and 81% suggested that such a program should be introduced nationwide. This shows the industry's strong willingness to participate in the productivity enhancement. KPC plans to constantly provide such special training programs free of charge to maximize productivity enhancement of enterprises and the nation.

4.2.2. Stabilization of Labor-Management Relations and Settlement of Industrial Cooperation

Reasonable labor-management relations are essential to productivity enhancement in the industrialized society. KPC has made every effort to solve labor disputes that have occurred since the late 1970s.

Figure 1-8 | Trends of Labor Disputes

(Unit: Case)



Source: Ministry of Labor, *Yearbook of Labor Statistics*, Annual.

As shown in Figure 1-8, labor disputes in Korea peaked in 1987 (a total of 3,700 cases). In the same year, KPC installed the Department of Labor Economy in the center and expanded research on the issues of labor disputes. In the following year, KPC established the Labor Training Institute and the Labor Research Institute to promote stable labor-management relations. Furthermore, KPC offered training to 1,500 workers every year on labor-management relations and labor education, under its education and training program. Also, KPC took the lead in reducing labor disputes and bringing stability to the industry by providing open training programs (Certified Labor Relation Controller and Labor Dispute Diagnosis and Alternatives) and customized training programs (Hanmaum Program). The number of labor disputes in Korea gradually decreased, reaching an average of 200 cases in the 1990s, and here, KPC's efforts have played a significant role.

4.2.3. Support for Government Policy on Productivity

KPC has promoted a productivity enhancement drive since its foundation and it has been recognized as the best professional organization in such field. This recognition can be verified by the fact that KPC worked as a consultative body on productivity enhancement in the 1980s when the Korean government started to adopt productivity enhancement as a key task. Furthermore, KPC hosted the "National Productivity Enhancement Promotion Conference" sponsored by the Ministry of Commerce and Industry in 1981. After that, KPC established the Month of Productivity (later replaced to the Week of Productivity) and provided related awards to outstanding enterprises. In the 1990s, the Ministry of Commerce and Industry and KPC jointly sponsored "Comprehensive Countermeasures in Productivity Enhancement" to promote productivity movements.

In 2010, the “SME Productivity Enhancement Strategy” sponsored by the President was established and released. In this regard, KPC has worked as a think tank for the Ministry of Knowledge Economy, and it will take the lead in specifically implementing this policy by developing methodology of Korean-style manufacturing innovation in 2011. KPC also intends to lead a consortium consisting of Korean and foreign experts on manufacturing innovation. It will also seek to expand productivity partnership programs between large companies and SMEs. Also, KPC plans to provide programs for fostering innovation experts.

Since its establishment, KPC has taken the initiatives in deploying nationwide productivity movements based on solid government trust. This is viewed as KPC’s most important experience and contribution.

5. Implications

5.1. Implications

Shortly after a new government was established in 1948, the Korean War broke out (1950-1953). To restore the nation from ruins, the Korean government and enterprises made tremendous efforts. Korea’s productivity movement, which was the basis of the nation’s development achieved while the nation was overcoming hardships, is now presented as experience of successful economic growth and enterprise development. And this may work as a model case for other countries.

The reason that Korea was able to successfully accomplish national economic development plans at the early stage is because a system was established in which the government’s economic development plans for industrial growth were consistently adjusted. In addition, KPC, which was established mainly by the private sector, played a leading role in promoting the government’s industrial policy and cultivating management and technical skills for the industry. KPC achieved consensus on the nation’s industrialization targets and distributed knowledge and skills required to revitalize the industry. Economic growth at the early stage of industrialization means achieving competitiveness through mechanization of the industry and cultivation of human resources with skills and knowledge. Thus, activities required to do this became the groundwork for productivity movements. Based on this groundwork, KPC has maintained its history of productivity.

Established in 1957 during difficult times, KPC has contributed to Korea’s growth and the growth of its companies, by deploying productivity movements. This helped the organization gain a high status. The major efforts and contributions by KPC to improve productivity include several aspects.

First, KPC has steadily developed its capability through research studies on companies and consulting projects on the productivity enhancement of companies and individuals. With these efforts, it became a leading organization for productivity enhancement. Second, since its foundation, KPC has recognized the significance of the human-centered productivity mindset, and played a key role in enhancing and distributing productivity enhancement knowledge and skills to workers and CEOs. Third, KPC has been innovative in response to the changing environment. Recently, it provided added value to both enterprises and customers by introducing the National Customer Satisfaction Index (NCSI), the Dow Jones Sustainability Index (DJSI), the National Brand Competitiveness Index (NBCI), and the Productivity Index. As a bridge between enterprises and customers, KPC is carrying out advanced productivity movements. Enterprises satisfy customers through productivity movements, which contribute to increasing enterprises' profits. The productivity enhancement movements by KPC require continued collection and analysis of data, which is then uniquely provided by KPC, a professional organization in such field.

On the other hand, KPC showed signs of weaknesses in early stages of its establishment and development. First of all, because KPC (non-profit organization) was established as a private organization, it faced difficulty in securing funding to implement the productivity movements at the beginning. Thus, KPC's programs were carried out based on external sources of financial aid, but the external financial support was not sufficient. The lack of financial resources impacted the operation of the organization, and thus, KPC had to focus on profit-making initiatives to maintain the organization rather than on quasi-public productivity enhancement programs. This trend still continues to this day.

The implications of KPC's experience in its establishment, operation, and productivity movements for other countries are summarized as follows:

First, at the time of its establishment, KPC was able to receive government funding to promote productivity enhancement movements as it was founded as a non-profit organization. Also, as the leading organization for enterprise-centered productivity enhancement movements, KPC served as a bridge between the government and industries and between enterprises and academia. However, financial aid from the government or international organizations had limits because it was affected by national and international factors, the political economy, and the social environment. If financial support from the government or international organizations falls or stops, then it is difficult to drive productivity enhancement policies or the organization is unable to perform its roles at all.

Second, the funding to establish KPC as a foundation came from private and individual funds, giving KPC the characteristics of a private enterprise in the way it operated. This should be avoided. However, if KPC had been founded as a government organization, it may have had difficulty in maintaining independence and autonomy. Productivity enhancement movements are characterized as a public service. However, it is difficult to obtain funding for productivity movements as a private organization. Nonetheless, if the organization is operated mainly with consigned programs from the government and profitable activities, it may be difficult to continuously promote productivity enhancement movements as mentioned above. Thus, the case of the Japan Productivity Center (JPC) where funding was raised jointly with companies to enhance productivity is desirable for operating such an organization.

Third, KPC, a third party and non-profit corporation, has played a mediating role between employers and workers, and has endeavored to stabilize labor-management relations. KPC laid the basis for productivity enhancement by promoting peaceful labor-management relations in the industry. Furthermore, KPC has driven the change from producer-centered productivity enhancement movements to a consumer-centered one by introducing the NCSI, the DJSI and the NBCI. Thus, KPC laid the foundation for productivity movements to meet the demands of enterprises, workers, and customers.

5.2. Possibility of Application

KPC's productivity movements have been influenced by Japan. Japan established the JPC two years earlier than Korea (1957) to promote productivity movements. Korea became aware of the importance of productivity while watching the establishment of the JPC and its operation and activities for productivity movements in Japan. With Japan as a benchmark, KPC was established, and it has led Korea's rapid economic development over the past 50 years, while leading the nation's productivity movements.[25]

Korea's productivity movement was influenced by the establishment and operation of the JPC. Indeed, the Korean economy lay in ruins after the Korean War, and the nation lacked know-how, skills and experience after the war, while Japan was accumulating advanced skills and experience. Under these circumstances, KPC learned advanced skills and methods for productivity enhancement by benchmarking Japan's case, which it then disseminated nation-wide becoming a center of productivity. These efforts to enhance national productivity have contributed to the nation's economic growth. Korea's experience in productivity movements and economic growth may become a good case applicable to other nations.

25. Per capita GDP grew at an average of 5.5% every year from 1950 to 2008 (See Section 1).

However, when Korea's experience is applied, some characteristics unique to Korea should be considered. Above all, nation-wide efforts were possible particularly in the period between the 1960s and 1970s when the economy grew rapidly because there was a new strong political leadership in Korea. The President of Korea, who seized power through a military coup, sought to build a country that pursued economic development without being restrained by the political process. This made Korea a "hard state" where policy was actually put into practice.[26] This context may differ from other developing nations. As the privileged class disappeared during political and economic upheavals after liberation such as the land reform in the 1950s, this administrative state was able to exhibit its strong ability of political enforcement. Korea' rapid economic growth needs to be understood under the premise of such leadership changes.

Also, many entrepreneurs moved from the North to the South after liberation in response to the government's industrial policy. The Koreans' strong will to achieve economic development after the Korean War increased agricultural productivity, which led to increased desire for education. This became the driving force for spreading productivity enhancement movements.

The following are factors that should be considered when other countries seek to apply Korea's experience in productivity movements:

First, the establishment of KPC as a public foundation by individuals and private organizations has its pros and cons. The big merits are that it allowed KPC to maintain a non-political, non-profit and unbiased stance, and thus, to promote fair and rational productivity movements without influence from enterprises, workers, and the government. While the JPC was established as a non-government body by private organizations, such as the Economic Organization Association, the Japan Labor Union Association, the Japan Chamber of Commerce, and the Japan Economic Development Association, KPC was established as a foundation by private organizations. This worked against KPC when it sought to intensively promote the policy of nationwide productivity enhancement.[27] Thus, it is recommended that a productivity enhancement organization be set up by private organizations free from politics and influence. But its nationwide productivity enhancement movements should be promoted with financial support from the government.

26. Park, Bok Yeong, Chae, Uk, Lee, Je Min, Lee, Keun & Lee, Sang Cheol, P*ossibility of Applying Korea's Economic Development Experience to Developing Countries,* Korea Institute for International Economic Policy, 2007, pp.97-98.
27. To solve this problem, many APO member countries set up a government-controlled organization or a compromise type of organization.

Second, funding of the productivity enhancement movements is an important factor that can make or break such an effort. Like KPC at the early stage, a productivity organization may not be able to receive sustainable financial support if the organization relies on contributions from individuals and private organizations only. Particularly at the early stage of the establishment, the organization may not be able to promote public business continuously although nationwide promotion is very important to enhance public awareness. Of course, if there is government funding, the productivity organization may be able to promote its productivity enhancement movements. However, it may be difficult to create actual outcomes due to the political economy and its influences, which would lead to loss of public trust. Thus, the Japanese case can be a good example where the industry offers funds and the government provides assistance according to productivity enhancement movements. Once a productivity organization is stabilized, it is desirable to gradually reduce government funding and to let private organizations take the lead. This is important to improve productivity by gaining trust from both enterprises and workers.

Third, the organization for productivity movements should be constituted based on a system sympathized by enterprises, workers, and customers. Especially, it is desirable that the productivity organization act as a third party for practical business entities, such as the enterprises, workers, and the government, to promote such movements publicly. As good examples, the productivity enhancement movements of KPC, such as the NCSI, the DJSI and the NBCI, can be presented.

Fourth, the strategies for productivity enhancement movements should be implemented according to the stages of economic development. Considering Korea's experience, it is important to enhance awareness of the concept of productivity and productivity enhancement. Especially, changing the entrepreneurs' mindset and raising workers' awareness of productivity can play decisive roles. Therefore, priority should be put on enhancing public awareness in the process of promoting productivity enhancement policy. Also, long-term government policy for productivity enhancement should be established when intense economic policy is set up at the national level. The growth of industries may occur only when enterprises' productivity improvement movements occur through the long-term productivity policy. If enterprises grow through productivity enhancement through an increase in input factors like capital and labor, outcomes from productivity improvement should be rationally divided between the enterprises and workers. Also, it is important to view people as the vehicles for productivity enhancement through the whole process of improving productivity, and thus, human-centered productivity movements should be promoted. In addition, the productivity movements are currently changing from the manufacturing field-centered to consumer-centered movements. Therefore, the productivity movements need to move toward customer-oriented movements rather than enterprise-centered ones.

Finally, KPC was able to achieve outcomes over the past 50 years because it was able to facilitate autonomous productivity enhancement in a way that benefited enterprises, workers, and customers together, while maintaining itself as a non-profit, non-political and unbiased organization. When applying Korea's case to individual countries, it is important to examine all these considerations.

Chapter 02

Industrial Standardization and Quality Management

Chapter 02

Industrial Standardization and Quality Management

Myun-Hun Lee(Korea Productivity Center (KPC))

<Summary>

The purpose of this research is to review Korea's efforts on industrial standardization which was implemented as fundamental to productivity enhancement, particularly in the manufacturing industry, as part of economic development and systematic standardization of quality management. The need for the standardization and management rationalization exists in all corporate activities, but the implementation of standardization in the manufacturing industry was as urgent a economic policy as any that was pursued by the government, which tried to achieve industrialization through exports. And at the same time, it was an important task which the Korean government had to successfully accomplish. The objective of industrial standardization is on one hand to improve the efficiency of production from the standpoint of mass production, and the other, to enhance the social benefits through increased user-friendliness and cost-effectiveness by unifying social values with standardization on the consumption aspect.

As Korea embarked on an export-oriented economic development strategy, the government sought to promote the export industry first, and in this regard industrial standardization for the enhancement of quality and productivity in the domestic industry was imperative. Accordingly, the government enacted the Industrial Standardization Act (1961) and established the Standardization Bureau in the Ministry of Commerce and Industry. At the early stages of economic development, the government-driven industrial standardization and quality management measures were implemented as national tasks. To this end, the Korea Productivity Center (KPC) introduced management techniques related to industrial standardization, quality management, production management and work management, brought over mainly from Japan.

It distributed the technique through industrial training and technical assistance. The Korean Standards Association and Korea Productivity Center, which began operation around the beginning of 1960's, provided the training, education, and consulting services.

Continuous investment in research and development by the government and the private sector significantly contributed to Korea's economic development but in our view the biggest contribution was increased enrollment in higher education and continuous cultivation and supply of highly skilled labor force. Up until the beginning of 1990's, Korea had attempted to introduce management techniques and promote productivity and quality improvement in line with advanced countries. Based on this experience, Korea was able to build up its own model called the 'Single PPM,' Korea's version of the Quality Innovation Movement.

The implementation of Single PPM requires guidance and support, and a certification system. The single PPM guidance service promotes mutual cooperation and growth between large corporations and small and medium-sized enterprises by allowing smaller companies to acquire knowledge on quality innovation systems and technique from large corporations, which contributes to lowering the ratio of defective products and to improving quality. In addition, SME manufacturers of parts and components for the auto and electronics industries are led to raise standards to international levels, thereby, increasing the competitiveness of the parts assembly industry.

To pursue these activities systematically, this research reviews the records and literature on Korea's industrial standardization, which was pursued from the beginning of 1960's and continues with the adoption of standards based on 100 PPM, the Korean version of quality management, which began from 1995 (The name was changed to Single PPM after 2000)..This paper is divided into two parts: Industrial Standardization and Quality Management.

In Part I, the background to the introduction of industrial standardization in Korea, and its implementation, are reviewed. Part I conclude with implications and draws conclusions. Part II discusses the development of quality management in Korea and the background to the introduction of the Single PPM. The applicability of Single PPM to developing countries is discussed comparing it to other quality management techniques. In doing so, the detailed contents of Korea's Single PPM and certification system, and its legal and regulatory, and funding framework are reviewed. Lastly, the results of the Single PPM Quality Innovation initiative, and its implications, are summarized.

Based on Korea's economic development experience, industrial standardization was the base upon which the national economy could be improved; it was a cornerstone of Korea's successful economic development. To push industrial standardization, government-led industrialization is desirable in the early stage.

Industrial standardization cannot be accomplished in over a short period; therefore, it should be pursued with a long-term horizon. It is certain that a system needs to be organized to respond to changes in the global economy and standards.

Moreover, simultaneous efforts for an active participation in the international standardization processes to share the information and to protect one's national interests and for a continuous public propagation must not be neglected as the industrial standardization requires the interests and utilization of the consumers as much as of the producers.

Industries around the world already have many ways for improving productivity. Among others, the importance of Quality Management has become well known during 'a period of quality' in the 21st century. The ultimate goal of industrial standardization are achieving cost savings, raising productivity and improving quality.

Korea's Single PPM Quality Improvement Movement seeks to promote the importance of quality standards among SMEs but also to meet the demands of customers by improving quality and lowering the ratio of defective products. In other words, the Quality Innovation Movement strives to instill global standards of quality.

The Single PPM Quality Innovation movement involves the following activities: determining the organization and range, assessing the situation, identifying the causes, establishing improvement targets and a plan, preparing and implementing action plans, evaluating and providing a certification, and expanding it to other products with follow-up services. As the Single PPM does not require complex professional knowledge in statistics like Six-sigma activities, it is considered to be applicable to both the large and medium enterprises of the developing economies. Furthermore, additional participations from other companies are expected if the Single PPM Guiding Committee could be fostered to assist the newly adopting companies and resolve the issues at the spot.

Chapter 02-1

Industrial Standardization

<Summary>

Standard is one of the great inventions of mankind. People's words and letters become the standard.

Standards is defined as a 'mutual agreement among people to realize convenience, efficiency and safety.' Things like words, letters, traffic signals, various statutes to ensure social order and value; codes of conduct in organizations like the army; and traditional customs and attitudes in society can be considered social pacts that people follow, and therefore, a category of standards,.

General people, however, tend to think that standards are a certain criteria which they are asked to follow and to compare in their ordinary life. People start to understand the concept of standards by coming across the word 'standard' from words and expressions like standard language, standard time and standard physique.

On the other hand, people have come to know that, as industry has developed, both manufacturer and consumer benefit together if standards are introduced in industrial activities. Examples include the standardization of sockets for electric bulbs, fire hoses and screws.

While these standards are related to products, standards are also required in communication in industrial production and trading. The symbols used in design drawings and the test methods to identify the characteristics of materials have been standardized. And the compilation of industrial standards in Korea is called 'KS' (Korea industrial Standard).

As such, industrial standardization was developed and implemented through an association, an organization of individual corporations engaged in the same business. It was also implemented at the national level, but it was expanded to the global level as globalization has increased international trade. This can be seen in the introduction of Le Système International d'Unités (SI, international system of unit), and the international application of standardization like ISO 9000 to ensure quality for consumers.

Standardization based on a wider meaning of standard can be expressed as, 'a basic measure to maintain the state of an unpredictable event in order to make it a predictable state'. We can see that the meaning of standardization as described above can be widely applied, from the ordinary life of individuals to the management of a nation.

Due to the Korean War in the early 1950's, Korea's industry was set up to produce military supplies and thus the need for standardization and quality management were raised at the government level. As such, the momentum for standardization and quality management in Korea came about because of the war. In view of the historical fact that it was the World War II when quality management was introduced in the U.S. in full scale; it was implemented in the defense industry during the war through inspection and process management. So, the circumstances surrounding how industrial standardization and quality management came about in Korea do not seem unusual.

After some difficulty, Korea's economic growth took off. In the early stages, focus was put on formulating an economic development plan. In the second stage, the leadership capability of the government was tested through a series of processes. In the third stage, funding required for industrial development was mobilized. In the fourth stage, measures for productivity enhancement were implemented in the industrial sector through standardization and quality management, which served as the base for development of export industries.

One of the first initiatives of KPC in relation to standardization was the publication of books on the theory and practices of standardization. KPC focused on the upgrading of manpower. In 1960, KPC published the books "Theory and Practices of Work Management" and "Theory and Practices of Production Management", and then in 1964, KPC published a research report "Analysis of the Effect of Industrial Standardization in Korea." With the publication of a series of 10 books on the enhancement of productivity, KPC strived to promote standardization and quality management through education and consulting.

1. Background of the Introduction of Industrial Standardization

1.1. Standards and Standardization

Standardization is one of the greatest inventions of the mankind developed to form 'cultures' and evolved with the history of mankind. The prime examples of standardization are alphabets and languages of each civilization.

Standardization is, also, 'a mutual agreement respected by all for the convenience, efficiency and safety of the people.' In this regard, traffic orders, various types of legislations and regulations to uphold the social norms and values, and the respected traditions of the civilization are all included in the range of 'standardization.'

Before we define standards or standardization, let us review how much it impacts our life first.

In the office, we are supposed to work in line with company rules or the job description, which is the standard of the company. We have to follow strict work standards. We also need to check whether materials are in compliance with industry standards (in the case of Korea, the Korean International Standards) and have to check whether the machines or equipment used are in compliance with established standards. Even the building in which we work in, or the way we do things, should be designed and constructed pursuant to various standards including the government or public safety guidelines. For example, emergency exits should be the standardized to ensure safety. Office hours and lunch hours should also be standardized based on the company's policy.

After work, we watch sports on TV or listen to it on the radio. Sports like football, basketball and baseball are all played according to standard rules of the game. A referee in a sports game has a monitoring role to enforce the rules. If a sports game is played without a referee, the game may not be played by its rules resulting in disorder. Also, there may be international games where rules applied in a domestic sports game are applied all over the world.

These illustrations were intended to show how standards are very much part of our everyday life. The reason for this is not only because standards are required but also because having them are more convenient and beneficial to our life as standards result in economic efficiency.

Then, how can we define standardization? In order to define standardization, standards should be defined first. When we say standards, in general we can think of a standard of measurement related to an industrial standard like the national standard of Korea or measuring unit like the metric system. In the regulations related to Korea's industrial standards, standard is defined as "a decision which was stipulated on a thing, performance, capability, layout, motion, procedure, method, formalities, responsibility, obligation, authority, way of thinking and concept for the purpose of unification or simplification so that benefit or convenience is fairly obtained among people concerned."

The International Organization for Standardization (ISO) defines standards as "what was approved as a result of individual standardization effort by a publicly certified organization," and ISO/IEC (International Electro technical Commission) Guide (2004) defines standard as "a document which was established based on agreement and was approved by certified institution and which provides rule, guideline or characteristics for common and repeated use for the purpose of establishing optimum order within a given scope."

Based on the definitions above, we can define standardization as "to set a reasonable criteria or standard for a thing in general and a systematic act of utilizing it." And ISO/IEC Guide 2 (2004) defines that "Standardization is an activity of enacting regulation for common and repeated use for the purpose of establishing optimum level of order within the given scope for practical or potential problems."

From the definitions described above, we can explain standardization. We can say that standardization provides order in an activity, an organized act, which is done under the cooperation of all people concerned establishing rules for the purpose of orderly access to a certain activity, promoting the benefits and the best economy of all people concerned in the course of its application and even paying attention on the functional condition and request for safety.[1]

The definitions of standards and standardization pursuant to ISO/IEC Guide 2 (2004) are as follows:

Standardization

Activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context.

Standard

Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of the order in a given context.

1. Korean Standards Association (2009), Future Society and Standards

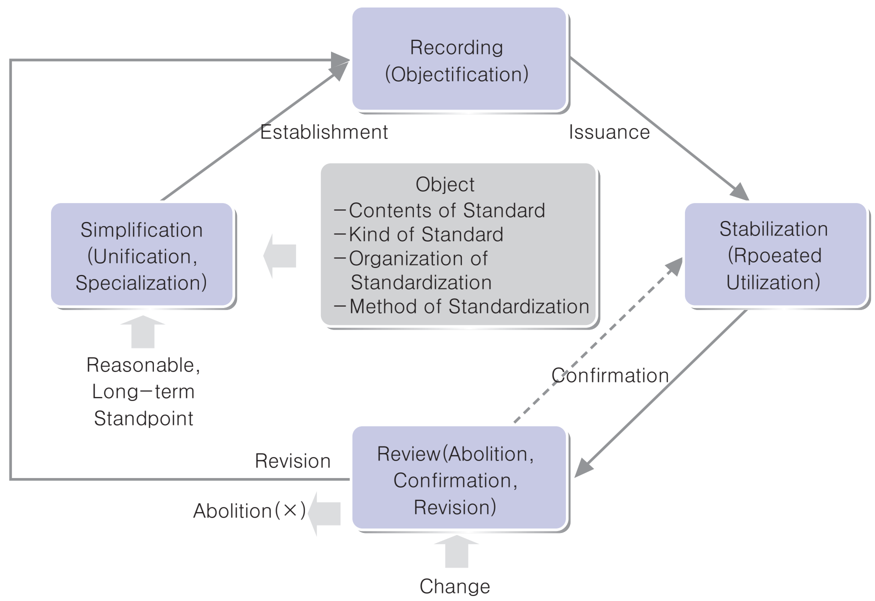
1.1.1. Origin of Standardization

When we look back on the history of human society, it is clear that humans must have accumulated knowledge little by little from early civilization. A survey reveals that the scientific knowledge base has increased two fold every 15 years since 1700. If knowledge is represented in terms of units i.e., one knowledge equals one particular knowledge based on the survey, the number of units corresponding to a particular knowledge increased to 1,048,576 units (20 squares of 2). Demand for industrial activities is increasing every year driven by new developments in science & technology, manufacturing, raw materials, and so on. In the case of the production of a machine, we can say that the number of designs for that particular machine can increase by the multiplier, or number of times it has increased over the years, of that particular knowledge used to make the designs. As such, increases in human knowledge can contribute to an increase in various kinds of goods or behaviors. The tendency of increase in things in human society in accordance with the lapse of time becomes similar to the principle of entropy increase in natural world. Increase in information, things and methods in human society makes our life convenient but it can also make life confusing as there are too many things to consider. It is the law of nature that knowledge, information and things all increase endlessly but it is human nature to be drowned in a flood of all those things if the law of nature is left unchecked without taking any action. In order for mankind to be able to survive under the laws of nature, the increase of things or complexities must be administered at a manageable level.

At the initial stage, humans solved problems by forgetting unnecessary things as human beings are inclined to ‘forgetting things’. However, as everything can now be recorded owing to the invention of letters, it made it necessary to consciously simplify everything. And humans tried to maintain a degree of order not only to be able to manage the increasing complexity of ordinary goods but also to manage living pattern, which led to the beginning of standardization. Here, ‘the level at which it can be managed’ means the increase of thing or the adjustment of complexity. All things follow the process of becoming more complex and diversified but this process can be managed by standardization. The process of standardization, described as a repeated process of simplification, recording and stabilization is indicated in Figure 2-1-1.

Since the beginning of the civilization of mankind, standardization has existed in various types. We can find similarities in standardization today based on the evolution of language, the formation process of customs, or the materials, shapes or dimensions of millstone which was used by primitive people. We can observe such similarities from the clay earthenware or pottery as well which was made in large quantity in Babylonia in approximately 4,000-5,000 B.C.

Figure 2-1-1 | The Process of Standard Establishment and Standardization Implementation



Data: Korean Standards Association (1995), Living & Standard.

On the other hand, as the life of village community began, it is estimated that the concept of quantity was introduced using figures such as counting the number of people needed to secure the safety of the village household and creating a measuring unit to determine the size of construction tools, farming tools and farmland.

It is believed that these primitive forms of standardization were gradually transformed as forms of tax to the village leaders, and measuring units for length, size and volume were standardized to ensure fairness, which eventually became a system. Therefore, standardization made communal life possible, and it became a basic means of survival.

As such, natural standardization of early days developed into artificial standardization mainly by being imitated and passed down to descendants.

1.1.2. Need for Standardization

The first type of standard in the history of mankind is believed to be the weight measuring unit which was standardized and used in Egypt around 7,000 B.C. Indeed, the standardized stone in the shape of a cylinder used at that time has been handed down over time until now. In East Asia, we can find evidence that Qin Shi Huang standardized the weight and measuring system after unifying China, which tells us that standards were established and used by a nation to ensure fairness in civil commercial transactions, the basis of national economy. It also sought to ensure fairness and efficiency in the collection of taxes. Since then, as mankind continued to develop and technology continued to progress, standardization played important roles.

The first role was the utilization of standard parts. In 17th century, the Dutch developed a production method for building fishing vessels which resulted in the construction of vessels within a remarkably fast time frame by making modules (standardization) for parts after the number of replaceable parts was determined before production began. According to this, the Netherlands was able to emerge as the biggest shipbuilding country and simultaneously build a powerful fleet of ships. The experience of Netherlands spread to the U. S.

Standardization began to be applied to manufacturing processes as well. Henry Ford who is called the king of automobile, pioneered this movement. Henry Ford replaced the batch production system in which a team of skilled laborers and apprentices manufactured automobiles; instead, he subdivided all the processes of automobile production and standardized production methods by individual process to increase productivity. By doing this, Henry Ford succeeded in becoming the most competitive auto manufacturer in the industry while paying the highest wages to its workers. As such, the standardization of production processes is believed to be one of the greatest accomplishments in industrialization in the 20th century, allowing for the mass production of high quality uniform products.

1.1.3. Development of Standardization

The start of the industrial revolution at the end of the 18th century can also be considered the time naturally occurring standardization was developed into artificial standardization (Industrial standardization). From that time, the concept of standardization became important in the mass production of goods and ensuring compatibility between goods. Standardization advanced steadily with the continuous industrial development and changes in the living environment. At the beginning of the 19th century, machinery based manufacturing production, division of labor and specialization were utilized while the manpower used in production began to be categorized by function carried out by workers who were directly responsible for production and engineers who designed and operated machineries. Together with this, 'technology' which was universally accepted knowledge based on science and objectivity, ,was separated and systemized from the 'function,' which was subjective and experience based. Accordingly, the specialized techniques in the fields of civil engineering, machineries, electricity and chemistry were developed.

Table 2-1-1 | Process of Standard Establishment & Standardization Implementation

Generation	Era	Key word for standardization of respective generation	Impact of generation transfer
0 Generation Before systemizing	Up to Industrial Revolution (Up to End 18C)	- Standardization of a biogenetical language, unit, things and tools	- Industrial revolution
1st Generation Maturing Period	From Industrial Revolution to Industrial Society (End 18C~Around 1950)	- Standardization to maintain mass production technology and management technique - Conception of modern standardization (Mass production)	- Restart after war - Introduction of quality management
2nd Generation Infiltration Period	From post war economic revival to rapid growth period (1950~1970)	- Basic distribution of quality management - Static standardization - Matured management efficiency	- Transfer from rapid growth to low growth
4th Generation New Generation Standardization	Technology Innovation period, Internationalization (1985~2000)	- Comprehensive (Companywide) quality management - Dynamic standardization - System based access	- Transfer to post industrialized society
5th Generation Digital Standardization	After the 21C	- Expand standard to all industries - Standardization of state-of-the-art field such as IT	- Digital industrial society - Consumer-centered society

Data: Korean Agency for Technology & Standards (2001), 40 years History of Industrial Standardization (KSA Restructuring).

Those days, standardization was focused on the production of goods utilizing the principle of division of labor and specialization. For example, the mass production of wooden pulleys for warships was based on the specialization of production functions. It was around this time when the concepts of standardization, specialization and simplification were applied. The manufacturing production sizes grew, and the systematization of objective and universal management knowledge was required as traditional management methods, which were subjective and experience based, were no longer sufficient. During this period, scientific management methods were designed by Taylor and Gilbreth, which is also known as the 'Taylor's scientific management method.'

1.2. Domestic Circumstance at the Time of the Introduction of Standardization

The fact that the industry and business sector welcomed the government's standardization project with the goal of industrial development and economy revival reflect the Korean people's earnest endorsement of the standardization project.

When we view the 5 year Economic Development Plan as the realization of modernization and industrialization of industrial structure, there was a demand in the increase in industrial production. As well, in reality, the international level of standardization was required as we seen from the cases of exports or military supply. As seen in the Industrial Standardization Act,[2] our expectation on standardization was very high as quality improvement is a common objective of industry, in addition to increasing productivity and securing low costs.

In view of Korea's industrial structure at the time, however, the practical application of standardization was not easy as its management method was still out-dated while production activities were in disarray. Therefore, KPC conducted assessment studies of corporations to assist the government's standardization project, to facilitate the standardization of individual corporations and to assess the state of Korea's manufacturing industry. The assessment of Korean companies when standardization was introduced was as follows.

1.2.1. Status of Korean Companies (1963)

The industrial standardization of Korea can not be completed by merely establishing the specification of industrial products. Rather, the establishment of strict specification of industrial product can function properly only when each corporation is equipped with correct perception and right attitude to accept it.

The actual state of most Korean corporations at the time based on a diagnostic assessment was as follows:

In terms of management,

(1) Production is conducted without prior planning and preparation.

(2) Goods are produced based on orders received without reviewing the limit of the manufacturer's own technology capability.

1. The Industrial Standardization Act (Law # 732, Enacted and implemented on Sept. 30, 1961) was changed to the Industrial Standardization Act (Implemented on June 9, 1993), Current the Industrial Standardization Act (Law # 10393, Partial revision on July 23, 2010)

(3) Labor mismanagement, or lack of, results in labor shortages, leading workers to work 13 to 15 hours a day at times, which results in a lot of products with defects.
(4) Nearly all small and medium-sized companies lack training and technology system.
(5) There are no work standards for employees, which may discourage workers and harm morale. Simply simply increasing wages cannot solve this problem.
(6) Management lack capability and responsibility.
(7) Market survey and after sale service are not available. There is lack of understanding and knowledge on the importance of thorough market surveys and customer feedbacks as tools for improving product quality and customer satisfaction.

In terms of manufacturing production,

(1) Companies lacked product design capabilities.
(2) Companies were often producing a broad line of products with limited production capabilities.
This was especially prevalent among small and medium-sized factories, which inevitably led to the production of inferior products and increased costs. Small companies may be forced to produce a small quantity of a broad range of products; despite this, companies should review their production plan considering their own production capacity and technology level.
(3) Work methods and procedures are not clearly specified.
Without clearly specified job functions, workers end up doing unnecessary works. Also, each worker cannot perform his/her work accurately as they are not given clearly specified work instructions.
(4) Imbalance on production line.
This is caused by the lack of proper production sequence based on the capability of workers and the capacity of machines or facility. For example, in case the production capacity of A machine is 200 each and B machine’s capacity is 100, either 1 set of A machine or 2 sets of B machine may be chosen depending on the site situation and then work process will be achieved smoothly. And when the required work hour for A work to make 1 item is 10 minutes and B work requires 20 minutes, it is normal to allocate 2 workers to B work. As such, in order to maintain process balance, proper work hours for each work should be measured. These imbalances result in a deterioration of work efficiency and increase in the cost of products.
(5) No facility supplementation plan is available.
That is to say, production must usually be stopped due to unexpected breakdowns of machines. Machines tend to be old and worn but a lack of maintenance may be a more important inadequacy.
(6) Standard for product is inappropriate.
The importance of quality standards is to ensure the uniform quality of products.

However, there are many instances where standards are inappropriate and thus product quality is subject to the discretion of each worker. And inspection methods are different and inconsistent for each inspector and there is no policy for investigating causes of product defects and follow-up measures for corrective action. This undermines the implementation of standards.

(7) Working environment is inadequate.

Proper work conditions are important to ensuring workplace efficiency. Natural light or artificial light is also important to ensuring efficiency. Especially in the case of factories where it can become very hot, the installation of exhaust or ventilation devices are critical. The cost of such facilities is not significant compared to the costs savings resulting from the enhancement of efficiency.

(8) Layout of factories is not efficient.

When machines and facilities are not laid out properly, it results in unnecessary inefficiencies. Besides this, there may be many other factors to consider in the management of factories such as poor safety management and negligence on the part of workers.

As mentioned above, Korean manufacturing factories had a lot of problems in realty at the time. As such, the progress of domestic standardization was not significant. According to an expert involved in the assessing the Specification Indication System to be implemented from 1963, it would be almost impossible for the manufactured products to comply with specifications regardless of whether the system is implemented perfectly, unless the companies do not solve all the above problems.

Then, what are necessary to solve the problems mentioned above? Among other things, the most important factor is to systematize and standardize all activities. Namely, in-house standardization should be accomplished. Unless this is satisfied, the manufacturers will never be able to produce products which comply with the established specification.

1.3. Policy Objectives

Industrial standardization means to standardize various industrial technologies. If we define that past technology is the technology that was transferred to successors based on succeeded experiences and individual skillfulness generation by generation, we can say that modern scientific technology has become more and more objectified as it uses natural forces based on systematic recognition of natural law.

However, if the same type of industrial product increases in numbers too much, it may hinder economic development due to increased complexity and confusion. Industrial standardization is essential to unify and simplify various types of complex products. Therefore, industrial standards serve as a basis for establishing standardized specifications, and provide the technical descriptions for production, distribution and consumption of the industrial products.

As such, the unification of a product's specification in order to contribute to economic development by rationalizing the production, distribution and consumption of goods requires to select the most suitable conditions considering various situations such as demand and supply of materials and adjustment of production quantity on top of technical issues.

Simplification here means to control the sales and use of products which have little demand among many similar items distributed in the market, and to select high demand items and to concentrate on the production of the selected items.

Standards mean (1) standards for measuring unit, (2) the definition of terminology, symbol and abbreviation, and (3) standards on specification such as type of good, grade, dimension, quality, design method, manufacturing method, packing method, testing method, work procedure and how to use.

At the time, the Korean government had no other choice but to adopt government-led export promotion policy under difficult conditions. To promote export-oriented development, standardization was a policy task and objective that preceded industrialization. And the standardization was a starting point in improving quality management and productivity of the manufacturing industry.

Entering into the information-oriented age of the 21st century, global economic blocks were formed and regional alliances such as EU and NAFTA were organized, which resulted in the expansion of regional hegemonies. Amid this, countries are engaged in fierce economic competition to secure their own interest and we are living in a more competitive world. Under such rapidly changing circumstance, the topic of international or global standards that can be commonly used all over the world has gained greater significance.

However, no matter how superior a technology is, the technology will become useless in the global market unless standards are established globally. As such, standards have emerged as a very important factor more than ever. Especially, in high-tech industries such as IT where technology innovation is required, the importance of the development of standards based on assumption of securing market has gained more importance than the development of technology itself. Without the need to mention recent expressions such as, "The nation which governs standard will govern the world and the nation which governs the world will govern standard" and "Standard is the yardstick of national competitiveness", standard is now "the issue of survival instead of the issue of choice" and we cannot deny the fact that securing competitiveness for standard is essential more than ever.

On the other hand, advanced countries like Europe and the U.S. established the criteria for standards very high and utilize it as a means to protect their own markets, and at the same time, they put emphasis on the issue of international standardization as a tool to diffuse their presence in overseas markets.

The objective of Korea's Industrial Standardization policy in the 21st century can be summarized into the following four items:

① To establish national standard system
② To reinforce strategic international standardization
③ To intensify management for product safety and legal measurement
④ To enhance the quality of technology innovation

Detailed action plans to accomplish these objectives include: (1) the implementation of future oriented standardization through consumer centered standard development and distribution, (2) the reinforcement of standardization policy development function through the establishment of national vision and strategy, (3) the intensification of the competency of civil standard by cultivating specialized manpower for civil standardization through the support of corporations' standardization activities while preparing the place of standard centering around civil organizations, and (4) the unification of government specification by establishing the strategy through the analysis of each government ministry.

2. Contents of Industrial Standardization

2.1. Development Process of Industrial Standardization in Korea

2.1.1. Introduction of Industrial Standardization (the 1960s)

It was after the announcement and the enforcement of the Farm Produce Quarantine Act (1949), the Trademark Act (1949) and the Marine Products Inspection Act (1950), which stipulated standardization and technical standards for the first time that a modern sense of industrial standardization was introduced in Korea.

Afterwards, nationwide systematic industrial standardization started under the leadership of the Korean government, with the announcement and the enforcement of the Industrial

Standardization Act on September 30, 1961 and the opening of the standardization bureau at the Ministry of Trade and Industry in November.

At the time, the standardization bureau began with three departments: administration, standardization and specification. The Industrial Standards Consultation Committee, which was deliberated over the industrial standards, was formed in February 1962. Also, the Institute of Korean Standard Standardization, the forerunner of today's Korean Standards Association, was established as an organization that would specialize in publication, distribution and education of industrial standardization-related materials.

The industrial standardization of Korea has been conducted in an environment considerably different from those of advanced industrial countries. That is, industrial countries pursued standardization along with industrialization, while Korea started standardization as a basic means of achieving a long-term economic growth plan.

Thus, the national standards as a step-by-step goal of the development of production technology were established in a way that would minimize conflicts between production, technologies, distribution and consumption, and achieve efficient economic growth by coordinating conflicting factors, such as the supply of raw materials, the development of domestic natural resources, fostering of underdeveloped production technologies, removing imbalances in technology levels in different sectors, consumer protection, the establishment of order in distribution, and the development of the domestic market.

At the initial stage of establishing national standards, Korea focused on its implementation and enforcement throughout the country to promote consumer protection and build trust. Naturally, the items which made up the base of industrial activities, including materials, parts and common testing methodologies, were the main products subject to standardization.

With the Korean Standards (KS) marking system introduced in 1963, the opportunity to extend national standards was created, and the opportunities to participate in international standardization movements were initiated by the country's entry into the two major international standardization organizations: the International Organization for Standardization (ISO) and the International Electro technical Commission (IEC). In 1965, the nation facilitated the utilization of KS standards by incentivizing the purchase of KS-marked products to public organizations. This was also the beginning of standardization in companies and the distribution of standardized products.

2.1.2. Fostering Basic Industries and Industrial Standardization (the 1970s)

The industries in Korea started to be active in the 1970s thanks to the enthusiastic implementation of economic growth policies and the successful execution of the five-year economic development plan that began in 1962. As the basic industries were founded and the restructuring and reengineering of the industrial structure were actively conducted, the industries gradually evolved from labor-intensive to technology-intensive industries.

As a result, it was required to quantitatively secure national standards and set the standards for every type of high-quality materials, parts and heavy chemical industry products. In order to cope with these changes, the Ministry of Trade and Industry established a long-term 10-year plan for industrial standardization from 1971 to 1980 aimed at raising Korea’s national standardization to the levels of advanced countries. As the Industrial Advancement Administration was launched, this plan was executed more actively. Over 500 national standardization guidelines were established every year, and they amounted to over 6700 national standardization guidelines at the end of the 1970s.

The national standardization guidelines set in this period mostly dealt with raw materials and parts, the basics of industrial activities, the establishment of common testing methodologies, machines, automobile parts, shipbuilding parts, aircraft parts, electrical machines, and chemical products, and most of these items were for the standardization of the heavy chemical industry. Such standardization worked as core elements in enforcing an energy-saving policy during the second global oil shock in the late 1970s and in fostering exports and the heavy chemical industry.

In the meantime, the priority procurement system of KS-marked products and the observation of national standards by public organizations were introduced in 1971, and the KS marking system for processing technologies and the KS ordering system were adopted. In 1977, the nation endeavored to swiftly spread the national standardization program and its activation in domestic industries by the simplification order system, simplification and unification of governmental specs and the standardization of packaging dimensions. In order to secure profitability with the expansion of its economic scale, Korea also actively pursued unification and simplification of industrial activities.

A sharp increase in KS standards and the expansion of industrial standardization policies such as the KS marking system led to the expansion of administrative organizations. The standards department of the Industrial Advancement Administration was reorganized with five sub-departments. The Korea Standardization Association, a private standardization organization, added quality management programs to its goals in 1976. It was then expanded and reorganized as the Korea Industrial Standard Association in 1977, with the revision of the Industrial Standardization Act.

2.1.3. Growth of Industrial Standardization Policy (the 1980s)

Because of the new highly-developed and diverse industrial environment triggered by new materials, new technologies and new information technologies in the 1980s, it became very important to implement standardization in order to accept related technologies from an economic point of view. In 1979, due to the scarcity of raw materials and the oil shock, a global recession ensued, which weakened exports and depressed the domestic market because of over-investment in the heavy chemical industry and chronic inflation. However, as the global economy rebounded, the country's exports started to recover and the domestic market began to grow in a stable manner thanks to the government's price stabilization policy and technology development prioritized policies.

Together with these developments, the lives of the general public became diversified and upgraded. In terms of the industrial structure, technology-intensive industries significantly expanded, and knowledge-intensive industries were vitalized, such as the information technology and advanced technology industries. In trade, market opening was continuously demanded and barriers to exports became higher due to the continued export growth and the favorable balance of international payments. Under these circumstances, the standard code of GATT took effect in 1980, requiring internationalization of industrial standards.

In respond to these socio-economic environmental changes, Korea converted the policy of industrial standardization, from the quantitative securing of standardizations to establish the industrial base in the 1970s, to the qualitative improvement of standardizations to achieve upgraded industries. Also, the nation adjusted the KS standards to match those of advanced countries so as to improve quality of industrial products. It also promoted unification and simplification to improve productivity and cut costs, and pursued continuous standardization to improve people's living standards, health care, environmental protection, energy saving and diffusion of new technology .

Major projects on industrial standardization in this period were the standardization of clothing, shoes and teaching materials based on surveys on Koreans' physiques conducted in 1979 and 1986. Thanks to these standards, ready-made articles were introduced more quickly.

In 1984, the internationalization of KS standards began, and the KS standards were adjusted to comply with the international standardizations or those of advanced countries. Through these efforts, the internationalization of national standards to meet global standards was realized, and thus, the quality of domestic goods was improved and any potential disadvantage in trade was avoided.

In 1987, the standardization of machinery parts and raw materials was facilitated to achieve localization of imports. Also, the five-year mid-to-long-term plan for industrial standardization was established to implement standardization of the technology-intensive industry and standardization of the information sector including computers and the new technology sector including biotechnologies, robots and optical fiber.

In 1987, in order to actively facilitate industrial standardization by the private sector, the country began to facilitate the establishment of organizational standards, vitalize company internal standardizations and upgrade company standards to those of KS.

In short, industrial standardization in the 1980s focused on the functions of industrial standards to upgrade the industries by implementing the systematic industrial standardization of company standards, organizational standards and national standards.

2.1.4. Advancement of Industrial Standardization (the 1990s)

Since the late 1980s, the Korean economy grew to the point where the nation became one of the top ten trading countries. However, the economic environment got worse due to the democratic wave starting from 1987 and inflated real estate market. Particularly in the 1990s, the opening of the domestic market was accelerated with drastic changes in the global economic environment, such as the launch of the Uruguay Round and the WTO system, and new kinds of trade barriers emerged like technology barrier agreements.

As to foreign relations, a series of events led to a more favorable international environment for Korea to actively participate in the international community. These events included the successful hosting of the 1988 Seoul Olympic Games, South Korea establishing diplomatic relationships with Eastern European countries after the end of the Cold War, the two Koreas jointly entering the United Nations, and the progress in the inter-Korean relations. Also, the profile of South Korea’s role in the international community was greatly enhanced.

All these economic and international environmental changes brought about negative impacts, such as cost increases in products caused by labor disputes, delay in quality improvement, and lack of progress in technology development. These effects weakened international competitiveness of Korean products, and caused an adverse balance of payments in trade.

Under these circumstances, the industrial standardization policy of the government changed to focus more on international standardization rather than on national standardization. Also, national standardization focused more on laying the foundation for achieving the national standards within companies.

As to the major industrial standardizations from the late 1980s to the early 1990s, the nation focused on vitalizing organizational standardization in 1989 to expand the foundation for company standards and standardization in the private sector by surveys on utilization of standards by companies. Also, standardization of new technologies and information technology was actively executed as a national standardization project. In 1990, focus was placed on vitalizing the international standardization programs by hosting the ISO, JTC1/subcommittee 21 and subcommittee 2 Seoul Conference and initiating standard exchange with Vietnam.

Along with this, studies on the public audit system of the KS marking system and an assessment of the standardization related to EC consolidation were conducted. From 1991, the enterprise standardization program started to be more specialized and specified. Also, international standardization activities became specialized with the establishment of an international standards department within the standard department of the Industrial Advancement Administration. This department was enlarged and reorganized as the international certification department in 1994.

In 1991, the nation actively promoted international standardization activities by dispatching missions to the ISO to vitalize international standardization, being elected as a member of a council in the ISO, and acquiring the right to host the ISO/IEC JTC1/SC2 and Technical Committee 104 Seoul Conference.

In 1992, after the revision of the Industrial Standardization Act, the Information Industry Standard Institute was founded to research and promote the standardization of information technologies in the private sector. Together with this institute, basic adjustment programs were implemented to solidify company quality guarantees, such as the inter-company standardization work manual publication, ISO 9000 series implementation, KS manual publication and the revision of KS examinations.

Between 1988 and 1992, a five-year standardization plan was established that aimed to create standardization based on the standards in the private sector, avoiding the previous practice of imitating the standardization of advanced countries. Between 1993 and 1997, a five-year industrial standards advancement plan was established. Over 300 kinds of international standardizations of KS were pursued, English translations were also actively performed, and the translated materials were distributed to exporting companies and the ISO, thereby supporting the successful execution of the five-year New Economy plan. In particular, the standardization policy proceeded with emphasis on the advancement of national standards, vitalization of standards in the private sector and the establishment of standards in new industries in environmental, logistics and new materials.

In October 1990, the Korea Laboratory Accreditation Scheme, a corporate aggregate of

Korea, was founded to oversee the accuracy of measurements in a more systematic way. On December 8, 1992, the Weighing Act was amended with the Act for Weighing and Measurement, which changed the measurement system from the previously daily life-focused system to an industrial measurement system. Thus, the development and establishment of national measurement standards, the improvement of the measurement and inspection system, and the testing institute of the standard material certification system were launched for the first time.

2.1.5. Single Global Standard (the 2000s)

As the Cold War ended and the whole world became a single market due to the development of the IT industry, the differences in standards from country to country became meaningless, and the entire world started to pursue a single global standard. In this environment, the roles and status of the ISO were enhanced. Those who led the development of the international standard took all, while the countries and companies that failed to join this initiative were forced to have economic burdens.

From 2000 to 2004, the 5-year plan to internationalize the KS was established, and all the resources in the Korean Agency for Technology and Standards (ATS) were concentrated on complying with the ISO or the IEC to move away from the previous system dependent on the JIS. As a result, 99.8% of the KS was the same as or referred to the ISO by the end of 2006.

International standardization was also actively pursued, and in October 2004, the IEC decided to hold its general assembly in South Korea for the first time. In addition, various kinds of international conferences were hosted by South Korea, and an increasing number of important posts, like the chairman of the ISO or the secretaries of international organizations have been held by South Koreans. Besides, the international standards for leading Korean products and technologies are increasingly being adopted.

NGOs, like the ISO, the IEC and the ITU, and international bodies that wield enforcing power, such as the UN, the WTO, the ILO and the WHO, work together to encourage all the countries to follow the international standards and restrict the movement of the products or services that are not in line with international standards. Today, standardization barriers, rather than technology barriers of advanced countries, are expected to impose a big burden on developing countries.

Table 2-1-2 | History of Industrial Standardization

Year	Contents
1949	Establishment of the Farm Produce Quarantine Act, standardization of the public sector projects such as railroads
1959	Establishment of the logistics supplies standardization (the national defense standards)
1961	Establishment of the Industrial Standardization Act (foundation of the standardization bureau, the Ministry of Trade and Industry) -Implementation of industrial standardization led by the Korean government
1962	Formation of the Industrial Standards Consultation Committee and Initiation of the KS standardization product and the approval system, the foundation of the Institute of Korean Standard Standardization
1963	Joining the ISO and the IEC, introduction of the Korean National Standards
1973	Inauguration of the Industrial Advancement Administration (systematic implementation of the mid-to-long-term plan on standardization) - KS standardization enactment & amendment, KS mark permit, KS mark order, simplification order
1982	Opening of the KS system to the global economy → Approval of the KS mark at factories abroad
1992	Revision of the Industrial Standardization Act - Expansion of standardization objects, adding information technology to the mining and manufacturing industries
1996	Abrogation of the Industrial Advancement Administration, transferring work to the Korean Agency for Technology and Standards (ATS)
1998	Complete revision of the Industrial Standardization Act - Introduction of the KS certification system led by the private sector, abolishment of the KS order system, conversion to the collective standard reporting system
2001	Adding the service sector to the standardization objects
2003	Adding the service sector by revising the Industrial Standardization Act Shift to the private sector-oriented standardization policy in 40 years of the industrial tandardization
2005	Strategies of the industrial standardization vision and implementation -Pursuit of strategic standardization to maximize national competitiveness (Now, standard is global competitiveness)
2008	Introduction of the service standard and the KS certification system -KS certification was expanded to include the service sector after the revision of the Industrial Standardization Act
2009	Improvement of the statutory compulsory certification system -Introduction of the Korea Certification Mark (KC Mark)

Source: Korea Standards Association (2009), some contents used from education materials in Industrial Standardization.

2.2. Industrial Standardization in Major Advanced Countries[3]

The standardization system in foreign countries takes various forms depending on certain factors, such as the political-economic situation of the country, the socio-economic features associated with the national development, the national structure and the organization of the country, features of the leadership within the country, and the size of the country.

National standardization can be classified into three types: the standardization system is completely scattered in the private sector, like that of the US; the standardization system is concentrated in the private sector, like those of the UK, Germany, and France; and the system is led by the government, like those of Japan, Singapore, and Taiwan.

The features and related standardization organizations in major advanced countries, specifically the U.S., Germany and Japan, are summarized below:

2.2.1. Industrial Standardization in the U.S.

The US standardization system reflects the unique US socio-economic traditions. By the time the national standardization project began, a number of self-regulating standardization organizations led the national standardization movement.

The Department of Commerce in the federal government established the National Bureau of Standards (NBS) in 1901 and carried out a wide range of activities in basic areas, including measurement standards, basic measurement, and the related field of application. However, a limited number of people participated in industrial standardization efforts, and the government set a rule of no engagement for the process of setting up standards and related activities.

Moreover, by finalizing the policy to support and accept the standardization activities of experts within the private sector through the Office of Management and Budget (OMB) circular No A-119 that was published in 1882, the activities of the self-regulating standardization organizations became stronger.

The American Standards Association (ASA), a private sector organization that coordinates self-regulating standardization groups, was founded in 1926. This organization was renamed the American Standards Institute (ASI) in 1966 and the American National Standards Institute (ANSI) in 1969.

3. Korean Standards Association (1998), *Traces of Quality Improvement Activities*

ANSI is a non-profit NGO that deals with the planning, coordination, review, notice, consultation and approval of national standards; coordination between the private sector and the government; gathering of standard information; management and distribution of the information gathered; and education on quality management. ANSI represents the U.S. in international standardization activities.

2.2.2. Industrial Standardization in Germany

The industrial standardizations of Germany and other Western European countries are led by and concentrated in the private sector. In Germany, the Deutsches Institut für Normug (DIN) plays a central role, and standardization has developed as an independent requirement from the industry. In other advanced industrial countries, the relationship between the standardization organization and the government is often stipulated in law, but Germany has adopted the flexible form of a contract to define this relationship.

This contract was signed in July 1975, and it defines the liberal free standardization system for the German economy and aims to share the complicated role with the government. Historically, the first standard association that initiated standardization activities in Germany was the Deutsche Normen Ausschuβ, (DNA). This organization was renamed the DIN as part of the contract with the federal government in 1975, and it represents German international standardization activities based on Article No.820 of the DIN.

2.2.3. Industrial Standardization in Japan

The industrial standardization of Japan has been driven by the government, which is in contrast to the U.S. and Germany. This difference was mostly driven by the fact that the industrial standardization of Japan, along with the export promotion policy of the government, was needed when the country was in the middle of industrial recovery after World War II. Also, the Japanese national standardization began in full scale in 1949 when the "Industrial Standardization Act" was enforced.

The principal driving force of national standardization in Japan is the Standardization Department of the Industrial Standard Institute, which is under the control of the Department of Commerce and Industry of Japan. This organization creates the long and mid-term plans for the national Japanese standard system, approves the Japan Industrial Standards (JIS), monitors JIS marking, manages the Japan Industrial Standards Committee (JISC), and deals with the supporting activities related to international standardization.

Meanwhile, the JISC is associated with the Industrial Standard Institute and is responsible for investigating and reviewing the JIS and performing advisory and consulting functions of related departments on the promotion of industrial standards. The Japan Standard Association (JSA) deals with the publication and distribution of the JIS, the promotion of quality management, and the supporting activities related to national standardization projects.

2.3. Implementation of Industrial Standardization in South Korea

2.3.1. Korean Industrial Standards

2.3.1.1. Meaning

The "Korean Industrial Standards" is the national standard notified by the president of the ATS under the Industrial Standardization Act. It is notified by the process of collecting stakeholders' opinions and the relevant authorities' deliberation, after which the standard plan is established. This standard is enacted after the global standard or advanced standard is enacted or the standardization necessity arises over new products, technologies, methods and processes. KS is remodeled or abolished every five years based on a review of its suitability.

2.3.1.2. Classification of Industrial Standards

The number of KS is represented as KSA ○○○, and alphabet A next to KS indicates each special area, and there are sixteen special fields. These special fields represent A (basics), B (machines), C (electricity), D (metals), E (mines), F (construction), G (commodities), H (groceries), K (fibers), L (ceramics), M (chemistry), P (medical service), R (transportation), V (shipbuilding), W (flight), and X (information). The next 1000-digit number is given as serial numbers after the relevant special area is further classified.

2.3.1.3. Level of Industrial Standards

The Korean Industrial Standards are world-class and economic standards. In other words, KS is set at the most economic level as stakeholders agree with each other on producers, consumers, raw and sub-materials, equipment and domestic technology levels, and then it is applied to actual cases. Because KS perfectly complies with global standards, it can be equivalent to current global standards.

2.3.2. Distribution of Korean Industrial Standards

2.3.2.1. Meaning

Establishing a new standard requires a lot of time and cost, but the establishment itself does not always ensure desired outcomes. The new standard generates results when it is actively diffused to an appropriate place in a timely manner to make people use and apply this standard. Thus, the systematic and rapid distribution system is critical to promoting standardization. Here, promoting includes not only diffusing the standard itself but also explaining the standard contents and spreading application techniques to users. In general, all countries establish a standards association to systematically distribute standards.

2.3.2.2. Access to Korean Industrial Standards

As to Korean Industrial Standards, it is possible to have access to the original standards at the Korean Standards Information System (www.standard.go.kr) operated by the ATS in charge of establishing standards. The development of standards demands enormous expenses and time, and the establishment of standards itself is not profitable. Thus, direct users of all standards (global, national, and organizational standards) make a payment to use the standards, and the profits incurred are used to develop better standards.

2.3.2.3. Distribution of Various Standards and Provision of Information

Firms and laboratories which require national, organizational, and forum standards can purchase various standards including the Korean Industrial Standards and global standards (ISO, IEC, and ITU) at the Korean Standards Association (KSA) founded based on the Industrial Standardization Act. Under the agreement with main global standards institutions, the KSA has actively distributed the standards to firms and laboratories which require the standards. The KS, ISO and IEC standards are distributed on the web by packages and the other standards are distributed in the form of DVDs, CDs, and PODs (Print on Demand). Also, comprehensive standards-related information such as the global standardization trends is provided by the Korean Standards Service Network (KSSN). Information on the standards including purchase of the standards is available at the website www.kssn.net.

3. Process of Industrial Standardization

3.1. The Enactment of Korean Industrial Standards and the Marking System

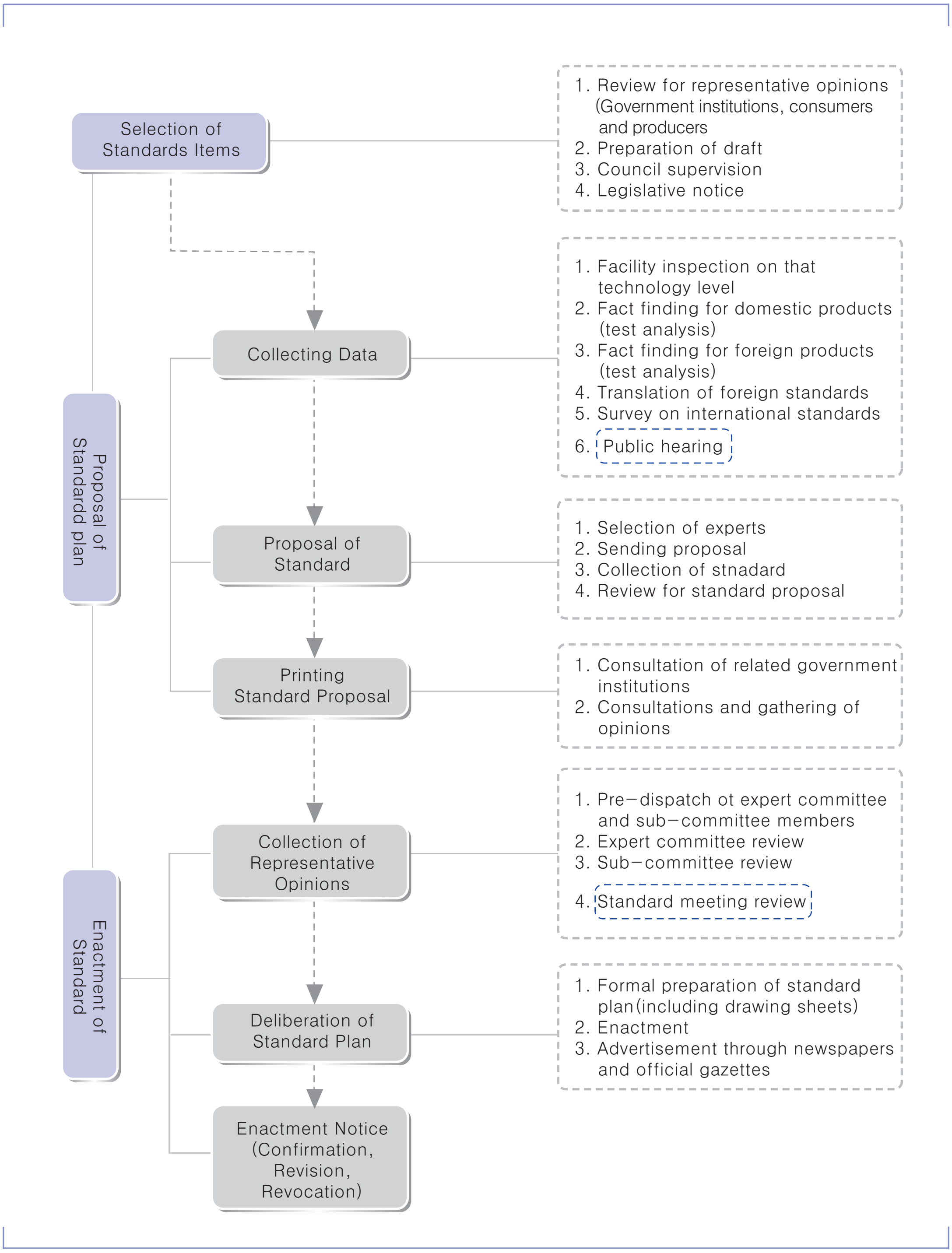
There are three major enactment processes for industry standardization: selection of standardized items, proposal of standards plans, and decision on standardization. Figure 2-1-2 shows the detailed process.

Figure 2-1-2 | Enactment Process of Industrial Standards

Source: The Bureau of Standardization, the Ministry of Commerce & Industry, *the Chronology of Korean Industrial Standardization* (1962).

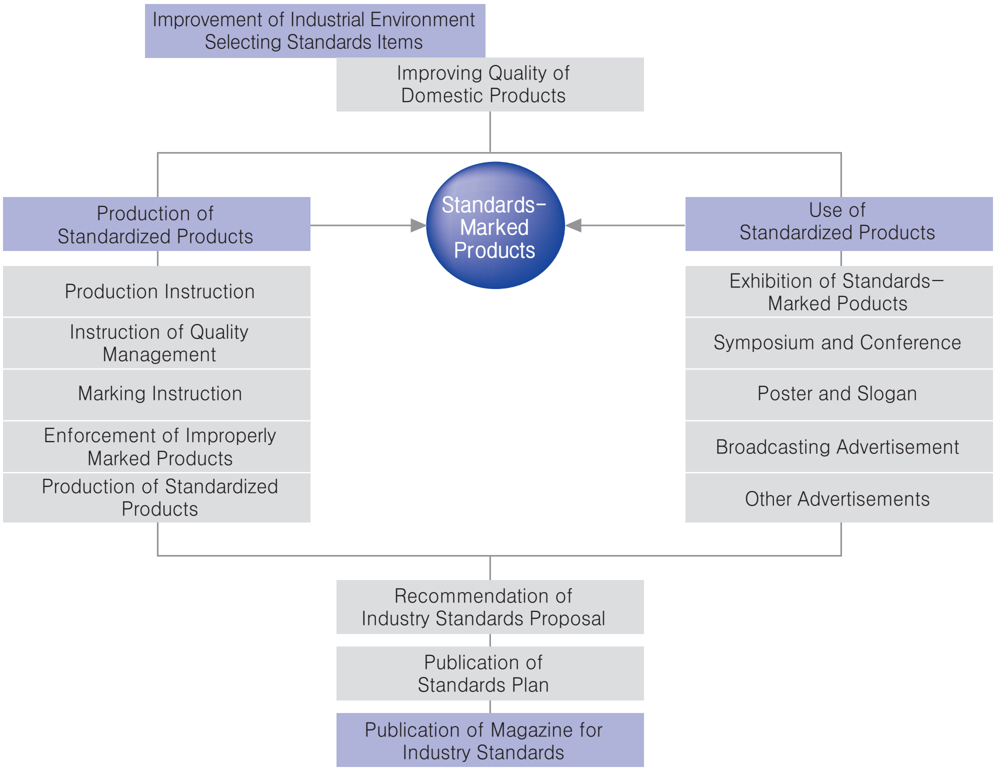
The process of industrial standards can be divided into three sections: selection of marking items, permission of marking, and management of marking items. The details of the proposal process for each item are offered in Figure 2-1-3. Also, Figure 2-1-4 illustrates the process of distribution and advertizement for the industry and customers.

Figure 2-1-3 | Process of Standard Marking



Source: The Bureau of Standardization, the Ministry of Commerce & Industry, *the Chronology of Korean Industrial Standardization* (1962).

Figure 2-1-4 | Distribution Process

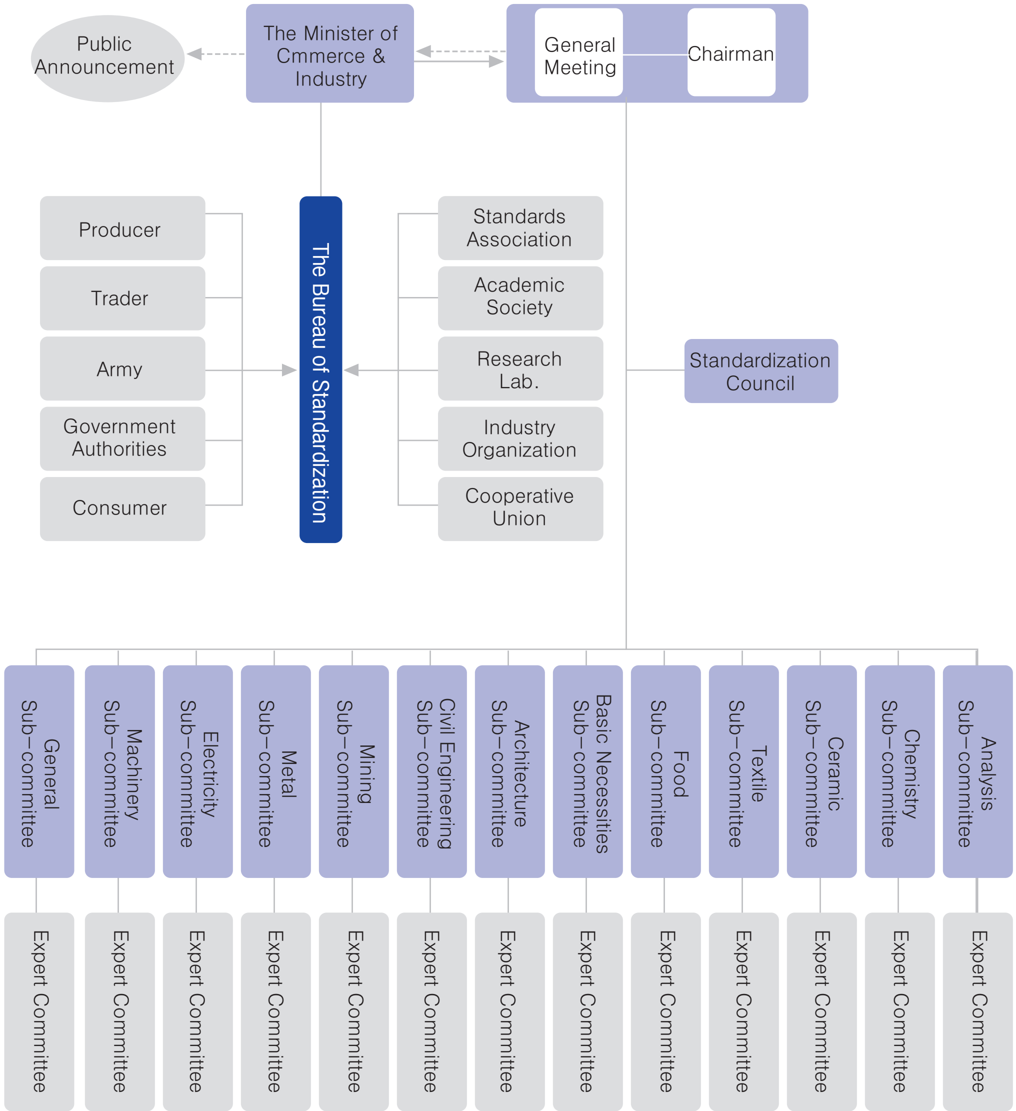


Source: The Bureau of Standardization, the Ministry of Commerce & Industry, *the Chronology of Korean Industrial Standardization* (1962).

Also, Figure 2-1-5 shows the Korean industrial standards (KS) mark, Figure 2-1-6 provides the structure of the industrial standards council, and Figure 2-1-7 offers the process of the KS mark.

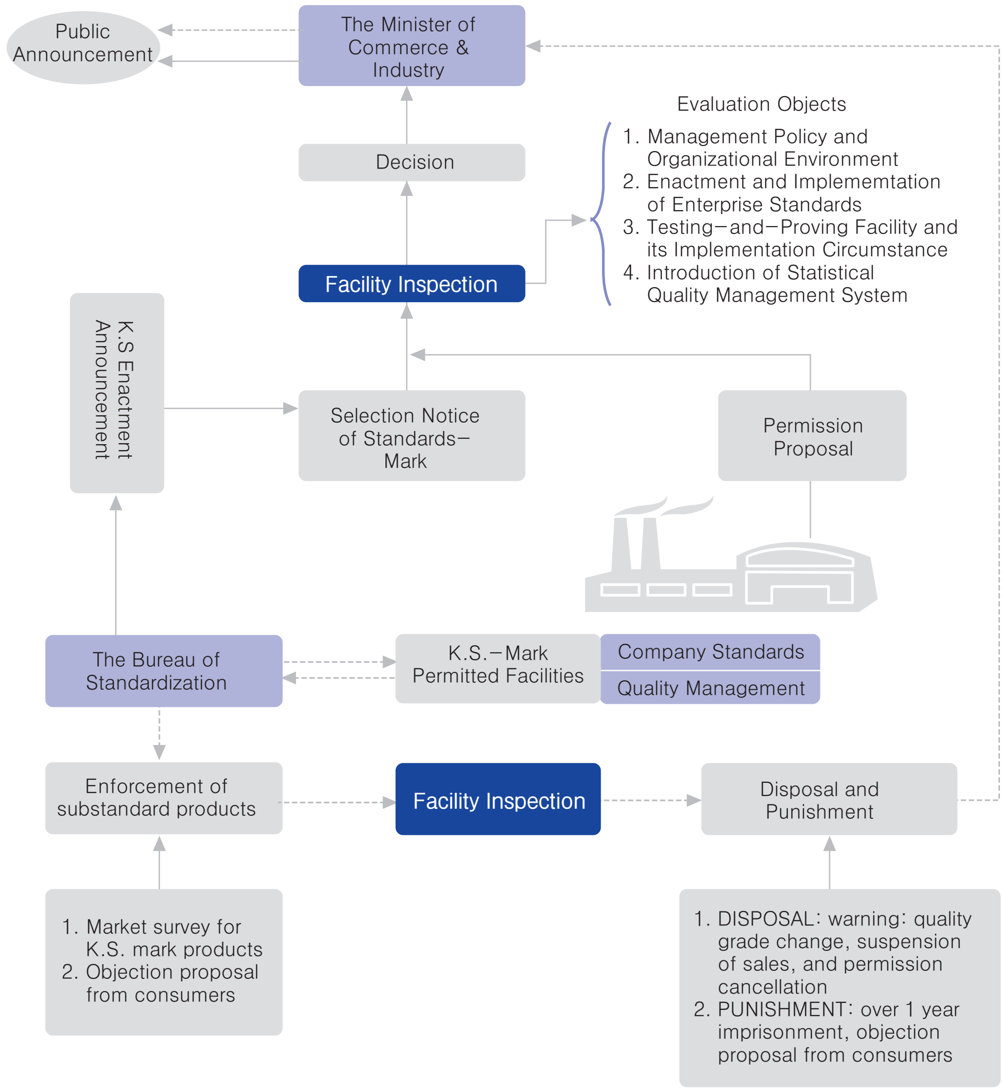
Figure 2-1-5 | Korea Standards Mark

Figure 2-1-6 | Structure of Industrial Standards Council



Source: The Bureau of Standardization, the Ministry of Commerce & Industry, *the Chronology of Korean Industrial Standardization* (1962).

Figure 2-1-7 | Distribution Diagram for the KS Mark System



Source: The Bureau of Standardization, the Ministry of Commerce & Industry, *the Chronology of Korean Industrial Standardization* (1962).

3.2. Main Activities for Industrial Standards

Table 2-1-3 summarizes the main activities for industrial standards by period from the 1960s to the present.

Table 2-1-3 | Main Standardization Activities by Period

Period	Activities
Introduction Period (1960s)	Establishment of the Bureau of Standardization (1961), enactment of the Industrial Standards Act, inauguration of the Industrial Standards Council, establishment of the Korean Standards Association, and participation in international organizations
	Promotion of standardization as a long-term economic development plan - In industrialized countries, industrialization proceeded along with standardization.
	Promoting standardization to develop domestic products and protect consumers - Units, materials, parts, common test methods, etc. (direct introduction of foreign standards)
	Practice of priority purchase for KS mark products
Fostering of Basic Industries & Standardization (1970s)	Expansion of basic industries and transition to technology-intensive industries
	Long-term plan for industrial standardization (1971~1980) -Increasing enactment of standards for high-quality products, materials, and parts -Approximately 6,700 standard enactments in the late 1970s as about 500 enactments occurred annually
	Playing a fundamental role for the government export drive, policy to foster the heavy chemical industry and energy-saving policy - Developing and distributing high-efficient products amid the second oil shock at the end of the 1970s
	Actively promoting unification and simplification of industrial activities with the scale of the economy increasing
Growth of Standardization policy (1980s)	Environmental change in industries: new technologies, new materials, and information
	Improvement of living standards and expansion of technology-intensive industries
	Invigorating knowledge-intensive industries such as the information industry and the high-tech industry
	Demand for standardization quality improvement rather than quantity expansion to upgrade the industries - Upgrading the Korean Standards to international standards - Standardization for productivity improvement and cost reduction
	Actively promoting unification and simplification of industrial activities with the scale of the economy increasing
	Standardization for safety, public health, environment, energy saving, and distribution of new technologies

Period	Activities
	Standardization in necessities such as shoes and clothing based on survey results of physical appearances of Koreans - Arrival of the ready-made product age regarding daily necessities
	5-year mid-to-long-term plan for industrial standardization - Industrial standardization in parts and material industries with higher substitution effects - Standardization planning for information industry, life science, robot industry, and optical fibers
Globalization in Industrial Standardization (after 1990)	Environmental changes in the global economy with the launch of the Uruguay Round and the WTO - Stronger pressure from foreign countries over market opening - Rise in trade barriers, including the agreement on technical barriers
	New demand for increased national roles in the international community as Korea's national status was enhanced -Shift from development of national standardization to international standardization
	5-year development plan for industrial standardization in 1994 - Compliance with industrial standardization - Translating Korean Standards in English and distributing English versions to the international standards organizations - Continuous efforts for globalization
	Hosting JTCI/SC21 and SC2 in Seoul in 1990
	Dispatching residential officials to the ISO headquarters since 1991 and becoming an ISO Council member in 1991
	Activity as a key member country in the ISO - The 8th country to become a member of both the Council and the Technical Management Board (TMB) in the ISO (2009)
	Launch of additional standards projects in the service field by adjusting the Industrial Standards Act (2010)

Source: Korea Standards Association (2009), some contents used from education materials in *Industrial Standardization*.

3.3. Standardization System

3.3.1. National Standard System

3.3.1.1. Constitution (Standardization is the nation's duty)

The second clause of Article 127 in the Korean Constitution defines that "the nation should establish a national standardization system," making national standardization a national duty.

As a reasonable, scientific and efficient means of managing a nation, standardization is required for all fields. However, a nation should lead all the plans for standardization because standardization itself does not generate any economic profits and it requires a lot of costs, time and professional skills.

In particular, rapid growth in the information industry has led to the creation of a single global market where a single standard is pursued, and this market is led by the country that preoccupies standards. Therefore, industrialized countries adopt standardization strategies as a key policy agenda.

3.3.1.2. Fundamentals of the Standardization Act

The Code Section 5930 was enacted on February 2, 1999 to reinforce Korea’s national competitiveness and to improve public welfare through science and technology innovation, upgrading of the industrial structure, and facilitating the information society.

3.3.1.2.1. Establishment of the National Standard System

To establish the national standardization system, the government should formulate various plans and take all the necessary legal, financial and administrative actions. In order to review matters on the basic national standardization plan and business adjustments among related government institutions, the National Standardization Council is established under the Office of Prime Minister and the management rules and functions of the Council are stipulated.

The government sets up the Basic National Standardization Plan every five years which decides agenda. Under this government plan, each chief director of related central administration office should establish and perform detailed plans every year.

3.3.1.2.2. Advancement of the National Standardization System

Complying with the International System of Units, the government classifies the unit system into the derived unit and the standard unit and determines a system of unit which is actually used. Also, the government determines the national correction system in order to consider making national measurement standards and the calibrators which are currently used in every field retroactive.

The government should promote and certify the development and production of standard materials to ensure the appropriateness of measuring devices, accuracy and quantitative evaluation. Also, the government should distribute these efforts and results to industry and educational institutions, establish standard references, and enact and distribute the metrology system and industrial standards. The operation of these systems is prescribed in the Metrology Act and the Industrial Standardization Act.

3.3.1.2.3. Operation and Management of the National Standard System

The government has the following duties of systematically and effectively operating and managing national standards.

① Efforts to comply with international standards regarding industrial standards, telecommunication standards, environmental criteria, and the regulations for public health and safety

② Notification of newly enacted industrial standards to the WTO

③ Implementing recognition and certification projects for the conformity assessment system, and ensuring that the standard enactment and the conformity assessment system comply with international guidelines

④ Introduction of the test-proving certification system and utilization of certification institutions by related directors of central administrative institutions

⑤ Adoption of the system to certify the quality management system and environmental management system

⑥ Recommending the conclusion of the Mutual Recognition Agreement (MRA) on the Standards and Conformity Assessment(SCA) between domestic certification institutions and international organizations

⑦ Strengthening mutual alliance between domestic standard institutions and international standard organizations or organizations in other countries and increasing technology exchange

3.3.1.3. Basic Plan for National Standards[4]

3.3.1.3.1. The First Basic Plan for National Standards (2001~2005)

- Background

With the advent of the technology and knowledge-intensive era in the 21st century, the industrial environment which needs creativity, innovation and creation of high value added has changed. As a result, the roles of national standards have changed to lead industry technology, create demand, secure world markets, and support exports by breaking down technical barriers.

To meet the demands of the times, the First Basic Plan for National Standards was established to make national standards play a key infrastructure role of enhancing national competitiveness, rather than a role of simply distributing product standards. Thus, a solid

4. Korean Standards Association (2009), *Future Society and Standards*

technical foundation for industry and exports was provided.

- Policy Objectives for National Standards

① Establish a technology-oriented national standard system
- Nurture the industry circumstances to enhance international competitiveness through solid technical fundamentals
- Reinforce industrial competitiveness by leading technological innovation and constructing core infrastructure for an advanced industrial structure
- Enhance inter-Korean economic cooperation by establishing an integrated standard base between the South and the North, and minimize the costs of reunifying the two Koreas by overcoming differences

② Improve the national standard system to promote exports and take advantageous position in the world market
- Facilitate exports by breaking down technical trade barriers in the international trade market
- Assist Korean enterprises to preoccupy the global market by providing effective means of advancing into the global market

③ Build up the technical foundation for realizing public welfare
- Realize public welfare by promoting the importance of sympathy for social regulations, such as consumer safety, public health, and environment protection
- Provide the base for welfare-oriented industrial development by harmonizing social regulations and growth of enterprises

- Strategies

① Establish the foundation for the national standard system
- Build up the foundation for promptly coping with the rapidly changing environment on international standards through the establishment of the national standard system and the preparation of a national strategy for national standards

② Actively pursue activities for advancing the national standard system
- Enforce R&D standards by providing technology infrastructure, upgrading national standards to those of industrialized countries, and enacting various reference standards
- Strengthen activities in line with international standards, thereby securing a larger part of the global market.
- Promote public safety and environmental protection by heightening regulation criteria, and promote the self-responsibility principle by utilizing voluntary standard regulations such as KS

③ Strengthen efforts to break down technical trade barriers
- Build up the foundation for the mutual-recognition agreement (MRA) through the overall modification of the SCA and the improvement of technology capabilities of related domestic SCA institutions

- Break down technical trade barriers by strategically enforcing the MRA

④ Prepare unified standards for the two Koreas

- Understand and compare the standard systems of the two Koreas in preparation for reunification to prepare a mid-to-long-term roadmap for unifying standards and a standard integration scenario
- Promote inter-Korean economic cooperation and minimize reunification costs by establishing strategies on unified standards

3.3.1.3.2. The Second Basic Plan for National Standards (2006-2010)

- Background

This plan mainly aims to analyze the results of the 1st basic plan for national standards, suggest directions in preparing overall standardization projects for the next five years, and promote effective and systematic standardization projects, thereby contributing to industrial development. The draft of the second basic plan was prepared by the subcommittee on national standard advancement, the subcommittee on industrial standards, the subcommittee on reinforcement of international standard response capability, and the subcommittee on revitalization of the private sector. These subcommittees consisted of experts from related enterprises and institutions, such as the Ministry of Knowledge Economy (MKE), the Korean Agency for Technology and Standards (KATS), and the Korea Research Institute of Standards and Science (KRISS). The draft was revised at meetings of the subcommittees and confirmed with the approval of the National Standard Council.

- Basic Directions
  - Actively respond to changes in the standard environment by upgrading the standard administration system
  - Establish internationally-reliable measurement standard technology
  - Reinforce international standards response competence to take advantageous position in the world market
  - Construct an advanced standard enactment system by strengthening the private sector's standardization capability

- Policy Objectives

① Advance the national standard system

- Innovation of the national standard management system
- Overall improvement of the national conformity assessment
- Promotion of strategic standardization and expansion of the base for the Standards and Conformity Assessment (SCA)
- Build fundamentals for unified inter-Korean standards

② Enhance the standard and technology sub-structure

• Advancement of measurement standards
• Expansion of standard material development and establishment of the distribution system
• Enactment of standard reference and construction of the development system
• Development of the legal metrology system

③ Strengthen the capability to cope with international standardization
• Take-off as a leading country regarding international standards
• Establishment of a support system for international standards
• Consolidating activities against technical trade barriers

④ Vitalize private sector standardization
• Strategic promotion of standardization competence for the private sector
• Acceleration of standard enactment activities of the producer group
• Cultivation of talented professionals and promotion of the practice system
• Enhancing awareness of standardization, advertisement, and education

● Strategies

① Construct an overall management system for the national standard certification system
• Secure reliability of national standards through the innovative enactment system for national standards and technology criteria and through the introduction of the KS mark, and suggest technological objectives for each product group
• Move toward ‘One Standard, One Test, Accepted Everywhere’ through the globalized operation system development for the national standard system and the conformity assessment system

② Enhance industrial competitiveness through strong national standard competence on measurements
• Lay the foundation for removing technical trade barriers by securing international confidence in domestic measurement data and inspection results
• Solidify the industrial infrastructure by connecting R&D projects with development of relevant test evaluation technology and measurement standard technology

③ Provide support to increase share of overseas markets through vigorous international standardization activities
• Distribute the leading domestic technologies to foreign countries and preoccupy the world market through periodic support of international standardization activities, nurturing of experts, sharing information on global standardization trends, and proposals for international standard development

④ Pursue an advanced standard enactment system by strengthening the competence of the private sector on standardization
• Promote the industry-university-institute standardization forum focusing on next-generation growth engines and the unexplored fields of international standards to establish a customer-oriented standard system

• Improve systems related to private sector standards and increase budget to switch the axis of standard development from the government to the private sector

3.3.2. Industrial Standardization

3.3.2.1. Industrial Standardization Act

3.3.2.1.1. Change in the Industrial Standardization Act

● Enactment of the Manufacturing Standardization Act

In July 1960, the Korean Industry Club suggested the need for manufacturing standards in the paper, "Problems of Industrial Recovery" and proposed a draft of the Manufacturing Standardization Act to the National Supreme Reconstruction Committee. The Manufacturing Standardization Act (draft) was passed at the cabinet meeting and approved by the National Supreme Reconstruction Committee in August 1961. The Act consisted of five chapters and 26 supplementary provisions, and it was announced as the Code Section 732 on September 30, 1961.

● Amendment of the Manufacturing Standardization Act

① First Amendment (1971.1.22, Code Section 2302)

Processing technology was added to the KS marked objects, and the priority purchase system was introduced which mandated the government and public enterprises to purchase KS products. Also, it became mandatory to recruit a quality manager to ameliorate the quality control of factories producing KS-marked goods.

Also, high-quality KS-marked products were exempted from the inspection requirement to avoid an overlapping inspection process.

② Second Amendment (1973.1.15, Code Section 2441)

After the launch of the Industrial Advancement Administration as an external authority under the Ministry of Commerce and Industry, the Bureau of Standardization was deleted (Article 3). Also, the "Ministry of Commerce and Industry"' or the "Competent Deputy Secretary" was changed to the "Industrial Advancement Administration" or the "Minister of Industrial Advancement Administration" under the Manufacturing Standardization Act.

③ Third Amendment (1977.12.31, Code Section 3068)

The 'mandatory KS-mark items' were introduced for products to promote public safety and customer protection, and administrative penalty was imposed on violators. Also, the "standard unification and simplified order system" was included to promote standardization of mining and manufacturing products and inspection was allowed for the KS-marked goods in the market.

④ Fourth Amendment (1982.12.31, Code Section 3636)

The period of revision and confirmation for standards was extended to five years and the regulations requiring the recruitment of a quality manager were relaxed to lessen the burden of enterprises. Instead, it was allowed to hire a person who completed quality management education. Also, the approval system of KS mark was introduced.

⑤ Fifth Amendment (1992.12.28, Code Section 4528)

Under the Standards Amendment concerning manufacturing standards, the international standards enactment trends and standardization, the “Manufacturing Standards” were revised to the “Industrial Standards” to require standardization not only for the manufacturing industry but also for the secondary industry, such as the mining and heavy industries, and the tertiary industry, such as the distribution industry. The Manufacturing Standardization Act was completely amended by establishing the range of industrial standards to cope with the newly rising high-technology industry and by supplementing the KS-marked authorization and the follow-up control system to strengthen the creditability of KS products.

⑥ Sixth Amendment (1997.8.22, Code Section 5330)

To respond to the trends and improve quality of public services, KS certification activities were converted to an advanced private certification system. Also, a provisional standard system was introduced for the sectors undergoing fast technological changes, and collective standard was revitalized.

⑦ Seventh Amendment (1999.2.5, Code Section 5777)

The collective standard declaration system was abolished to make main agents autonomously manage collective standards.

⑧ Eighth Amendment (2007.5.25, Code Section 8486)

The KS certification system was introduced to the service industry and the standard development cooperation institution system was adopted. This was designed to help professional private institutions develop a plan for timely implementation of industrial standards as a prompt response to market demands. Also, the certification-centered collective standard system was revised to make systematic enactment, registration, distribution and application possible. In addition, the legal system was completely changed to help the public understand more easily.

Table 2-1-4 | Enactment & Amendment of the Industrial Standardization Act

Order	Date	Reason for Amendment	Code Section
Enactment	1961. 9. 30	-	732
1st	1971. 1. 22	Partial Amendment	2302
2nd	1973. 1. 15	Partial Amendment	2441
3rd	1977. 12. 31	Partial Amendment	3068
4th	1979. 12. 28	(O) Partial Amendment*	3181
5th	1982. 12. 31	Partial Amendment	3636
6th	1992. 12. 8	Entire Amendment	4528
7th	1993. 3. 6	(O) Partial Amendment	4541
8th	1993. 12. 27	(O) Partial Amendment	4622
9th	1995. 1. 5	(O) Partial Amendmen	4891
10th	1997. 8. 22	Partial Amendment	5350
11th	1997. 12. 13	Partial Amendment	5454
12th	1999. 2. 5	Partial Amendment	5777
13th	1999. 9. 7	(O) Partial Amendment	6019
14th	2000. 12. 29	(O) Partial Amendment	6315
15th	2001. 12. 31	Partial Amendment	6575
16th	2003. 5. 29	(O) Partial Amendment	6893
17th	2005. 3. 31	(O) Partial Amendment	7441
18th	2005. 12. 23	Partial Amendment	7748
19th	2006. 10. 4	(O) Partial Amendment	8038
20th	2007. 1. 3	(O) Partial Amendment	8221
21st	2007. 1. 19	(O) Partial Amendment	8260
22nd	2007. 4. 11	(O) Partial Amendment	8363
23rd	2007. 5. 25	Entire Amendment	8486
24th	2007. 7. 27	(O) Partial Amendment	8562
25th	2007. 12. 21	(O) Partial Amenment	8770
26th	2008. 2. 29	(O) Partial Amendment	8852
27th	2008. 12. 26	Partial Amendment	9229
28th	2009. 1. 30	(O) Partial Amendment	9384
29th	2009. 2. 6	Partial Amendment	9427
30th	2009. 3. 25	(O) Partial Amendment	9535
31st	2010. 6. 8	Partial Amendment	10348
32nd	2010. 7. 23	(O) Partial Amendment	10393

* (O) Partial Amendment: It means that the Amendment was triggered by other Amendment of Law. In other words, changes in the relevant legislation name and the revision of the relevant law have amended the corresponding laws.

3.3.2.1.2. Explanation of the Industrial Standardization Act

- Enactment and Amendment of Industrial Standards

When the Director of the Korean Agency for Technology and Standards (KATS) enacts industrial standards, he or she should collect opinions of interested parties, and the industrial standards should be deliberated and approved by the Council before they are publicly announced and finally confirmed. Only the industrial standards undergoing this process are called the Korean Industrial Standards.

- Marking Assignment and Evaluation Criteria

When the Director of KATS deems that there is a special need to distribute and promote industrial standards for certain mining and manufacturing products and services, the director can designate and announce the KS mark for these items after the approval of the Council on Industrial Standards. The evaluation criteria used for certification should be used for the evaluation of production facilities and on-site inspection. The KS mark for each product assigned by the Director of KATS becomes effective just after its public announcement and mark assignment with the approval of the Council.

- Council on Industrial Standards

The Council inspects and deliberates on issues regarding the enactment, revision, confirmation and repeal of Industrial Standards and may consult the director of related administrative institutions. The Council is set up under KATS, which belongs to the Ministry of Knowledge Economy, and relevant public officials and experts on industrial standards are appointed by the Minister of Knowledge Economy as council members.

- Certification of K.S. Mark

Anyone who produces mining & manufacturing products or provides services can apply to the Certification Authority for certification of the KS mark only when he or she has established production standardization, the introduction of the quality management system, and continuous and stable supply capability at the high quality required by KS. The Certification Authority certifies the KS mark through strict examination according to the inspection criteria for each factory and workplace. Under the KS marking regulations, a person certified can put the KS mark on the products, envelopes, containers, or prints for advertisement.

- Formal Objection System

If a product or service is believed to not match KS qualification standards, an appeal and complaint form can be submitted to the Certification Authority with the necessary information including: the company name, name of the standard, the standard number, the purchase place, the reason for the appeal and complaint. The Certification Authority that received a complaint can request a certified person to take proper action in responding to the complainant if the

Authority determines that the product or service fails to meet the standards of KS. If the Authority determines that a product or service may pose harm to the public, it can recommend to the Director of KATS that the product or service be inspected.

- Support for KS Marked Products

① KS Observance

When the central government, the local government, government-funded institutions and the public authorities apply for commodities, procurement of services, production management or facility construction, they should observe the Korean Standards. In case there are no Korean Standards, they should refer to collective standards. This is because it is difficult for each institution to ensure compatibility as well as to check quality by satisfying its own specifications and it would be a burden for producers to meet each customer's different levels of demand.

② Priority Purchase System of KS-Marked Products

When the central government, the local government, government-funded institutions and the public authorities purchase or need commodities, procurement of services, production management or facility construction, they should preemptively purchase KS-marked products or products with higher-quality based on collective standards. The government obligation to purchase KS-marked products is to ensure public safety and protect consumers, and to save costs and time by not having to go through the quality assurance process.

③ Exception for Contract Bids

The Enforcement Decree 23, which is the Act Relating to Contracts to Which the State is a Party, and the Enforcement Decree 26, which is the Act on Limited Tendering, allows for an exception of selection competitive tendering or limited tendering for KS mark products.

④ Exemption of Examination and Type Approval for KS-Marked Products

The certified KS products are exempted from inspection, examination, and type approval regulated by other legislations to avoid duplication and to lessen the burden on the manufacturing industry.

- Safety Certification and Self-Safety Report Confirmation Report under the Act on Quality Management and Safety Control of Industrial Products · Safety Certification by the Electric Appliances Safety Control Act
- Inspection of safety devices by the Occupational Safety and Health Act
- Type Approval, type registration and uniform radio waves registration by the Radio Waves Act
- Type Approval by the Enforcement Decree of the Framework Act on Telecommunications
- Inspection of containers by the High-Pressure Gas Safety Control Act
- Type Approval of fire-fighting machines and devices by the Installation, Maintenance, and Safety Management of Fire-Fighting System

- Type Approval of measuring instruments by the Testing and Examination of the Act on Environment
- Type Approval of construction equipment by the Construction Equipment Management Act
- Safety Certification of safety parts of elevators by the Manufacture and Management of Elevators Act
- Type Approval of measures under the Measures Act
- Examination by the Safety Control and Business Regulations of Liquefied Petroleum Gas Act
- Quality Certification of rail articles by the Rail Safety Act
- Production approval and report by the Medical Device Act
- Quality Certification by the Urban Railroad Act

● Collective Standard System

The certification group on collective standards regarding industrial standards can establish and utilize the collective standard for symbols, terminology, the function, process, methods, and descriptions used for specific professional fields to ensure public safety, protect customers and promote efficiency for members.

● Unified and Simplified Order System

The Minister of Knowledge Economy can give relevant manufacturers orders, such as the designation of items, events and standards for unification or simplification of parts and materials of main mining & manufacturing products, when the industry standardization of mining and manufacturing products is needed.

This is a mandatory system.

3.3.2.1.3. Government Standards

The Korean Standards under the Industrial Standards Act are government standards that define terminology, symbols, products, methods, and procedures, which can affect many and unspecified citizens. Also, there are standards for national defense, the environment, groceries, and railroad, and they have been enacted and managed according to their own laws, which are called the Government Standards.

For Government Standards, terminology such as standards, industrial standards, and technical standards has been used together. More than 19,030 types of Government Standards have been enacted and used based on 116 Acts.

Each ministry uses its own standards and enacts different test methods for the same product due to the lack of inter-ministerial coordination. For such reason, the government has sought to consolidate the Korean Standards and the Government Standards. Especially in regards to testing methods, which are based on the Korean Standards, included below.

Table 2-1-5 | Government Standards by Ministry

(Dec. 2006, Unit: type)

Ministry	Laws	Standards	Ministry	Laws	Standards
The Ministry of Science & Technology	6	41	Ministry of Maritime Affairs and Fisheries	6	35
Ministry of Government	4	12	National Police Agency	1	518
Ministry of Culture & Tourism	3	4	National Emergency Management Agency	2	101
Ministry of Agriculture & Forestry	11	725	Rural Development Administration	6	225
Ministry of Knowledge Economy	17	1,632	Forest Service	3	15
Ministry of Information and Communications	11	594	Food and Drug Administration	7	6,165
Ministry of Welfare and Health	5	9	Coast Guard	1	1
Ministry of Environment	14	272	Ministry of Education and Human Resources Development	1	1
Ministry of Labor	1	77	Small & Medium Business Admin.	1	3
Ministry of Construction and Transportation	13	140	Meteorological Administration	1	2
Public Procurement Service	1	39	Total	116 (106)	19,030
Defense Acquisition Program Admin.	1	8,419			

* The actual number of laws except the number of departmental laws is 106.
Source: Korean Agency for Technology and Standard (2007), Technical Standards White Book.

3.4. National Certification System[5]

3.4.1. Outline of the Certification System

Certification means that the suitability of specified requirements for products, services and procedures is guaranteed in writing by a third party, which is a certification institution, after being evaluated according to such defined procedures as the Korean Standards and Technical Standards.

This system is closely in line with the shifting paradigm in the domestic and international environment. Amid the changes, the strategy of nations and companies to preoccupy or increase their share of markets has become increasingly important. Also, governments use standardization efforts for certification as part of their strategies to spread domestic technologies to the world market and to dominate it.

In addition, the paradigm shift in standardization and certification has rapidly proliferated to new areas including: ethical management, the service industries such as tourism and finance, and innovative technology industries such as bio-technology and information technology. Also, the increase in participation by various stakeholders, such as enterprises, consumers, the handicapped, and environmentalists, to improve market suitability shows a totally different environment compared with the past.

3.4.2. Current Situation of the Certification System

3.4.2.1. Domestic Surroundings

There are two certification systems in Korea: a legal certification system which has a legal basis and a private certification system which does not. The legal certification system has 95 types of certificates based on 64 legislations and has been operated in 18 central administrative institutions. On the other hand, the private certification system manages 60 types of certificates on the basis of their own autonomous regulations in test and examination institutions, representative groups for each classified industry, and local governments.

These certification systems do not have unified procedures, criteria and terminologies, and various types of these systems have been used by each institution regarding certification, conformity, examination, type approval, approval, appointment, registration, etc.

5. Source: Korean Agency for Technology and Standard (2010), 2009 Technological Standards White Book

Table 2-1-6 | Classification of the Certification Systems

Types		Contents
Legal Certification System	Compulsory	Mandatory certification stipulated by the legislations to protect life and properties of the people: 9 institutions and 39 certificates such as the safety certificate for industrial products * Without certification, production and distribution are impossible.
	Voluntary	Recommended certification on the basis of legislations to attain policy objectives such as environment protection and energy saving: 18 institutions and 56 certificates including a environment mark * Providing incentives such as priority purchase and financial aid
Private Certification System		Certification autonomously performed by the private sector to meet market demands without a legal ground: about 60 certificates like the Q-mark

Source: Korean Agency for Technology and Standard (2010), *2009 Technical Standards White Book.*

The different number of certification systems was only four in the 1960s, 13 in the 1970s, and 21 in the 1980s. However, it increased to 83 in the 1990s and stands at 155 presently, as 134, or 87% of the total, were newly introduced after the adoption of the quality management system, IS 9000, in the 1990s.

Table 2-1-7 | Number of Certification Systems by Year

Type	'60~'69	'70~'79	'80~'89	'90~'99	'00~'09
Legal Certification	4	12	17	60	95
Private Certification	0	1	4	23	60
Total	4	13	21	83	155

Source: Korean Agency for Technology and Standard (2010), *2009 Technical Standards White Book.*

The legal compulsory certification is mainly focused on quality, environment and public health, and the legal voluntary certification deals with various fields such as safety, environment, public health, innovative technology, energy, software, design, service, and group certification. On the other hand, the private certification is not limited to specific areas as long as there are demands for that.

Table 2-1-8 | Number of Legal Certification Systems by Sector

	Safety	Quality	Environment	Public Heath	New-Tech	Energy	S/W	Service	Others	Total
Compulsory	21	5	9	4	-	-	-	-	-	39
Voluntary	5	24	6	2	6	3	5	4	1	56

Source: Korean Agency for Technology and Standard (2010), 2009 *Technical Standards White Book.*

3.4.2.2. Overseas Circumstances

3.4.2.2.1. The European Union (EU): Conformite Europeenne (CE)

The EU has used the compulsory CE-mark system for products relevant to safety, sanitation, health, environment, and customer production as a joint system for EU countries, and prohibits non-CE-marked products from distribution.

It took about eight years for the EU to organize the certification system and the EU manages the CE mark for about 22,000 products under 22 item groups. Apart from this certification, some European countries are operating their own compulsory or voluntary certification systems: VDE for Germany, D-mark for Denmark, and LGIE for France.

3.4.2.2.2. The United States (U.S.): FDA, FCC

The U.S. mandates pre-approval of the Food & Drug Administration (FDA) for food and medicine before distribution to confirm whether or not they meet the requirement of safety and effectiveness. Also, wireless products require certification which is issued by the Federal Communication Commission (FCC) before they are sold or imported to check whether or not they meet the requirements. After approval, a certification mark should be attached to all the products. Also, the Underwriters Laboratories (UL) system is operated for the safety of electric and electronic products.

3.4.2.2.3. Japan: Product Safety (PS)

Japan has uniformly used the PS mark as a compulsory certification system since 2003. For each product, it has its own certification mark and without a certified mark it is prohibited from sale: PSE for appliance, PSC for industrial products, PSTG for Gas products, and PSLPG for Liquefied Petroleum Gas (LPG) products. Also, the Japan Industrial Standards (JIS) has been used as the voluntary certification to measure the quality of industrial products.

3.4.2.2.4. China: China Compulsory Certification (CCC)

China has dualistically managed its compulsory certification system depending on whether industrial products are domestically produced or imported. These industrial products include appliances, communication devices, toys, and pressurized products and can be categorized into 325 products in 19 items. After joining the WTO, China unified the certification system on May, 2002 and made it mandatory for products to show a CCC mark. Also, the country makes it possible to sanction products without a CCC mark.

3.4.3. Results and Future Plans for Standardization and Certification System

3.4.3.1. Improvement of the Statutory Compulsory Certification System

3.4.3.1.1. Introduction of the KS mark

Through the amendment of the National Standard Act in April 2009, Korea decided to use the KS mark starting from January 2011 by unifying the certification marks regulated under the legal compulsory certification systems. Of the 39 legal compulsory certification systems managed by nine institutions, 13 certification marks were used according to five institutional Acts, but the Ministry of Knowledge Economy and the Ministry of Labor began to preferentially enforce the unified KC mark starting from July 2009.

Figure 2-1-8 | Changes in the Unified Certification Mark

Source: Korean Agency for Technology and Standard (2010), *2009 Technical Standards White Book.*

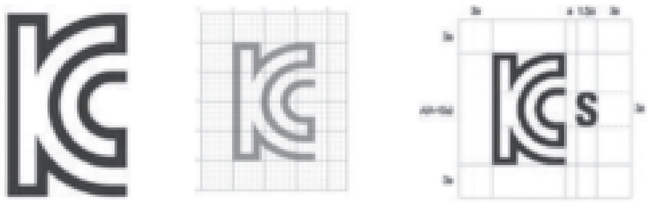
The national compulsory certification system regulates the criteria of safety, quality, environment and public health to protect the lives and properties of the people. Only products meeting these criteria are allowed to be distributed and can receive certification.

However, despite the importance of legal compulsory certification, producers and consumers had difficulties identifying the certification marks because both legislations and certification marks varied depending on the certification system used for industrial products, appliances, measurement devices and communication devices. To resolve this inconvenience, the 13 certification marks currently used were unified under the KC mark to make it easily identifiably and convenient to public.

In the mean time, various actions such as advertisement and information sessions conducted via TV, the Internet and brochures to raise public awareness of the KC mark.

The government plans to actively promote the globalization of the KC mark and to promote it to housewives, workers and students, and overseas through overseas embassies and KOTRA.

Figure 2-1-9 | Basic Design of the National Unified Certification Mark



* Letters by Certified Area: Safety (S), Quality (Q), Environment (E), Health (H).
Source: Korean Agency for Technology and Standard (2010), *2009 Technical Standards White Book.*

3.4.3.1.2. Introduction of the Examination System for Standard Certification

Approximately 20 categories were examined during the certification process under the previous legal compulsory certification system. To meet the requirements of the ISO or IEC Guide 67 regarding certification examination methods, they were simplified to nine examination categories of standard certification.

It is known that there are 20 categories of certification examination methods in 39 domestic legal compulsory certification systems. Though these methods are not seemingly different from international standards, it is still difficult to confirm that these methods would meet international standards. Therefore, when a new certification system is enacted, an examination method is decided without confidence in whether or not a new system complies with international standards.

To solve this problem, nine categories of standard-certification-examination criteria were established in line with international standards, and they were applied to all the legal compulsory certification systems. These nine categories were classified contingent on implementation: the product test and facility inspection in the certification phase and the product test and facility inspection in the follow-up control phase.

The Ministry of Knowledge Economy established the examination categories for certification systems through the enactment of the Enforcement Decree of National Standard Framework Act by preparing the standard-certification-examination categories. Each ministry operating the legal compulsory certification system is permitted to choose relevant categories from the certification systems under its jurisdiction and stipulate them in individual legislations, thereby maintaining the autonomy of the certification system.

In addition, several certification-examination categories had to be applied to a product which was under more than two legal compulsory certificates. This caused inefficiencies in cost, time and manpower. Therefore, it is planned to streamline procedures and duplications through a one-time application process, mutual approval of duplicate test items and simultaneous practice of regular examinations.

3.4.3.1.3. Establishment of Legal Grounds for Effective Management of the Certification System

The consultation function regarding the certification system among central administrative institutions has been reinforced by activating the National Standards Council. Under the Practices Committee under the Council, a new certification system had to be reviewed and adjusted according including mutual duplication among certification systems and compliance with international standards.

If a government institution revises or enacts a legal compulsory certification system or seeks to indicate the national-unified-certification mark, the Minister of Knowledge Economy must be consulted in advance rather than just submitting a report to ministry as it had been done in the past. This is designed to prevent an increase in similar or same certificates, to improve duplications between certification systems and to ensure systems comply with international standards.

The roles of KATS are to provide information on international standards and domestic certification systems and to advise the central government administrative institutions. By doing that, the institutions can reduce the duplication of certificates or failures to comply with international standards due to the lack of information.

3.4.3.2. Improvement of Legal Voluntary System and Private Certification System

The policy objective is to minimize duplications regarding certification objectives, certification categories and its procedures in legal voluntary certification systems. Currently, there are 56 legal voluntary certification systems, which is higher than the number of legal compulsory certification systems. Moreover, because of several incentives such as fund support, priority purchase, and points grant, a lot of products have more than two certificates, and thus, are subject to the same examination categories.

Accordingly, it is planned that products with similar certificates will be minimized by inter-institutional cooperation and improvement of the incentive system. At the same time, the same examination categories will be mutually approved among institutions to relieve the cost burden of enterprises.

In addition, the improvement plan for private certification seeks to revitalize private certificates after its assessment. Though the number of private certification systems amount to six now, it is anticipated that the number will greatly increase. Moreover, because these systems are not regulated by law, they fail to comply with international standards, and some private certificates even cause confusion among customers.

Therefore, the government plans to help private certification institutions advance into the overseas market by revising and distributing management and evaluation guidelines for private certification to ensure their credibility, and by supporting costs for conducting test and facilities inspection for outstanding certification institutions.

3.4.3.3. Improvement of National Certification System and Techno-Management Operation System

Currently the Korean government plans to minimize duplications in examinations by emphasizing the linkage between technical standards and national standards, and to promote coordination among nations.

Though there are approximately 19,000 types of technical standards in the country, the linkage between technical standards and national standards is so low that there are duplications in the examinations on similar test categories. It has been difficult to obtain cooperation on this from other countries. Therefore, the government is setting up a plan to construct a database (DB) for technical standards and reinforce the linkage between technical standards and national standards by comparing the two standards.

Currently, the government is acquiring a basic DB for technical standards, and constructing the unified code system for technical standards which is designed for better information retrieval. Also, the government is extracting Metadata using the International Classification of Standards (ICS) and developing programs for code registration which are capable of search and identification by industry and item.

In addition, the government plans to expand information exchange among the Conformity Assessment institutions via the construction of a network system for certification information, to provide customers with information and SMEs with domestic and overseas certification information on regulated items, application criteria, and procedures.

Since domestic certification institutions have relatively poor infrastructure compared with advanced countries, it is necessary to advance the certification industry to the internationally competitive levels. Thus, the government needs to equip itself with test devices equal to those in developed countries, to improve the ability to test standards in line with international standards such as the International Organization for Standardization (ISO) and the International Electro-technical Commission (IEC), and to participate in relative-evaluation-programs used for testing skills.

Additionally, the government will introduce a qualification system for examinants, a standard certificate, and a follow-up control system which complies with international standards, for the establishment of the examinant system and the certification and globalization of certification institutions.

3.5. International Standardization and Standardization Activities of the ISO and the IEC

The recognition of the economic value of standardization, or "one who dominates standards shall conquer the world," has broadly spread around the world. Moreover, under the protocol of the WTO and the TBT, member countries should introduce or modify new technical standards on the basis of international standards. Thus, countries have been competing fiercely on the world stage by upgrading their own technical standards to international standards.

In promptly responding to this global movement, Korea is carrying out various international standardization activities to fulfill the objective of becoming a World Top 7 Standardization Country in 2012. Though Korea lags behind top countries such as the U.S., Germany, France, and the U.K., it achieved some meaningful results in 2009. First, the total number of international-standards proposals, one of the most representative indicators of international standardization activity, reached 329 at the end of 2009, which is up 79 from the previous year. Also, the total number of presidents, assistant administrators, and representatives in technical committees (TC) and sub-committees (SC) greatly increased to 95 in 2009 from 81 in 2008.

Particularly in 2009, Korea became a member country of the Council, where most important policy decisions are made, and a member country of the Conformity Assessment Board (CAB) in the IEC. Also, the nation joined 862 TCs out of over 900 TCs in the same year, showing an 81% enrollment rate.

In 2009, Korea hosted international conferences on standardization 42 times to promote Korean standards, and Korean standard experts took part in various technical committee meetings, a total of 279 meetings (1,591 persons) held all over the world.

Meanwhile, Korea participated in annual meetings of the Pacific Area Standard Congress (PASC) and the Asia-Pacific Economic Cooperation, Standard and Conformity Sub-Committee (APEC SCSC). In doing so, Korea gained knowledge on the international landscape of technical standards in member countries, and enthusiastically performed activities in the local standardization institutions as well, through cooperative works on international issues such as energy efficiency and promoting enterprise standardization activities. Also, Korea signed a Memorandum of Understanding (MOU) on mutual cooperation in the Standards and Conformity Assessment with 31 countries and 41 institutions from around the world at the end of 2009. This expanded Korea's base for the nation's international standardization activities. Also, Korea has invited 98 experts in the field of standardization and uniform assessment from countries and organizations, including the Association of Southeast Asian Nations (ASEAN), to hold training sessions for them since 2002, contributing greatly to the development of international standards.

Furthermore, Korea joined international standardization organizations such as the ISO and the IEC in 1963 and has continuously performed international standardization activities since its entry into the international standardization society. As the representative institution of Korea, the Korean Agency for Technology and Science (KATS) has actively been engaged with the ISO, the IEC and the PASC, a local cooperative institution on standards.

Table 2-1-9 | Major International Standardization Organizations Korea Joined (2009.12)

International Organization		Objectives of Establishment	Establishment	Enrollment	Member Countries	Standards
ISO		- Enactment or distribution of international standards for general areas such as science, technology, and economy - International exchange of products and services	1947. 2	1963. 6	161	17,765
IEC		- Enactment and distribution of international standards on electrical and electronic appliances	1906. 6	1963. 5	75	6,027
IECQ	CMC	- Management and operation of International Electro-technical Commission Quality (IECQ)	1976. 5	1979. 1	16	-
	ICC	- Certification of international examination institutions - Fair application of practice and regulation for quality certification and verification	1978. 1	1984. 1		
IECEE		- Promotion of international trade through mutual approval in electrical and electronic appliances	1985. 9	1987.12	47	-
IECEx Scheme		- Maintenance of safety level and mutual approval regarding explosive electrical appliances	1997.10	1997.12	26	-
PASC		- Response to the dominant position of the European area in international standardization activities - Promotion of mutual interests in the Pacific countries	1973. 2	1973. 2	24	-

Source: Korean Agency for Technology and Standard (2010), 2009 *Technical Standards White Book*.

4. Results of Industrial Standardization

4.1. Ten-Year Industrial Standardization Plan and Results

The 10-year Industrial Standardization Plan was established, with 1969 set as the base year, 1970 as the planning year, and the period from 1971 to 1980 as the enforcement years. The first five years from 1971 to 1975 were set as the first half, and the latter five years from 1976 to 1980, as the second half.

The first half focused on establishing new standards, and the second half focused on improving the standards through revision and confirmation, and the budget required was obtained from the special account for economic development. Also, the enactment, amendment and confirmation of 100 to 150 new standards, which were conducted based on the existing industrial standards every year, were carried out separately from this 10-year plan.

The long-term 10-year industrial standardization plan was enforced for the following three purposes:

① Improving the domestic industrial structure, production quality, and technology levels by promptly establishing and distributing various standards (product standard and delivery standard, etc.) to set up standardization for the rapidly-developing mining and manufacturing industries

② Promoting domestic standardization by unifying different domestic standards, and pursuing domestic standards in line with international standardization

③ Expanding the KS labeling system, and facilitating standardization administration by improving and complementing the laws and decrees regarding industrial standardization

Also, expected effects are considered by dividing them into the national side, the manufacturer side, and the customer side.

① National side: establishing mass production through systematization and specialization of products, increasing exports by strengthening international competitiveness, simplifying transactions, establishing distribution orders and protecting consumer rights, raising wages by enhancing productivity of labor, bringing spending savings to the national budget, and modifying the Industrial Standardization Act and Enforcement Decree

② Manufacturer side: establishing an effective production system by dividing labor and simplifying processes, reducing costs by improving labor productivity and production efficiency, preventing waste of raw materials, and promoting easy purchase and expanding compatibility

③ Customer side: enhancing convenience through simplification of market places and fair practice, making quality of products more discernable, purchasing high quality products at low prices

Due to the success of the five-year economic development plan implemented since the early 1960s and the continued enforcement of other economic development policies, all the Korean industries began to be vitalized in the 1970s.

Especially, the mining and manufacturing industries grew from 14.8% during the period of the five-year economic development plan (1962-1966) to 21.3% in 1969, exhibiting unprecedented rapid growth, not seen in world economic history. In exports, industrial products accounted for 79% of the total exports in 1969.

Starting from this period, basic industries continuously expanded and the industrial structural adjustment and reorganization began. Thus, the country's industrial structure has slowly evolved from a labor-intensive industry to a technology-intensive industry.

Table 2-1-10 | Changes in the Domestic Industrial Structure

(Unit: %)

Division	1961	1970	1975	1979
GDP	100.0	100.0	100.0	100.0
Agriculture, Forestry and Fishery	39.1	26.7	25.0	19.1
Mining	15.5	22.5	27.0	29.9
Manufacturing	13.6	21.3	26.1	28.8
Construction, Electricity, Gas and Waterworks[1]	4.4	6.5	6.0	10.2
Service	-	34.8	33.2	32.0
Non-Profit Public and Private Sector Service[2]	41.0	9.4	8.3	8.8

Note: 1. Including wholesale, retail, food, accommodation, transportation, storage, communications, finance, insurance, real estate, business services, community and personal services.

2. Housekeeping services included.

Source: the Bank of Korea (1990), National Accounts.

Above all, the nation's industrial structure was upgraded from a light industry-centered to a heavy chemical industry-centered industry. By 1970, the food, beverage and textile industries accounted for approximately 62% of the entire manufacturing industry. Backed by the government policy of fostering the heavy chemical industry, however, the ratio of food, beverage and textile business reduced to about 48% in 1979. On the other hand, the ratio of the heavy chemical industry increased from about 38% in 1970 to 52% in 1979. Thus, Korea took on the aspect of an industrialized country in the 1970s.

Table 2-1-11 | Changes in the Industrial Structure

(Unit: %)

Division	1966	1970	1975	1979
Manufacturing	100.0	100.0	100.0	100.0
Light Industry	65.9	61.9	54.1	47.9
Food and Beverage	26.7	29.2	23.1	19.8
Textile	24.6	19.3	19.9	17.8
Others	14.5	11.6	9.8	8.9
Heavy Chemical Industry	34.1	38.1	45.9	52.1
Petro chemistry	10.3	13.7	15.1	13.8
Secondary metal	3.5	1.4	3.2	17.5
Machinery	10.6	14.0	18.4	21.8
Others	9.7	8.7	7.5	4.1

Source: the Bank of Korea (1990), *National Accounts.*

Also, total exports steadily increased from less than $1 billion in 1970 to more than $10 billion in 1977, and the volume increased to $21.254 billion in 1981. The quantity and the quality of Korea's exports improved greatly. The share of industrial products as a share of total exports rose from 83.2% in 1970 to 90% in 1979, and the share of the light industry goods reduced from 84.4% in 1970 to 57.2% in 1979. On the other hand, the share of the heavy chemical industry products grew from 15.6% in 1970 to 42.8% in 1979.

Against this backdrop, the industrial standardization activities were continuously promoted to upgrade the industries. With the first and second 5-year economic development plans successfully enforced and the size of the economy expanded, it was required to quantitatively secure national standards and to establish standards for high-quality raw materials and parts, and for the heavy chemical industry products. Hence, the government established the 10-year industrial standardization plan from 1971 to 1980 in order to actively respond to the changing environment, and focused on raising the nation's industrial standards to those of advanced industrialized countries.

This plan led to enacting 500 kinds of new national standards every year during this period, generating a quantitative growth of national standards. As a result, Korea secured a total of 6,700 national standards at the end of the 1970s.

The national standards enacted in this period mainly consisted of standards for raw materials and parts, uniformity in examination, machinery, automobile parts, shipping products, aircraft goods, electromechanical machinery, and chemical products. These standards worked to lay the foundation for the government's policy to foster exports and the heavy chemical industry, and considerably contributed to the government's energy saving policy during the second oil shock.

During the period of the 10-year industrial standardization plan, the nation introduced systems, such as compliance of national standards by public institutions, prior purchase of KS marked goods, the KS mark system for processing technology, and the KS order system in 1971. In 1977, the country adopted the simplification order system, the unification and simplification of government standards, and the standardization of package sizes. Through these efforts, the national standardization project expanded and settled down quickly and effectively, and profitability was secured as the economy grew in size.

In the 1970s, when the 10-year industrial standardization plan was carried out, the KSA grew enormously both in size and quality based on the solid foundation laid in the 1960s. Responding to the government's active standardization policy, the organization considerably broadened quality control activities and steadily published and distributed standards which had increased a lot due to the 10-year industrial standardization plan.

As the KSA was designated as an organization to nurture quality control in 1971, the qualitative and quantitative growth of training and education in quality control grew. To meet the rising educational needs, the KS Hall was built in 1976 and it satisfied various training and educational demands of the industries. Also, KSA continuously endeavored to hold seminars by inviting world renowned quality control experts and to introduce advanced quality control techniques through training overseas.

4.2. Present Situation of Industrial Standardization

4.2.1. KS Possession by Year and Type

The Korean Industrial Standards (KS) started from 300 types in 1962. As the nation established the annual target of 300 types, the number of the standards reached 23,415 (as of late September 2010), which is an increase of about 80 times during the 50 years of economic growth. Also, with the industries diversified, upgraded and globalized, 3,149 standards were repealed by late September 2010. Indeed, standards do not survive forever, and instead, they evolve in response to changes over time. In other words, standards respond most quickly and sensitively to technological change. Table 2-1-12 shows the present situation of KS by year.

According to KS possession by type, the number of product standards is 7,625, the number of standards for methods is 8,422, and the number of delivery standards is 7,368. Table 2-1-13 shows the present situation of KS possession by type.

Table 2-1-12 | Korean Industrial Standards (KS) Possession by Year

(Unit: type)

Year	KS by Year				Number of Standards Owned(Year-End)
	Enactment	Amendment	Confirmation	Abolition	
1962	300	-	-	-	300
1965	283	97	130	97	1,081
1970	159	154	297	4	1,846
1975	605	334	815	13	4,698
1980	327	632	1,722	50	7,029
1985	101	459	1,650	39	7,475
1990	368	549	1,388	216	8,552
1995	309	670	1,496	126	9,368
1996	310	740	1,228	72	9,606
1997	375	1,081	1,273	130	9,851
1998	419	444	927	77	10,193
1999	448	598	686	45	10,596
2000	290	427	1,456	41	10,845
2001	1,343	1,426	1,554	182	12,006
2002	3,616	1,810	1,108	446	15,176
2003	3,142	1,518	600	304	18,014
2004	1,988	1,029	702	137	19,865
2005	1,656	1,092	735	270	21,251
2006	995	1,694	2,059	188	22,058
2007	916	2,558	3,351	214	22,760
2008	483	1,891	3,042	181	23,062
2009	567	1,508	2,323	257	23,372
2010.9	103	355	197	60	23,415

Source: Korean Agency for Technology and Standard (2010), 2009 *Technical Standards White Book*.

Table 2-1-13 | Korean Industrial Standards (KS) Possession by Type

(Unit: type)

Year / Type	1995	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010.9
Product Standards	5,234	5,586	5,714	5,803	6,020	6,422	6,861	7,263	7,381	7,550	7,581	7,628	7,625
Standards for Method	2,537	2,997	3,106	3,500	4,894	6,383	7,070	7,588	7,818	8,119	8,232	8,384	8,422
Standards for Delivery	1,597	2,013	2,025	2,703	4,262	5,209	5,934	6,400	6,859	7,091	7,249	7,360	7,368
Total	9,368	10,596	10,845	12,006	15,176	18,014	19,865	21,251	22,058	22,760	23,062	23,372	23,415

Source: Korean Agency for Technology and Standard (2010), 2009 *Technical Standards White Book*.

4.2.2. KS Possession by Sector

As of late September 2010, the number of KS by sector shows that there were 4,088 in the machine industry, 3,708 in the electrical and electronic sectors, 3,463 in the chemical sector, 1,640 in the metal sector, and 1,065 in transportation machinery. Table 2-1-14 shows KS possession by year and sector.

Table 2-1-14 | KS Possession by Sector

(Unit: type)

Sector \ Year	1995	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010.9
Total	9,368	10,596	10,845	12,006	15,176	18,014	19,865	21,251	22,058	22,760	23,062	23,372	23,415
Basic (A)	483	538	536	591	688	817	905	982	1,090	1,130	1,108	717	721
Machine(B)	1,594	1,740	1,764	1,943	2,481	3,020	3,445	3,763	4,043	4,150	4,201	4,098	4,088
Electronic(C)	1,333	1,097	1,140	1,342	1,861	2,492	2,798	3,032	3,131	3,339	3,395	3,694	3,708
Metal(D)	897	941	943	965	1,217	1,384	1,466	1,572	1,628	1,652	1,654	1,641	1,640
Mine(E)	251	248	248	278	354	429	425	421	435	434	434	447	446
Construction(F)	596	586	604	635	674	742	774	802	814	833	845	851	853
Necessities (G)	282	267	267	251	267	302	358	376	371	366	363	370	370
Food(H)	146	148	147	220	301	396	433	435	490	513	524	498	501
Environment(I)	0	0	0	0	0	0	0	0	0	0	0	638	644
Biology(J)	0	0	0	0	0	0	0	0	0	0	0	68	68
Textile(K)	444	512	517	580	664	741	788	793	788	816	823	863	874
Ceramic(L)	371	362	362	365	408	415	416	423	443	453	458	479	464
Chemistry(M)	1,512	1,961	2,094	2,248	3,016	3,460	3,705	3,906	3,998	4,091	4,090	3,445	3,463
Medicine(P)	286	327	327	341	439	517	612	679	703	733	737	693	693
Quality Management(Q)	0	0	0	0	0	0	0	0	0	0	0	111	111
Transportation(R)	492	594	604	644	773	889	980	1,044	1,036	1,065	1,080	1,065	1,065
Service(S)	0	0	0	0	0	0	0	0	0	0	98	108	108
Logistics (T)	0	0	0	0	0	0	0	0	0	0	0	304	304
Shipbuilding(V)	498	499	501	534	582	637	689	784	823	837	843	834	834
Aerospace(W)	183	232	238	256	310	368	434	471	467	486	491	521	521
Information(X)	0	544	553	813	1,141	1,405	1,637	1,768	1,798	1,862	1,918	1,927	1,939

*Four new sectors (environment, biology, quality management, and logistics) were created based on "Guidelines for Korean Industrial Standards Classification and Management"(2008.7.21), (enforced in January 2009).

Source: Korean Agency for Technology and Standard (2010), 2009 Technical Standards White Book.

4.2.3. KS Possession by Type and Sector (2007-2008)

Table 2-1-15 | KS Possession by Type and by Sector (2007-2008)

(Unit: type)

Type / Sector	2007				2008			
	Product Standards	Standards for Method	Standards for Delivery	Total	Product Standards	Standards for Method	Standards for Delivery	Total
Basic (A)	224	262	644	1,130	225	278	605	1,108
Machine (B))	1,584	952	1,614	4,150	1,602	961	1,638	4,201
Electronic (C)	1,190	970	1,179	3,339	1,196	1,007	1,192	3,395
Metal (D)	618	823	211	1,652	618	835	201	1,654
Mine (E)	97	281	56	434	97	283	54	434
Construction (F)	302	417	114	833	301	429	115	845
Necessities (G)	265	68	33	366	262	68	33	363
Food (H)	169	313	31	513	183	318	23	524
Environment (I)	0	0	0	0	0	0	0	0
Biology (J)	0	0	0	0	0	0	0	0
Textile (K)	187	521	108	816	188	528	107	823
Ceramic (L)	180	238	35	453	180	243	35	458
Chemistry (M)	1,051	2,490	550	4,091	1,045	2,486	559	4,090
Medicine (P)	455	114	164	733	459	111	167	737
Quality Management (Q)	0	0	0	0	0	0	0	0
Transportation(R)	406	431	228	1,065	405	443	232	1,080
Service (S)	0	0	0	0	0	0	98	98
Logistics (T)	0	0	0	0	0	0	0	0
Shipbuilding (V)	539	91	207	837	548	89	206	843
Aerospace (W)	249	48	189	486	238	52	201	491
Information (X)	34	100	1,728	1,862	34	101	1,783	1,918
Total	7,550	8,119	7,091	22,760	7,581	8,232	7,249	23,062

*Product standards: regulations on the requirements for products that should be satisfied to carry out certain performance under particular conditions, such as the shape, size, quality and safety of a product.

*Standards for methods: regulations on methods of examination, analysis, inspection, verification, and measurement.

*Standards for delivery: regulations on the definition of notion, terminology, abbreviation, sign, symbol, unit and sequence.

Source: Korean Agency for Technology and Standard (2010), 2009 Technical Standards White Book.

4.2.4. KS Possession by Type and Sector (2009-2010.9)

Table 2-1-16 | KS Possession by Type and by Sector (2009-2010.9)

(Unit: type)

Sector \ Type	2007				2008			
	Product Standards	Standards for Method	Standards for Delivery	Total	Product Standards	Standards for Method	Standards for Delivery	Total
Basic (A)	113	138	466	717	112	138	471	721
Machine (B))	1,532	1,012	1,554	4,098	1,532	1,006	1,550	4,088
Electronic (C)	1,293	1,067	1,334	3,694	1,291	1,082	1,335	3,708
Metal (D)	618	823	211	1,652	618	835	201	1,654
Mine (E)	97	296	54	447	97	295	54	446
Construction (F)	303	433	115	851	304	436	113	853
Necessities (G)	254	78	38	370	253	78	39	370
Food (H)	187	295	16	498	190	295	16	501
Environment (I)	14	539	85	638	8	544	92	644
Biology (J)	0	43	25	68	0	43	25	68
Textile (K)	184	566	113	863	185	575	114	874
Ceramic (L)	189	248	42	479	190	248	26	464
Chemistry (M)	1,041	1,968	436	3,445	1,043	1,982	438	3,463
Medicine (P)	3,445	118	146	693	430	118	145	693
Quality Management (Q)	3	19	89	111	3	19	89	111
Transportation(R)	396	444	225	1,065	396	444	225	1,065
Service (S)	0	2	106	108	0	2	106	108
Logistics (T)	129	78	97	304	129	78	97	304
Shipbuilding (V)	546	84	204	834	546	84	204	834
Aerospace (W)	249	56	216	521	249	56	216	521
Information (X)	41	86	1,800	1,927	41	86	1,812	1,939
Total	1,927	8,384	7,360	23,372	7,625	8,422	7,368	23,415

Source: Korean Agency for Technology and Standard (2010), 2009 Technical Standards White Book.

4.3. Growth in Labor Productivity

Industrial Standards that centered on standardization, simplification and specialization, which are the basis of mass production, has played a pivotal role in Korea°Øs economic growth, and will continue to play an important role in the future. Among many factors, industrial standardization contributed tremendously to improving productivity of the manufacturing industry. Table 2-1-17 shows growth in labor productivity of the manufacturing industry by period. Labor productivity increased about 8.3% in the 1970s, 8.0% in the 1980s, 10.6% in the 1990s, and 6.6% in the 2000s. The average growth rate over the past four decades is about 8.3%, which is a remarkably high accomplishment in world history.

Table 2-1-17 | Growth in Labor Productivity of the Manufacturing Industry by Period

(Unit: %)

Period	1971~80	1981~90	1991~98*	2000~09*	Total Growth Rate('71-'09)
Average growth rate	8.3	8.0	10.6	6.6	8.3

* Period of 1970 ~ 1998: more than 10 full-time employees
* Period of 2000 ~ 2009: more than 5 full-time employees
* Because the population changed after 1998, the time series analysis could not be continued

Source: Korea Productivity Center (2010), Productivity Statistics DB

Today, more attention and discussion have been put on standardization in new sectors, and in non-industrial sectors, such as safety, environment, public health, sanitation, and social responsibility.

The development of standards is necessary to securing a safe and comfortable life from natural disasters, building codes, products and foods standards, and to expand the standards for marginalized people, including the elderly and the handicapped, thereby improving people’s lives.

4.4. Standardization Case: Shinheung Paper Company

As a case study, this paper discusses the introduction of standardization and business rationalization initiatives at the Shinheung paper manufacturer which used the Korean Industrial Standards.

Anyone would appreciate a Korean company producing Kraft wrappers, the number one wrapping material, if the wrappers could save tens of thousands of dollars a year. However, in spite of the government’s industrial policy, it was not easy for a Korean company to manufacture the wrappers due to the lack of funds and technical know-how.

In 1954, Shinheung Paper Company, the first Kraft factory in Korea, was constructed, and its operation began in May 1960. The machine at this factory was the largest one in Korea and equipped with the latest machines and reliable designs of the United States. Under import substitution, the factory produced Kraft wrappers in quality and production in less than one year after operation, and it produced 7,000 tons of wrappers in 1961 and about 10,000 tons in 1962. The company even exported some of its wrappers.

To improve the quality of domestic Kraft wrappers, the company completely complemented defective products and continuously improved the quality of its products, while solving difficulties, such as power, water, coal, and techniques.

However, there were many different basis of weights applied - 60, 70, 80, 81, 2, 90, 96, 100, 120, and 150g/㎡- in producing the Kraft wrappers. Also, various standards existed, such as the United States Federal Standard (USFS) and the Japan Industrial Standard (JTS), etc. Because of these different standards, the production process had to be changed frequently. This was seriously disadvantageous from a long-term perspective. Also, due to the short period of factory operation, it was hard to collect process management data which made it possible to produce Kraft wrappers for the first time in Korea.

A basic solution to these difficulties was necessary to unify various standards into one because quality control followed four principle steps: ① Standard ② Execution ③ Comparison ④ Revision

These four steps were performed day and night. A standard of quality was needed, and strict inspection policy was applied. Revisions were conducted at the production planning committee at the factory. Due to these efforts, the quality improved a bit, but implementation of these four steps often stopped due to different quality standards.

If the company improved quality, then it had to study its impact on production, and if production rose, then it again had to undergo quality control according to new standards. This process was repeatedly conducted. And in April 1962, the Korea Industrial Standard for Kraft wrappers was finally enacted as KS M 7,501.

Starting from June, this newly legislated standard was finally applied, and the basis weights were also limited to a couple of types. This standard was stricter than the Japanese standard, and it was equivalent to the US standard.

After the new standard was adopted, its production increased 25% in July, 33% in October, and 50% in December. This improvement showed that the paper manufacturer reflected the standard in its quality control and process management in a fair manner. The company tested rigidity standards for every product according to this standard.

It was true that there were some complaints about this strict method, but these complaints were solved by emphasizing the more important issue, ensuring standards.

The unified standard had great effects on improving quality and increasing production. Also, the unified standard enabled the company to control quality, thereby simplifying transactions, improving productivity and reducing production costs.

4.5. Implications

4.5.1. Standardization for Promoting Exports

The 5-year economic development plan was designed to foster the export industry to improve the international balance of payments, in response to the country's desperate economic conditions in the early 1960s.

At the time, most Korean exports were products of the primary industry. As the nation was expected to experience shortages in resources in the near future, it was inevitable to reform the structure of the industries and to sharply increase exports in the secondary industry. Also, it was necessary to maintain the existing overseas markets and secure new markets using high-quality and low-price products, and this was closely connected to standardization of products.

Korea did not have any standards, but the Bureau of Standardization was established in the Ministry of Commerce and Industry shortly after the 5.16 Revolution, and about 300 national standards were enacted and proclaimed just one year later. This helped Korean products gain credibility around the world.

Thanks to standardization and quality control, problems resulting from lack of information, wastage, and unfair practices were solved, and new Korean products appeared. Shoddy domestic goods and foreign products disappeared from the Korean market and distribution order was established. The nation's international credibility was enhanced and big progress was made in pioneering new markets.

Before standards were established, no promotional materials on Korean products contained specific standards, but after the enactment of the standards, goods were produced and traded according to Korean industrial Standards.

The government designated 1963, the second year of the 1st 5-year economic development plan, as "the Year of Export Promotion" or "the Export-First Year," and it was focusing on promoting exports.

From this, it is easy to assume that establishing industrial standardization was the key to securing standards for exports and high-quality products to fulfill the national goal.

4.5.2. Pan-National Standardization

Standardization of industrial goods not only increases production efficiency, but also makes transactions simple and fair. By doing this, it establishes distribution order and enhances the nation's competitiveness in the global market.

However, before the industrial standards were set up, industrial standardization was virtually ignored, and this caused confusion and waste in all production and transactions. Also, the complicated and unfair distribution order made it difficult to enter the international market.

Moreover, the year 1963, "the Export-First Year," was when the government was concentrating all its efforts on exports, and thus, industrial standardization was a very urgent national project. This was because the inexpensive yet high-quality products, which were capable of competing with foreign products in the global market, were closely related to standardization of products.

This standardization project was carried out by the Ministry of Commerce and Industry, but in reality, it was a government project pushed forward under the premise of pan-national cooperation. Therefore, this project could not be successfully implemented overnight, and rather, it required continuous efforts and research, and the government had to take the lead. In actuality, however, it is safe to say that this project could succeed because of active participation of industries actively and of greater public awareness of this project.

The standardization project is the basis of industrialization. For that reason, it is possible to minimize trial and error and firmly establish standardization only when the government and all the interested parties actively join this project.

5. Conclusions

5.1. Standards are the Base for Economic Development[6]

Walt Whitman, an American poet, said, “A vast similitude interlocks all.” He did not refer to standards, but the phrase defines the characteristics of standards. A vast similitude here means standards, such as numbers, weight, units, measurement systems, alphabet, currency, mathematical symbols, which are common to us all. These standards make communication and transactions among parties smoother.

Adam Smith pointed it out that economic power stemming from trade (transactions) offered opportunities in the division of labor and this enhanced productivity greatly.[7] Standards that are used for measurement, production, currency, and communication provide clear definitions that make economic activities possible, and by using these standards, it becomes possible to expand the division of labor, and increase productivity, and obtain economic growth. Technical standards serve as the foundation, and because of this, changes, developments and economic revolution began in human history.

5.2. New Understanding of Standardization

Today, the most pressing issue is to improve the quality and productivity of goods to enhance international competitiveness. In that sense, it is necessary to consider the significance of standards again.

The general public tends to think that KS-marked products are the only standards, but standards apply to broad areas. Thus, it is important to define the true meaning of standards.

The application of standards ranges f///’’/rom the international among countries to individual nations, industries, and enterprises.

Standardization can be classified in three ways: first, the components, characteristics and shapes of products; second, the production process and testing methods; and finally, communication needed for trade and industrial activities.

6. Ken Krechmer, *the Fundamental Nature of Standards, Economics Perspective: the International Journal. A. Schumpeter Society Economics Conference*, University of Colorado at Boulder, June, 2000.
7. Smith, Adam, The Wealth of Nations, Fifth edition, Random House, 1937

In the modern industrial society, standardization eliminates lack of definition that may occur during trade and industrial activities, while it increases productivity and quality of goods. Imagine how inefficient it might be if there is no standards for international trade. If engineers use different types of signs and measurements when designing products, it would result in great inefficiencies and disorder.

For example, if the KS standard did not exist, all the product components, characteristics and shapes must be specifically described, which causes unnecessary waste of time, materials, and costs. And even if the same raw materials were used to make a product at the same factory, the same type of quality cannot be achieved by different workers.

From these examples, we can understand how important it is to establish standards in trade and industrial activities. Continued efforts should be given to setting up standards in developing countries as well. As an industrial structure is upgraded, quantities of products and information will increase and become more complicated. To deal with such diversity, complexity and a sharp increase in quantities, establishing standards is imperative.

To achieve continuous economic growth, it is encouraged to actively invest in equipment. Even if we are equipped with manufacturing facilities, our international competitiveness will not increase if the quality of our products is lower than that of our competitors. We put emphasis on working hard, but working hard is not necessarily connected to the improvement of our international competitiveness. To improve quality and productivity of products, we must work efficiently and reasonably.

In other words, investing money and equipment and working hard are not sufficient conditions for revitalizing the economies of developing countries. Rather, standardization and quality management should be added to boost productivity, quality and international competitiveness.

In this study, we define the true meaning of standards in an attempt to lay the foundation for economic growth of developing countries. By enthusiastically conducting practical standardization activities, it is possible to solve economic difficulties and enhance the international competitiveness of developing nations.

People may think that experts on standards are all that is needed to establish standards, but this is not true. For a country's national sports team to play at the international level, it requires not only players but also the sports-related infrastructure.

The more we understand standardization, the quicker we can introduce and set up standards. For that reason, it is necessary to train experts on standardization, nurture government-led leadership, promote standardization in society, and pursue internationalization.

5.3. Technical and Economic Effects of Standards

Standardization is a method of codifying techniques that are suitable for the times. Standards make communication easier among parties and reduce costs by eliminating the possibility of misunderstanding. For example, in the textile and painting industries, it is possible to communicate more clearly by setting up standards on numbers and color. Moreover, standards can play a role of providing information, thereby possibly reducing searching and measurement costs. From this point of view, standards are considered to be bundles of information.

Interchangeability may be the biggest effect gained from establishing standards. There are two meanings behind interchangeability: one is interchangeability in shape and measurement, and the other is compatibility in performance and function. The former makes the economies of scale possible through innovation of the production process. As the result, it brings a reduction in production costs and error rates, facilitates the development of new technology, and increases sales.

The latter explanation of compatibility increases the external effects of networks. This means that as the number of users increases, effectiveness from the use of the product increases as well. For example, if new software for computer CPUs or the Internet is developed, it will have effects on all related parties including regular users. This is why related semiconductor and software manufacturers witness an increase in their sales when Microsoft releases a new OS version.

Standards also perform a function of accelerating technological innovations. Once a standard is formulated and established, it can bring enormous profits to a corporation, and therefore, companies put much emphasis on acquiring standards by developing new technologies. This phenomenon prominently appears in the electrical and electronic fields and also in the communications sector.

Standards for product quality control, environment, safety, and health improve convenience and quality of our lives. This shows that standards have the characteristics of public property, implying that they play an important role in obtaining social goals.

Because the global economy is under the control of the WTO today, standards are an integral part of facilitating international trade. A report prepared by the World Bank in 2002 says that standard barriers are higher than tariff barriers in world trade. Also, an OECD report estimates that 2 to 10% of the price of a final product is used to satisfy the standards.

In the case of Korea, its national standardization policy has focused on fostering industries since the KS system was adopted in 1962, and thus, the country has lacked a standardization policy for the people. Most of about 23,000 KS standards were established to develop industries, rather than to improve living standards. At the initial stage of establishing standards, it was not easy to set up standards due to different views between administrative agencies and interests of related enterprises. However, while undergoing trial and error, the government-led industrial standardization policy was able to bear fruit thanks to various to promote and induce participation among enterprises and citizens.

Hence, when a developing country pushes forward with industrial standardization, government-led standardization is needed at the initial stage, while improving the quality of living standards is set as the ultimate goal of standardization. Therefore, the nation requires a complementary policy that actively encourages companies and citizens to participate in establishing standards. The government should establish an Industrial Standardization center, which operates under the government, and works closely with private professional organizations from academia and industry exchanging information. The government also needs to make an effort to adapt to the changes in the global environment. Moreover, establishing an incentive system is considered to be a practical way for promoting the adoption of Industrial Standardization. The government must set a long-term plan and continuously promote it.

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I. Industrial Standardization

1. Conformity of KS to International Standards

(Unit: type)

Classification / Year	KS Possession	International Standards Applied to KS (A)	Results of Correspondence			Not Equal (NEQ)	Ratio of Correspondence (%, B/A)
			Total (B)	Identification (IDT)	Modification (MOD)		
2001	12,006	5,469	3,453	2,378	1,075	2,016	63.1
2002	15,176	7,515	7,048	5,520	1,528	467	93.8
2003	18,014	9,856	9,784	8,227	1,557	72	99.3
2004	19,865	11,535	11,488	10,073	1,415	47	99.6
2005	21,251	12,691	12,669	11,262	1,407	22	99.8
2006	22,058	12,978	12,965	11,623	1,342	13	99.9
2007	22,760	13,969	13,957	12,714	1,243	12	99.9
2008	23,062	14,171	14,160	12,937	1,223	11	99.9
2009	23,372	14,675	14,661	13,397	1,264	14	99.9
2010.9	23,415	14,607	14,577	13,324	1,253	22	99.8

2. Access to KS Internet by Year*

(Unit: case)

Field \ Year · Section	Holding Number of KS (Number)	KS Internet Free Reading Numbers by Year				
		2006	2007	2008	2009	2010.9
Basic (A)	717	157,859	266,411	511,815	145,988	91,682
Machine (B)	4,098	392,168	610,520	1,089,017	542,733	395,529
Electronic (C)	3,694	246,383	347,659	669,144	342,653	236,473
Metal (D)	1,641	224,318	288,299	461,908	296,389	224,994
Mine (E)	447	15,970	22,757	39,119	19,190	12,596
Construction (F)	851	253,332	309,750	501,993	293,205	234,632
Commodity (G)	370	27,355	49,298	92,390	46,238	25,615
Food (H)	498	21,860	50,498	99,984	38,031	25,529
Environment (I)	638	0	0	0	34,361	23,477
Biology (J)	68	0	0	0	6,210	3,132
Textile (K)	863	61,826	78,118	117,114	63,132	46,530
Ceramic (L)	479	61,130	76,608	121,054	76,153	57,915
Chemistry (M)	3,445	318,370	401,317	624,959	295,325	219,718
Medicine (P)	693	29,706	52,880	91,741	38,866	32,804
Quality Management (Q)	111	0	0	0	20,245	17,336
Transportation (R)	1,065	49,356	70,889	113,431	58,603	39,403
Service (S)	108	0	0	46,693	17,028	9,245
Logistics (T)	304	0	0	0	33,244	18,203
Shipbuilding (V)	834	35,297	50,084	82,566	36,858	25,037
Aerospace (W)	521	16,783	23,621	32,427	18,358	12,344
Information (X)	1,927	76,890	119,717	219,678	86,188	53,140
Total (Growth from the Previous Year)	23,372	1,988,603	2,818,426 (41.7%)	4,915,033 (74.4%)	2,508,998 (-49.0%)	1,805,334 (-6.42%)

* After the Internet was launched by the Agency for Technology and Standards, KSSN (www.standard.go.kr), MOUs were concluded with Naver ('06.1.2), Empas ('06.8.1), Nate ('07.6.18) and Korean Institute of Science and Technology Information ('07.10.5) to permit access to the Internet.

3. Internet Search of International Standards by Year (ISO/IEC)

Division / International Body	Total Number of Standards ('08.12)	Number of Search					
		2005	2006	2007	2008	2009	2010.9
ISO	17,765	234,746	154,943	113,725	69,659	32,094	20,441
IEC	6,027	143,479	36,370	144,600	32,847	17,652	10,445

Note: 1. Numbers are based on the international standard search results using the Agency for Technology and Standards, KSSN (www.standard.go.kr).

2. This search covers the standard number, standard name and the abstract (Free access to the original text is not allowed).

* The subtotal of ISO/IEC standards is based on the annual report of each organization.

4. Unification of Government Standards*

Administrative Institution	Target of Unification	2003~07	2008		2009		
		Performance (Cumulative)	Target	Performance (Cumulative)	Target	Performance (Cumulative)	Not Unified
The Ministry of Education, Science, and Technology	1	1	0	1	0	1	0
Ministry of Culture, Sports and Tourism	1	0	1	0	1	1	0
Ministry of Food, Agriculture, Forestry and Fisheries	13	5	8	8	5	8	5
The Forest Service	12	9	3	9	3	12	0
Rural Development Administration	94	92	2	92	2	94	0
Ministry of Knowledge Economy	223	197	26	214	9	216	7
The Small and medium Business Administration	1	0	1	0	1	1	0
The Ministry of Health, Welfare and Family	27	26	1	26	1	27	0
Korea Food & Drug Administration	94	74	20	89	5	94	0
Ministry of Labor	31	10	21	31	0	31	0
Ministry of Environment	41	18	23	23	8	35	6
The National Weather Service	1	1	0	1	0	1	0

Administrative Institution	Target of Unification	2003~07	2008		2009		
		Performance (Cumulative)	Target	Performance (Cumulative)	Target	Performance (Cumulative)	Not Unified
The Ministry of Land, Transport and Maritime	84	50	34	77	7	84	0
The National Maritime Police Agency	4	3	1	3	1	3	1
Public Procurement Service	111	94	17	111	0	111	0
Safeguard Agency	1,844	1,841	3	1,844	0	1,844	0
The National Police Agency	152	84	68	84	68	85	67
Firefighting Agency	40	29	11	29	11	40	0
Communications Commission	59	30	29	31	28	59	0
Total	2,833	2,564(184)	269	2,673(109)	150	2,747	86

* Government Standards mean technological standards that are established by each government organization based on individual legislations. Unification of government standards means making governmental technology terms, units and methods of examination equal to the KS standards.

5. Excellent Group Standards

(Unit: Number)

Division		2002	2003	2004	2005	2006	2007	2008	2009	2010.9
Excellent Organization for Group Standards	Newly Designated	3	1	2	0	1	0	0	0	0
	Cumulative	10	11	13	13	14	14	14	15	14
Number of Items Recognized as Group Standards		76	77	82	84	91	94	94	1	85

6. Industry Standard Council

6-1. Technology Commissions under the Industry Standard Council

(Unit: person)

Name of Technology Commission	Number of Members		Location of Workplace (Commissioned Member)			Gender (Commissioned Member)		Human Composition			
	Total	Commissioned Member	Committee Member	Capital Area	Provincial Area	Male	Female	Business Circle	Academia	Research Institute /Organization	Others
Total Technology Commission	543 (482)	470 (413)	73 (69)	372 (322)	98 (91)	383 (333)	87 (80)	102 (95)	241 (209)	185 (164)	15 (14)
Leather and Commodity Technology Commission	10	8	2	8	0	6	2	2	2	6	0
Architecture Technology Commission	9	6	3	5	1	4	2	3	3	2	1
Measurement Technology Commission	9	7	2	6	1	5	2	2	2	5	0
Rubber Technology Commission	10	9	1	5	4	7	2	4	3	3	0
Mold Technology Commission	8	6	2	6	0	6	0	0	4	4	0
Industrial Chemical Technology Commission	10	9	1	9	0	7	2	3	5	2	0
Machine Tool Technology Commission	9	8	1	4	4	7	1	4	2	3	0
International Technology Commission	8	8	0	5	3	7	1	1	5	2	0
Basic Machine Technology Commission	11	10	1	7	3	8	1	2	4	4	1
Machine Part Technology Commission	13	13	0	10	3	13	0	5	6	2	0
Basic Technology Commission	6	6	0	6	0	5	1	0	6	0	0
Agricultural Machine Technology Commission	10	7	3	6	1	5	2	2	3	1	4
Paint and Ink Technology Commission	10	8	2	7	1	6	2	5	3	2	0
Culture Technology Commission	9	8	1	8	0	7	2	1	4	4	0
Distribution Technology Commission	12	8	4	8	0	6	2	1	4	6	1
Welfare Technology Commission	11	10	1	9	1	8	2	0	3	7	0

Name of Technology Commission	Number of Members		Location of Workplace (Commissioned Member)		Gender (Commissioned Member)		Human Composition				
	Total	Commissioned Member	Committee Member	Capital Area	Provincial Area	Male	Female	Business Circle	Academia	Research Institute /Organization	Others
Analysis Technology Commission	10	10	0	6	4	8	2	4	4	2	0
Metal Technology Commission	11	11	0	8	3	11	0	5	3	3	0
Society Business System Technology Commission	10	9	1	9	0	9	0	2	5	2	0
Industrial Textile echnology Commission	11	8	3	6	2	6	2	0	5	5	1
Industrial Automation Technology Commission	9	8	1	7	1	7	1	1	6	2	0
Industrial Electronic Technology Commission	11	9	2	8	1	6	3	0	8	3	0
Industrial Biology Technology Commission	9	9	0	4	5	7	2	1	5	3	0
Service Technology Commission	9	9	0	9	0	7	2	1	3	5	0
Petroleum Product Technology Commission	7	5	2	4	1	4	1	2	1	4	0
Textile Product Technology Commission	11	8	3	7	1	7	1	2	5	3	1
Transportation Equipment Technology Commission	10	8	2	6	2	7	1	2	5	3	0
Food Technology Commission	10	8	2	7	1	4	4	2	5	2	1
Energy Technology Commission	13	9	4	6	3	8	1	3	6	4	0
Energy System Technology Commission	11	9	2	8	1	8	1	0	4	7	0
Ceramic Technology Commission	10	9	1	9	0	7	2	3	3	4	0
Nuclear Energy Technology Commission	11	8	3	6	2	6	2	1	6	4	0
Medical Appliances Technology Commission	11	10	1	9	1	8	2	1	8	1	1
General Industry machine Technology Commission	11	11	0	11	0	10	1	2	5	4	0
Resource Technology Commission	9	8	1	4	4	7	1	2	2	5	0

Name of Technology Commission	Number of Members		Location of Workplace (Commissioned Member)			Gender (Commissioned Member)		Human Composition			
	Total	Commissioned Member	Committee Member	Capital Area	Provincial Area	Male	Female	Business Circle	Academia	Research Institute /Organization	Others
Electricity Application Technology Commission	13	10	3	6	4	8	2	0	7	2	0
Electronic Material Technology Commission	10	9	1	8	1	7	2	1	7	2	0
Electronic Equipment Technology Commission	10	6	4	5	1	4	2	3	4	3	0
Electronic Component Technology Commission	10	9	1	9	0	8	1	0	6	4	0
Precision Instrument Technology Commission	9	7	2	4	3	5	2	0	6	3	0
Fine Chemistry Technology Commission	10	9	1	7	2	6	3	2	4	4	0
Information Technology Commission	10	10	0	9	1	6	4	2	8	0	0
Information Industry Technology Commission	7	7	0	5	2	5	2	0	6	1	0
Paper Technology Commission	9	7	2	3	4	6	1	2	5	2	0
Shipbuilding Technology Commission	12	11	1	5	6	10	1	0	2	9	1
Steel Product Technology Commission	13	12	1	8	4	11	1	7	3	3	0
Civil Technology Commission	11	9	2	7	2	7	2	5	3	3	0
Plastic Technology Commission	10	9	1	7	2	7	2	2	4	4	0
Aerospace Technology Commission	11	9	2	5	4	8	1	1	4	3	3
Environment Technology Commission	11	11	0	8	3	9	2	1	6	4	0
e-Business Technology Commission	10	10	0	7	3	7	3	2	5	3	0
Standard Conference	28	28	0	26	2	25	3	4	13	11	0

Note: ( ) is the number of members who are not overlapped.

6-2. Specialized Commissions under Each Technology Commission

Technology Commission	Number of Specialized Commissions	Number of Commission Members
52 Technology Commissions	469	5,374
Leather and Commodity Technology Commission	8	82
Architecture Technology Commission	9	113
Measurement Technology Commission	9	90
Rubber Technology Commission	5	53
Mold Technology Commission	2	19
Industrial Chemical Technology Commission	3	29
Machine Tool Technology Commission	3	37
International Technology Commission	3	28
Basic Machine Technology Commission	6	94
Machine Part Technology Commission	18	195
Basic Technology Commission	9	93
Agricultural Machine Technology Commission	2	26
Paint and Ink Technology Commission	8	63
Culture Technology Commission	2	17
Distribution Technology Commission	11	142
Welfare Technology Commission	3	42
Analysis Technology Commission	5	71
Metal Technology commission	13	117
Society Business System Technology Commission	6	77
Industrial Textile Technology Commission	5	45
Industrial Automation Technology Commission	5	70
Industrial Electronic Technology Commission	26	302
Industrial Technology Commission	1	9
Industrial Biology Technology Commission	2	15
Service Technology Commission	7	86
Petroleum Product Technology Commission	1	10
Textile Product Technology Commission	5	48
Transportation Equipment Technology Commission	17	158
Food Technology Commission	4	20
Energy Technology Commission	12	160
Energy System Technology Commission	12	133

Technology Commission	Number of Specialized Commissions	Number of Commission Members
Ceramic Technology Commission	14	144
Nuclear Energy Technology Commission	6	76
Medical Appliance Technology Commission	16	156
General Industry Machine Technology Commission	30	354
Resource Technology Commission	7	56
Electricity Application Technology Commission	26	288
Electronic Material Technology Commission	5	60
Electronic Equipment Technology Commission	14	190
Electronic Component Technology Commission	6	96
Precision Instrument Technology Commission	5	40
Fine Chemistry Technology Commission	5	56
Information Technology Commission	14	219
Information Industry Technology Commission	20	291
Paper Technology Commission	2	20
Shipbuilding Technology Commission	16	206
Steel Product Technology Commission	13	114
Civil Technology Commission	4	50
Plastic Technology Commission	14	152
Aerospace Technology Commission	3	23
Environment Technology Commission	14	131
E-Business Technology Commission	13	208

6-3. Performance of the Industrial Standard Council by Year

(Unit: Case, Person)

Division	2007			2008			2009			2010. 9		
	Held	Deliberation	Attendance	Held	Deliberation	Attendance	Held	Deliberation	Attendance	Held	Deliberation	Attendance
Technology Commission	547	6,708	3,141	378	5,755	2,701	442	4,918	3,151	125	1,049	949
Specialized Commission	443	2,046	2,999	314	1,490	2,764	395	2,502	3,359	268	932	2,194
Total	990	8,754	6,140	692	7,245	5,465	837	7,420	6,510	393	1,981	3,143

7. KS Standard Sales (Sales at the Korean Standards Association)

7-1. Standard Sales by Year

(Unit: 1,000 Won)

Division	KS(Ratio)	Foreign Standards (Ratio)	Total
2002	1,774,822(46.8)	2,015,841(53.2)	3,790,663
2003	2,031,698(55.5)	1,631,746(44.5)	3,663,444
2004	2,334,100(55.1)	1,902,675(44.9)	4,236,775
2005	2,282,318(55.5)	1,826,675(44.5)	4,108,993
2006	2,456,261(53.5)	2,132,572(46.5)	4,588,833
2007	2,407,411(47.6)	2,654,087(52.4)	5,061,498
2008	2,541,573(45.5)	3,049,424(54.5)	5,590,997
2009	2,706,387(43.0)	3,587,509(57.0)	6,293,896
2010.9	2,044,582(38.2)	3,302,168(61.8)	5,346,749

※ Renewal Cycle: Half-yearly, Source: Korean Standards Association.

7-2. Sales by Purchase Type

(Unit: 1,000 Won, Number)

Division	Printed Media		Electronic Media		
Method of Sales	Individual Standards(I)	Handbook	Individual Standards(II) Electronic Files Provided)	Internet Service*	CD-ROM
Amount of Sales(Number of Sales)	28,182 (2,992)	350,147 (1972)	323,691 (36,522)	1,110,456 (111)	232,106 (51)
Total (Amount)	378,329		1,666,253		

* The amount of sales is decided based on "Web Service Periods.".

※ Renewal Cycle: Half-yearly.

Source: Korean Standards Association.

7-3. Sales by Industrial Field*

(Unit : 1,000 Won)

Division	Basic (A)	Machine (B)	Electronic (C)	Metal (D)	Mine (E)	Construction (F)	Commodity (G)	Food (H)	Environ ment(I)	Biology (J)	Textile (K)
Amount of Sales (Number of Sales)	17,435 (1,580)	50,013 (5,120)	90,464 (7,029)	42,982 (5,308)	1,097 (161)	34,039 (5,457)	2,846 (396)	1,452 (318)	11,368 (931)	428 (44)	5,067 (913)

Division	Ceramic (L)	Chemistry (M)	Medical (P)	Quality Management (Q)	Transpo rtation (R)	Service (S)	Logistics (T)	Shipbuil ding(V)	Aerospace (W)	Information (X)	Total (I+II)
Amount of Sales (Number of Sales)	9,836 (1,590)	41,351 (5,325)	4,699 (516)	35,330 (2,370)	5,737 (757)	2,450 (346)	3,362 (588)	1,015 (150)	557 (69)	9,873 (546)	371,400 (39,514)

II. The Current State of Korea Standard (KS) Certification

1. Criteria for KS Evaluation

1-1. Number of KS Judging Standards by Year

(Unit: Number)

Year	Announcement by Year			Number of Judging Standards(End of Year)
	Enactment	Revision	Revocation	
1975	121	-	-	522
1980	81	-	-	907
1985	71	-	10	1,124
1986	215	-	27	1,312
1987	356	-	5	1,663
1988	272	-	27	1,908
1989	167	264	4	2,071
1990	83	207	22	2,132
1991	50	94	10	2,172
1992	25	173	23	2,174
1993	17	58	10	2,181
1994	30	293	5	2,206
1995	27	118	6	2,227
1996	25	53	17	2,235
1997	17	87	47	2,205
1998	33	139	18	2,220
1999	18	864	475	1,763
2000	22	243	2	1,783
2001	23	121	56	1,750
2002	15	80	60	1,705
2003	33	137	137	1,601
2004	10	161	226	1,385
2005	4	154	67	1,322
2006	30	93	18	1,334
2007	34	44	57	1,311
2008	51	67	17	1,345
2009	43	131	12	1,376
2010. 9	6	38	16	1,366

1-2. Number of KS Judging Standards by Field

(Unit: Number)

Field \ Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010.9
Basic (A)	64	60	60	47	48	48	48	46	44	33	33	33	33	3	3
Machine (B)	360	358	362	251	254	254	250	258	235	234	242	242	242	241	239
Electronic (C)	376	365	369	371	372	330	289	265	235	223	225	228	229	237	239
Metal (D)	206	206	208	158	161	162	162	161	159	159	160	161	165	169	162
Mine (E)	26	27	27	15	15	14	14	14	8	8	8	8	8	6	6
Construction (F)	153	134	122	110	117	118	123	121	123	124	129	128	133	136	137
Commodity (G)	185	185	184	80	80	77	77	75	73	68	68	52	52	47	47
Food (H)	69	72	76	81	82	86	89	91	94	94	94	117	147	157	160
Environment (I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biology (J)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Textile (K)	60	61	66	65	67	71	71	72	28	28	28	28	28	28	28
Ceramic (L)	92	90	90	91	91	94	89	89	73	65	65	65	66	66	66
Chemistry (M)	409	408	415	410	411	412	412	332	247	220	216	184	184	193	191
Medical (P)	57	56	56	13	13	13	13	9	9	9	9	9	14	14	13
Quality Management (Q)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation (R)	110	110	111	56	57	59	55	55	44	44	44	43	29	28	27
Service (S)	0	0	0	0	0	0	0	0	0	0	0	0	2	6	7
Logistics (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	31	27
Shipbuilding (V)	59	59	59	0	0	0	0	0	0	0	0	0	0	0	0
Aerospace (W)	9	9	10	10	10	7	7	7	7	7	7	7	7	7	7
Information (X)	0	5	5	5	5	5	6	6	6	6	6	6	6	6	6
Total	2,235	2,205	2,220	1,763	1,783	1,750	1,705	1,601	1,385	1,322	1,334	1,311	1,345	1,376	1,366

2. KS Certification and Identification

2-1. KS Certification and Identification by Year

(Unit: Number, Case)

Division / Year	Number of KS Certified Products	Number of KS Certified Factories	Total Number of KS Certifications
1970	145	269	457
1975	266	338	1,100
1980	395	665	1,851
1985	597	1,513	2,450
1990	951	2,951	7,888
1991	966	3,312	8,405
1992	955	3,569	8,683
1993	967	3,947	9,437
1994	977	4,245	10,069
1995	973	4,343	10,199
1996	985	4,529	10,641
1997	999	4,715	11,172
1998	1,016	4,981	11,856
1999	1,022	5,336	12,345
2000	1,013	5,498	12,687
2001	1,006	5,627	12,885
2002	1,000	5,834	12,484
2003	950	5,811	10,174
2004	924	6,015	10,154
2005	901	6,149	10,227
2006	885	6,127	10,043
2007	877	6,112	10,027
2008	865	6,054	9,856
2009	849	6,063	9,820
2010. 9	831	6,120	9,923

2-2. KS Certification and Identification by Field

(Unit: Number)

Year / Field	2006			2007			2008			2009			2010.9		
	Product	Factory*	Certification	Product	Factory*	Certification	Product	Factory*	Certification	Product	Factory*	Attendance	Product	Factory*	Certification
Basic (A)	16	59	80	16	57	76	16	52	70	8	21	24	7	17	19
Machine (B)	144	602	973	146	591	959	144	562	919	139	562	900	133	568	905
Electronic (C)	170	987	2,158	163	984	2,144	162	975	2,098	154	976	2,099	155	1,010	2,177
Metal (D)	116	747	1,174	114	756	1,200	115	730	1,156	112	741	1,194	114	754	1,223
Mine (E)	5	10	11	5	10	11	5	9	10	4	9	9	4	11	11
Construction (F)	108	2,591	3,290	110	2,604	3,310	109	2,604	3,302	111	2,588	3,284	111	2,604	3,310
Commodity (G)	46	182	212	46	179	211	43	178	207	41	171	194	36	165	183
Food (H)	36	78	122	37	72	120	39	96	145	39	101	150	26	68	89
Environment (I)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biology (J)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textile (K)	14	20	25	14	19	24	12	18	23	12	17	22	12	17	22
Ceramic (L)	51	505	654	51	506	668	50	505	691	49	518	712	49	522	730
Chemistry (M)	137	644	1,264	135	621	1,231	131	591	1,161	128	578	1,107	131	588	1,115
Medical (P)	8	10	14	8	10	14	8	8	12	8	8	12	8	8	12
Quality Management (Q)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation (R)	27	46	57	25	40	50	23	37	44	21	28	32	20	28	32
Service (S)	0	0	0	0	0	0	1	9	9	4	34	34	6	46	47
Logistics (T)	0	0	0	0	0	0	0	0	0	12	29	38	12	30	39
Shipbuilding (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aerospace (W)	7	2	9	7	2	9	7	2	9	7	2	9	7	2	9
Information (X)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	885	6,483	10,043	877	6,451	10,027	865	6,376	9,856	849	6,383	9,820	831	6,438	9,923

* Overlapped counting was allowed.
* Some items were counted redundantly due to the change in the numbers of the Korean Industrial Standards.

3. Number of KS Certified Factories by Firm Size

(Unit: Number)

Year / Division / Firm Size	2006		2007		2008		2009		2010.9	
	Number of Factories	Composition Ratio (%)	Number of Factories	Composition Ratio (%)	Number of Factories	Composition Ratio (%)	Number of Factories	Composition Ratio (%)	Number of Factories	Composition Ratio (%)
Over 300 Employees (Major Company)	231	3.8	246	4.0	253	4.2	219	3.7	229	3.8
Below 300 Employees (Small Company)	5,896	96.2	5,866	96.0	5,801	95.8	5,743	96.3	5,823	96.2
Total	6,127	100	6,112	100	6,054	100	5,962*	100	6,052*	100

* The overlapped factories and the factories in the food sector were excluded from the number of factories (6,383) in "2-B".

4. KS Certified Factories by Area

(Unit: Number)

Area	2003	2004	2005	2006	2007	2008	2009	2010.9
Seoul	106	104	93	84	84	86	104	103
Busan	258	266	265	262	248	233	229	229
Daegu	170	177	174	406	393	146	145	141
Incheon	416	418	424	161	154	388	374	372
Gwangju	69	68	65	61	61	65	62	65
Daejeon	77	81	83	75	71	70	69	70
Ulsan	117	119	115	113	112	103	95	95
Gyeonggi	1,715	1,781	1,835	1,822	1,815	1,801	1,781	1,830
Gangwon	260	277	283	295	290	290	280	280
Chungbuk	377	390	390	393	406	413	411	420
Chungnam	455	472	491	489	492	489	478	498
Jeonbuk	289	297	305	309	308	296	286	289
Jeonnam	321	318	330	331	331	333	319	316
ueongbuk	498	519	539	540	551	539	546	562
Gueongnam	524	543	544	542	542	526	494	482
Jeju	71	73	70	69	65	72	72	74
Overseas	88	112	143	175	189	204	217	226
Total	5,811	6,015	6,149	6,127	6,112	6,054	5,962*	6,052*

5. KS Certified Enterprises Overseas by Year

Country	Item Number	Factory Number	'91~ '01	2002	2003	2004	2005	2006	2007	2008	2009	2010. 9
China	102	192	16	11	10	13	23	42	28	25	22	15
Hungary	1	1	-	-	-	-	-	1	-	-	-	-
India	3	3	1	1	-	-	1	-	-	-	-	-
Japan	7	22	1	1	-	2	3	-	-	1	6	8
Cambodia	2	1	-	-	-	-	-	-	-	-	1	-
North Korea	2	1	-	-	-	-	-	-	-	1	-	-
Thailand	3	2	2	-	-	-	1	-	-	-	-	-
Vietnam	4	3	-	-	-	-	-	1	-	-	2	-
Turkey	1	1	-	-	-	-	-	-	-	-	1	-
Taiwan	1	1	-	-	-	-	-	-	-	-	-	1
Switzerland	1	1	-	-	-	-	-	-	-	-	-	1
11 Countries	125*	228	20	13	10	15	28	44	28	27	32	25

* The actual number of the items of certified factories overseas is 125 in total, which does not match the total number of items certified overseas. This is because the certified items are overlapped for each country.

Chapter 02-2

Quality Management

<Summary>

It was after the construction of factories in key industries with the U. S. aid after the Korean War that a system for Quality Management was introduced in Korea first. In 1955, the ‘Chungju Fertilization Plant’ was constructed with foreign assistance from the International Cooperative Alliance (ICA), and in the process, knowledge on Quality Management was acquired from U. S. engineers who constructed the plant.[8]

Then, the technology for Quality Management was partially acquired along with the construction of the factory, and introduction of technology and training on Quality Management. At the time, however, there were no books on Quality Management written in or translated in the Korean language. One of the first books on “Quality Management” was a mimeograph of a Japanese version published by the Korea Standard Specification Association (Currently Korea Standards Association) in December 1962. The book contributed to the promotion of Quality Management theory in Korea.

Also, the “Industrial Standard Screening Committee” was founded within the Ministry of Commerce and Industry in 1962, and the KPC and Korea Standard Specification Association provided training and education on Quality Management with Korean instructors. As such, Quality Management was distributed to Korean industries in full scale.

8. Na Chang-Soo, “Status and Direction of Quality Management System”, Quality Management, Vol. 7-2, April 1972

In 1965, the Society of Korean Quality Management was founded, and it published the Expository Glossary of Quality Management Terminologies and QC (Quality Control) Education materials. In 1966, many organizations including the Korea Standard Specification Association organized long-term and short-term QC training seminars. On the other hand, in 1970, the Society of Korean Quality Management held the 'National QC Circle Conference' for the first time, and the conference helped many corporations introduce QC circle activities.

Quality Management was systematically established in Korea ever since products began to be standardized nationally. In the 1960's, Quality Management was able to develop in terms of size thanks to the government's standardization initiatives. Korean industries gradually started to recognize the need for improving quality management on the back of the activities of the Society of Korean Quality Management which was founded in 1966. However, it was after the middle of 1970's, when improving the quality of products was deemed critical to growing Korean exports. It was then that manufacturers recognized the importance of ensuring quality and turned their attention on Quality Management. Accordingly, Korean manufacturers can be said to have started implementing QC from the later part of the 1970's. The history of the standardization and Quality Management efforts during the initial stages of economic development are as follows:

- 1961 Enacted the Industrial Standardization Act
- 1963 Implemented the Korean Standard (KS) mark system
- 1967 Enacted the Industrial Product Quality Management Act and implemented the quality mark system
- 1973 Founded the Industrial Promotion Administration and implemented Standardization and QC services
- 1975 Established the Practical Quality Management Division, implemented industry-wide QC activities and established the Quality Management Grand Prix.
- 1981 Implemented the Grade System for factory Quality Management
- 1983 Constructed the Quality Management Training Institute and implemented the Quality Management Diagnosis System
- 1992 Converted the QC Movements to the Quality Management (QM) Movement and implement
- 1993 Implemented a domestic certification system for International Standardization Organization (ISO 9000)
- 1995[9] Introduced the 100PPM Quality Innovation Movement Division, and implemented a certification system
- 2000 Converted the 100PPM Quality Innovation Movement to Single PPM Quality Innovation Movement and implemented it

9. PPM: Part Per Million

In this paper, the ‘100PPM Quality Innovation Movement (Currently the ‘Single PPM Quality Innovation Movement)’ will be discussed, among Korea’s initiatives on quality management, led by the government Then, its implications will be summarized. We can say that the Single PPM Quality Innovation Movement, which was implemented in 1995 by the Single PPM Quality Innovation Implementation Institution in the Korea Chamber of Commerce and Industry is an independent quality management system through which advanced overseas quality management systems were developed to fit Korea’s context.

1. Quality Management and the Background of the Introduction of Single PPM

From 1963, the implementation of the Quality Control System was required under the screening requirements of the Korean Standard (KS) mark factory license system, which based on the Industrial Standardization Act. It played an important role in the distribution and diffusion of Quality Control in Korea. The Quality Inspection System was introduced for certain items before the products were shipped to prevent the distribution of poor quality products by enacting “the Industrial Product Quality Control Act” in 1967. Also, the “Factory Quality Control Grade System” was introduced in 1981 to implement the “Quality” Marking System for products manufactured by factories that relied on the Quality Control System. Thanks to the introduction of the two systems, a national Quality Control System was established led by the government to some extent. It also offered a way to diffuse and distribute the systems KSA held including “the 1st National Standardization and Quality Control Contest (the Ministry of Commerce and Industry, Industrial Promotion Administration-1975).” Furthermore, awards for Quality Control and Quality Control Task Division Team Activity Promotion Contest have been given every year up to now.

After having organized ‘the 1st National Quality Control Circle Competition Exhibition” in 1975, KSA held the 36th “2010 National Quality Task Division Team Competition Exhibition” in 2010. Under the slogan of “Powerful Quality Nation Korea,” various quality related awards were given at the 36th National Quality Management Contest (Hosted by the Ministry of Knowledge and Economy and supervised by the Korea Standards Association) on November 23, 2010.

Industrial Standardization and Quality Management contributed greatly to Korea’s industrial development by reorganizing the industrial structure in the early stages amid difficult economic conditions. At the time, Korea’s GNP per capita was approximately 100 US dollars at the beginning of 1960's. These efforts helped to transform Korea from an agricultural country to an industrial country with high added value productivity.

In other words, the implementation of Total Quality Management in Korea promoted 'the growth of manufacturing industry,' the development of national economy. The 20th century is referred as the age of Production, and the 21st century as the age of Quality.[10] As such, Quality Management will continue to be a cornerstone in the Korean economy, making it stand out in the global economy through quality innovation at the top management level down to workers. The Single PPM Quality Innovation Movement, which is positioned in the center of Quality Management, is expected to raise the quality competitiveness of Korea in line with international standards.

1.1. Development of Quality Management

1.1.1. Development Stage of Quality Management

In his book (Total Quality Control, McGraw-Hill, 1986) Feigenbaum of the U. S. explained about the development of Quality Management by describing its development in five stages. Feigenbaum also pointed out that the stages developed over a cycle of approximately 20 years. The five stages are as follows:

① 1st Stage - Age of Operator Quality Control
At the end of the 19th century, a small number of workers controlled the contents of their work by themselves at the manufacturing sites.

② 2nd Stage - Age of Foreman Quality Control
As the economy started to be equipped with modernized production systems at the beginning of the 1900's, foreman or supervisor controlled Quality Control as the organization was divided and division of labor was utilized.

③ 3rd Stage - Age of Inspection Quality Control
On or after World War I, production systems became more complicated and inspection centered on Quality Control, in which inspectors checked the output of workers, was adopted during the 1920's and 1930's.

④ 4th Stage - Age of Statistical Quality Control
Going through World War II, Quality Control Techniques which utilized statistical methods rapidly developed and were distributed centering on war industry. Especially,

10. The Ministry of Commerce, Industry and Resources (Mar. 2005), "Basic Plan for Quality Management" Powerful Quality Country Korea (Q-KOREA), Public Notification of the Ministry of Commerce, Industry and Resources (2005-27 (Mar. 4, 2005))

the Shewhart Control Chart Method and the Dodge and Romig Sampling Inspection Theory were developed as representative methods for statistical quality control.

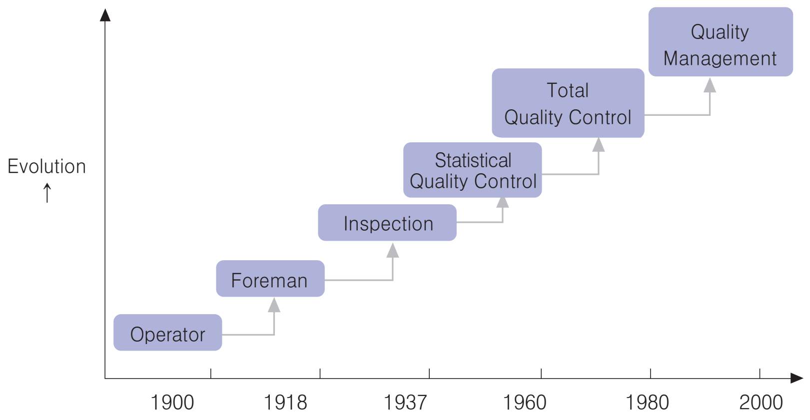
⑤ 5th Stage - Age of Total Quality Control

The quality control which relied on a few methods or a few particular persons was developed to TQC System which satisfies more diversified customers' needs with the participation of all sectors. Especially, TQC was rapidly developed in Japan after the 1960's and started to be structured as Company-wide Quality Control (CWQC), or the so-called Japanese type of Quality Control. The ideas that originated from Japan such as QC Circle, Characteristics Factor Chart, Policy Management, Total Productive Maintenance (TPM), Quality Function Deployment were imported inversely and utilized by the U.S.

As the Japanese economy started to threaten European countries including the U. S. after the 1980s, advanced countries became interested in Japan's TQC, Quality Management System was developed and intensified as the management strategy to enhance quality competitiveness, as western countries faced a more liberalized trade environment under the WTO and increased competition. We can deem these processes as the 6th stage of the development process.

The development process of Quality Management including the five development stages is shown in Figure 2-2-1.

Figure 2-2-1 | Development Stage of Quality Management



Source: Korea Chamber of Commerce and Industry Single PPM quality Innovation Implementation Institution (2000), "Single PPM Quality Innovation Theory and its Implementation Strategy".

1.1.2. World War II and the Development of Quality Control

It was from the time of the outbreak of World War II in 1941 that Quality Control was applied in private industries in full scale. At the time, many problems and tasks emerged during the process of transforming the industrial structure from peacetime to wartime production.

In transforming the industry for wartime production, the following challenges and tasks had to be addressed.

- Required volume of the goods (war supplies) must be supplied at the requested of the customers (military).
- The level of quality of goods, which serves as a critical success factor of the strategy implementation, should be always at a comparative advantage compared to other countries (enemy) A systematic participation of all employees including the executive directors and a continuous improvement of technology is essential for the maintenance of a stable production and competitive product design
- The quality of goods should be uniform. Large disparities or differences could lead to more defected goods and problems in strategy and tactic.
- Time and cost necessary to ensure quality should be managed at the most economic level. It is important to conduct preliminary management before low quality goods are produced, and comprehensive management system for design quality, manufacturing quality and service quality should be established.
- To ensure these management techniques are implemented well as well as customer satisfaction, firm policy and objective on quality should be set by the management while all members of the organization should have a thorough understanding of quality, problem and improvement.

The above contents can be summarized as follows: “The concept of Quality Control” is ‘to produce goods which customers request in an economical manner at a certain level of uniformity and to supply them in time, satisfying customer’s needs as much as possible.’

The process of intensive implementation of research and development resulted in the development process of Quality Control technology, and the basic concept of Quality Control based on these principles, which are still the core of Quality Management and for the basis of Single PPM Quality Innovation activities.

1.1.3. Quality Control of Japan

After defeat in World War II, Japan conducted surveys and studies of the U.S. industry for its own economic revival. In doing so, Japan came to know that many American corporations including the defense industry introduced and implemented Quality Control. Even though social conditions were very difficult after World War II, Japan was trying to learn about Quality Control of the U. S. Eventually, the Japan Science & Technology Association sought the expertise of American Professor Deming with the help of the U.S. administrative government in Japan at the time.

Professor Deming who came to Japan in 1950 emphasized that Japan needed "the technology to economically produce and supply the products that consumers request" first, and then, anything else in order to undergo economic recovery and reconstruction after the war. Also Japan needed to secure U. S. dollars while pursuing industrial development via technology. He also thought that all these things could be done by corporations through proper utilization of Quality Control techniques based on statistical methods at all phases of production.

The Japanese government highly appraised Professor Deming's expertise and methods on Quality Management and published books with his lectures. With the money earned by selling the books, Japan established the Deming Prize and awarded the prize to companies that demonstrated high quality. The Deming Prize system, which was known to be the first award of its kind in the world and became very popular in Korea based on Japan's remarkable economic revival, served as the model for the Quality Control Grand Prix (Currently National Quality Award) which was established in 1975.

Since then Japan started to form the framework for "Japanese style Quality Control" modeled off the western Quality Control including the U.S., to fit Japanese corporate structure and context. Many areas were modified and developed in relation to Quality Management such as the Company-wide Quality Control (CWQC), policy management, TPM (Total Productive Maintenance), QC Circle, Characteristics Factor Chart, Taguchi Method, 7 Tools of QC, and New 7 Tools of QC. Among these areas, QC Circle Activity served as the basis of the Quality Task Division Team which Korea also promoted extensively.

In the 1970's, Korea started to introduce Japan's QC Circle Activity. At the time, Korea was reorganizing all of its industrial structure and put all policy efforts on pursuing an export-oriented development strategy.

It was in 1962 when the Japan Science and Technology Association published the first issue of "Site and QC" and distributed the magazines throughout the industry, promoting QC Circle Activity in full scale. The basic policy of this magazine is summarized as follows:

- The magazine's content should promote education, training and distribution of management enhancement methods and ways for improving the capability of site supervisors. The content should be easy to understand.

- Managers should be encouraged to voluntarily purchase the magazine at their own will to encourage as many managers as possible to voluntary read the magazine for their own study.
- Employees should participate and form groups led by managers called ‘QC Circle’ to enhance knowledge. The training and education should be based on lectures and simultaneously address management problems and be a part of company-wide Quality Control.

On the other hand, the basic principles of Japan Science and Technology Association can be summarized as follows:

- Knowledge system or intensified control has temporary effect only and has adverse effect in longer term.
- Basically, it is important to build up the capability to perform better work instead of merely asking employees to do better. That is to say, it is important to identify ‘what can we give to the site’ instead of ‘what can we get from the site’.
- In the end, motivation which can give incentive to contribute to the company becomes important task in management type.
- Factors from viewpoint of management that differentiate workers and managers are based on age, social experience, educational background and income level.
- First of all, books which are easy to understand, are interesting, and are relevant should be published.

Originally, QC activity in Japan was deemed to be a big success as a Japanese model of Quality Control was developed and distributed based on Quality Control theory of the U. S. to industrial sites of Japan.

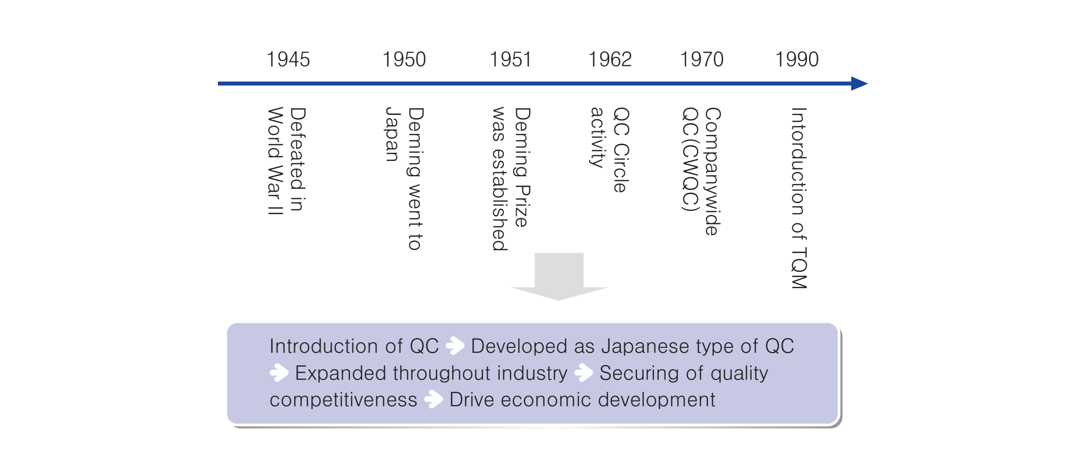
Professor Ishigawa of Tokyo University of Japan cautioned that the application and introduction of Japan’s QC Circle in western countries would not be suitable. This was because the mindset of Japanese and the structure of Japanese corporation are different from those of western countries. As Professor Ishigawa said, people agreed with Ishigawa’s opinion that Japanese QC Circle would not be suitable for people who are not familiar with Chinese characters or the countries which do not practice Buddhism and Confucianism. Unexpectedly, however, many countries introduced Japanese QC Circle and people who agreed with Ishigawa’s opinion including Ishigawa himself were surprised at how successfully it was implemented in any case. Although there were much supplementation and modification, it is really surprising to see that many corporations in the world introduced small group activity which is the core of Japanese QC Circle. Also there are many international events that promote small group activity.

Professor Ishigawa is a great scholar on Quality Control who is widely known to western advanced industrial countries including the U. S. His books and papers were read by many western people who wanted to learn about Japanese Quality Control, and especially the Characteristics Factor Chart which we are widely utilized including the “7 basic means of QC” which was created by Professor Ishigawa.

The name of QC Circle was created based on the suggestion of Professor Ishigawa. That is to say, he had been offering education sessions on Quality Control for site managers of corporations from 1950s and giving guidance on Quality Management activities as part of the “Company QC Review Committee”. During this period, he had discussions with the editing committee of the magazine “Site and QC” about the name of the activity and they decided to use the name “QC Circle”.

The development process of Quality Management of Japan can be summarized as Figure 2-2-2.

Figure 2-2-2 | Quality Management of Japan



Source: Korea Chamber of Commerce and Industry Single PPM Quality Innovation Implementation Institution (2000), “Single PPM Quality Innovation Theory and Implementation Strategy”.

1.2. Change in Perception on Quality

Concrete and clear understanding and definition on the concept of quality are the most important premises for successful implementation of Quality Management and the Single PPM because the object for management in Quality Management is nothing but Quality.

Critical factors that led to the successful implementation of Quality Management in companies and even in public institutions include: the adoption of Quality Management System Specification (ISO 9000 series) of ISO as the Korean Industrial Specification (KS) in 1992; the implementation of the certification system for ISO 9000 specifications in 1993; and the enactment of ‘the Quality Management Promotion Act’ instead of the conventional ‘the Industrial Products Quality Control Act’ in 1993. The Quality Management Promotion Act was revised again on December 29, 2000 as ‘the Quality Management and Industrial Product Safety Management Act’.

Especially, the implementation of Quality Innovation and 100PPM Quality Certification System of 100PPM Quality Innovation Promotion Division, which was organized on January 20, 1995, played an enormous role in enhancing quality of products produce by small and medium-sized companies and in establishing the Quality Management System. Moreover, the quality innovation efforts under the 100PPM System was taken over by the Single PPM Quality Innovation efforts to assure ‘less than 10 defect products out of 1,000,000 products’ from previous ‘100 defect products out of 1,000,000 products.’ It is in the process of successful implementation now.

Korea’s Quality innovation efforts have demonstrated remarkable development even though there has been various trial and error, and difficulties in the introduction and implementation as compared to the case of advanced countries. The following issues, however, are pointed out as tasks which should be addressed as soon as possible:

- The meaning of logic of quality related terminologies are not systematically arranged and recognized.
- Quality experts are insufficient. There is a need for experts who were educated and trained by industry such as automobile and semiconductor industry.
- As various quality related systems are separately operated, waste and inefficiency are generated due to frequent screening and post control.

Many challenges remain to be addressed on top of the ones mentioned above but the first challenge on terminology is the most imperative that needs to be resolved. For example, the terminologies such as Quality Management/administration, Quality Management, quality assurance, quality innovation, quality improvement activity are frequently used without clear distinction. In extreme cases, the quality of life and the quality of living are mentioned explaining the concept of quality and all these quality are dealt within the scope of quality management activity. Of course, there may be nothing wrong with expanding the scope of translations based on the concept or meaning form only. However, too expanded or restrictive or distorted of a translation may lead to unrealistic Quality Management or words without meaning, as only concrete setting of objects can lead to actual management activity.

In ISO and KS, quality is defined as “the degree to which a set of inherent characteristics fulfils requirements".

Besides the above, the definitions on quality defined by Quality Management or relevant institutions are as follows:

- Suitability of use - Juran -
- Suitability for need - Crosby -
- Ability to satisfy total desire for a product or service - ANSI -
- Degree of change from target value - Taguchi -
- Degree of total satisfaction for the request and expectation of internal and external consumers who get prompt and lowest price service - IBM -
- Offering a product and service which internal and external customers request and expect to have - Boeing -
- Customer's impression through total experience of our products - Hewlett-Packard -

And, the theory of Professor Garvin who explained the definition of quality pursuant to concrete characteristics divides the quality of product and service into eight factors or six factors as per Figure 2-2-3.

Figure 2-2-3 | Garvin's Quality

Source: Korea Chamber of Commerce and Industry Single PPM Quality Innovation Implementation Institution (2000), "Single PPM Quality Innovation Theory and Implementation Strategy".

The above ISO and KS specified that the definition of Quality Management is "the activity that is coordinated to command and manage the organization for quality" and defined that Quality Management System is "the management system that commands and manages organization about quality."

The concept and framework for Quality Management is significantly changed in reality, as it crosses over spatial and temporal dimensions but the unchanging principle is based on the fact that quality competitiveness becomes core function for corporate performance. Table 2-2-1 shows a comparison of the perception of quality from the past, present and the future.

Table 2-2-1 | Comparison of the Perception of Quality pursuant to Past, Present and Future

Category	Past	Present	Future
Perception of Quality concept is	Quality of product	Quality of goods and service	Quality of management including quality of goods and service
Occurrence of Quality problem is	Occurred due to mainly problems in site management	Occurred due to insufficient management capability of Dept in charge	Occurred due to lack of organized management system
Who manages Quality?	Site workers and supervisor	Support of Dept in charge and Dept concerned	Computer assisted Total Quality Management (CATQM)
Responsibility for Quality inferiority lies to	Site manager and worker	Head of Dept in charge	CEO
Role of Management on Quality problem is to	Top down instruction and verification of performance	Setting quality policy and organized participation	Demonstration of quality leadership and organizational development
Characteristics of Management System is	Vertical instruction and order	Horizontal coordination and participation	Organization with flexibility
Concept of Customer is	Consumer	Customer	Stakeholder
Manufacturer's responsibility for Customer is	Consumer protection and claim handling	Customer satisfaction and service	Expansion of indemnity and social contribution
Organization structure	Strict hierarchy	Horizontal team organization	Productive and autonomous organization
Occurrence of problem	Individual mistake	Insufficient capability of members	Problem in management system
Compensation and acknowledgment	Result	Process and result	Process and result
Management style	"2 mouths and 1 ear"	"1 mouth and 2 ears"	Stakeholder

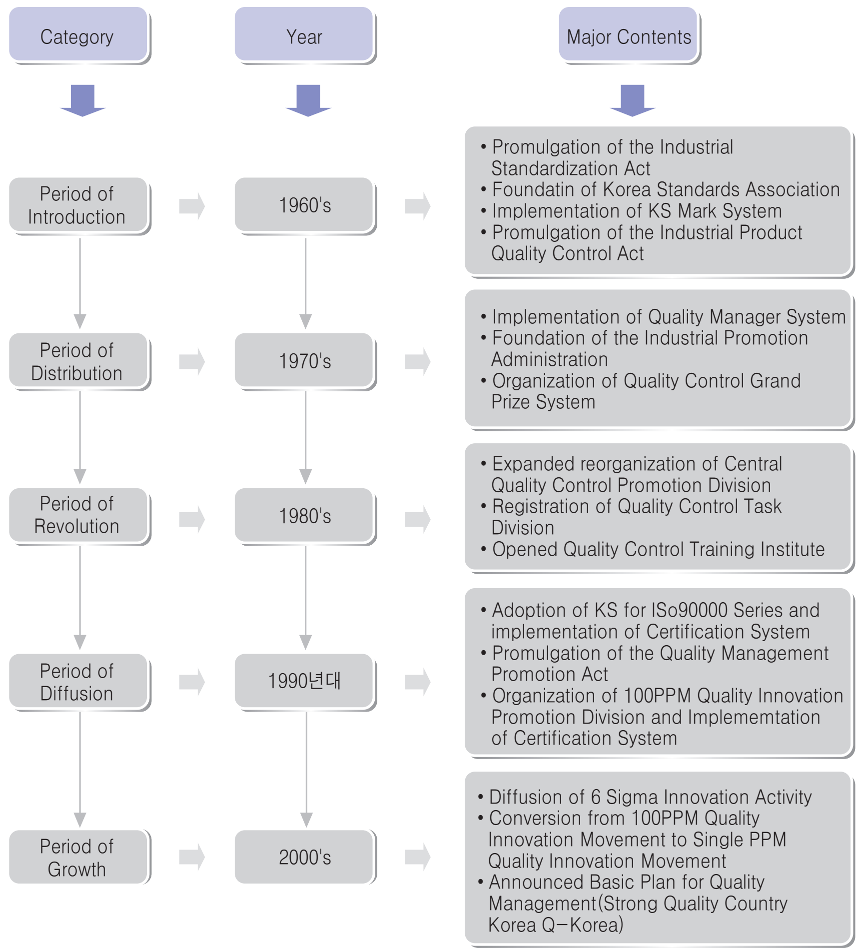
Source: Korea Chamber of Commerce and Industry Single PPM Quality Innovation Implementation Institution (2000), "Single PPM Quality Innovation Theory and Implementation Strategy".

1.3. Background of the Introduction of Quality Management

1.3.1. Quality Management of Korea

The development process of Quality Management in Korea started in the beginning of the 1960s at the onset of industrial modernization and growth of Total Quality Management (TQM), and continues through the period of distribution in 1970s, revolution in 1980s and diffusion after 1990s as summarized in Figure 2-2-4.

Figure 2-2-4 | Development Phase of Quality Management in Korea



Source: Korea Chamber of Commerce and Industry Single PPM Quality Innovation Implementation Institution (2000), "Single PPM Quality Innovation Theory and Implementation Strategy".

1.3.1.1. Period of Introduction - Let's Learn Quality Control

On September 30, 1961, the Industrial Standardization Act was promulgated as statute No. 732 and the Standard Bureau was established in the Ministry of Commerce and Industry. In 1962, the Korea Standards Association was established as a civil organization in charge of the guidance and distribution of Standardization and Quality Control. The KS Mark Permit System was implemented from 1963. The name of the Industrial Standardization Act was changed to the Industrial Standardization Act and the KS Mark Permit System was changed to the KS Mark Certification System.

The Industrial Product Quality Control Act, which was enacted in 1967 during the 2nd 5 year Economic Development Plan, was revised and promulgated as the Quality Management Promotion Act in 1993 as mentioned earlier and revised again in December 2000 as the Quality Management and Industrial Product Safety Management Act.

In order to establish the KS Mark Certification based on the Industrial Standardization Act, the following screening criteria were required:

① Standardization in general - Stipulation on Standardization and the implementation of Quality Management.

② Material management - Stipulation on inspection item, inspection method and management method by major material item.

③ Process management - Stipulation on inspection item, inspection method and management method by process.

④ Product quality - Stipulation on inspection item, inspection method and the maintenance of KS level quality.

⑤ Manufacturing facility management - Stipulation on management method by major manufacturing facility.

⑥ Inspection facility management - Stipulation on inspection facility management method by major inspection facility.

Apart from the above six items, sampling method for product testing, KS Mark indication method and the category of Certification are also included in the screening criteria.

Each criteria item requires Standardization and thorough Quality Control so that final products meet KS standards by stipulating the requirements in detail. For example, the criteria require a detailed method for conducting Quality Control in the following: "Inspection method should be stipulated to apply management technique so that the quality of the product concerned is maintained above KS level."

The KS Mark Certification System served as the basis for Korean corporations to implement

Quality Control, which was promptly distributed and diffused to general corporations thanks to various benefits and promotion systems such as preferential purchase of products with KS Mark.

While Japan introduced Quality Control urgently to pursue industrial development and economic revival after World War II, Quality Control could be smoothly distributed to industry in Korea through the operation of KS Mark System. Of course, some foreign scholars who came to Korea as exchange professors introduced the concept of Quality Control while it was partially introduced by foreign engineers who participated in the construction of Chungju Fertilization Plant with the ICA fund.

KS Mark Permit System which began with the issuance of Mark Permit No. 1 (light bulb) was enough to raise considerable interest among consumers of the time when defective products were prevalent. As such, corporations competed to introduce and implement Standardization and Quality Control before other corporations in order to obtain KS Mark Permit which meant government's guarantee of quality. Korea did not have much expertise in the field of Quality Control, so a number of problems were exposed in the expansion and distribution of Quality Management. But it helped many corporations receive Quality Control education and the supports from experts and organizations.

The efforts of the Korea Standards Association in the guidance and distribution of Quality Control during this period should be noted. While there was not much recognition and interest in Quality Management among companies, KPC regularly organized training and educational seminars for managers and employees and steadily dispatched technical experts to provide on-site education and training on Quality Control.

1.3.1.2. Period of Distribution - Let's Resolve through Quality Control

Thanks to the export promotion policy and rapidly increasing consumer protection policy, Quality Control began to emerge as a task for all industry to introduce and implement as a matter of course.

To this end, various policies and systems were implemented to improve the quality of products, as the issue of poor products was steadily raised by government and civil organizations from the end of the 1960s. In the 1970s, there were two major policy initiatives to address poor quality products which are as follows:

① Implementation of Quality Manager System

This qualification system existed neither in Korea nor in other countries. Some European countries had a Quality Control instructor system for instructors but there was no requirements in which certain corporations or organizations had to employ a qualified expert in Quality Management like Korea.

The introduction of this system owes to the policy of export promotion implemented at the time. That is to say, the government as well as companies widely recognized that industrial modernization could not be achieved without rapidly growing exports and enhancing the quality of products is essential to growing export. Accordingly, the government intensively promoted the training of qualified Quality Managers who were equipped with expertise on Quality Control. At the same time, corporations that implemented Quality Control (KS Mark Permit Corporations) were required to employ Quality Managers. Besides, the employment of Quality Managers was mandatory requirement for the corporations which sought exemption of export inspections and wanted to obtain the “Quality” Letter Mark permit. There were dominant logic and intention that practical responsibility for poor management of quality lies to the Quality Manager while CEO should be responsible for poor business management.

The name of ‘Quality Manager’ was changed to ‘Quality Control Engineer’ in the process of streamlining technical qualification systems later, and again the mandatory requirement for the employment of the Quality Control Engineer was eliminated for the purpose of relaxing regulations, which is regrettable since improving the quality competitiveness of products is now a policy imperative.

② National Exhibition Program for Industrial Products

A National Exhibition Program for industrial products sounds strange but the idea is easily understandable in the context of trying to significantly improve the quality of industrial products in the 1970s. The idea was to select superior industrial products, which are closely related to consumption and export, through strict screening, in the same way outstanding artworks are selected through National Art Exhibitions for awards and promotion.

At the time, there were too many “superior industrial products’ under the consumer policy, which caused confusion when it came to selecting truly good products. As all institutions like the mass media used words like ‘Gold prize selected by consumer,’ consumers became rather confused. Accordingly, with the goal of identifying superior industrial products at the government level based on strict screening criteria and to protect consumers’ right to know, the National Exhibition Program for industrial products was launched. This program which the Ministry of Commerce and Industry planned at the time, however, was submitted to the Vice Minister Meeting but decided to be held without clear reason or any room to supplement even, and now there is almost no one who remember even the name of this program.

In 1973, the Industrial Promotion Administration was founded following reforms of the government organization, and the basis for implementation of a wide range of policies for Standardization and Quality Control related works. The establishment of the Industrial Promotion Administration was a key turning point in the development of Quality Management in Korea because industry's expectation to government was as big as such and the foundation to take off for export increase and rational based management activity was prepared. The 1st Governor Choi Jong Wan put focus on "the enhancement of competitiveness through Quality Control" as the core driver of the Industrial Promotion Administration. Whenever asked what he was doing, he always responded with: "I am working on Quality Control."

In 1974, "Target corporations for Quality Control" were designated, selecting corporations which were subject to various regulations and received government support. The following obligations were stipulated in the Ministry of Commerce and Industry Notification No. 10561 (the Industrial Promotion Administration, "White Paper on Quality Management", 1991).

- Establishment and operation of Quality Control Organization which is appropriate for the corporation concerned
- Enactment and operation of in-house specification
- Employment of more than 1 Quality Manager.
- Participation of employees by process or work team, establishment and operation of basic organization for QC Movement (Quality Management Task Division Team)
- Establishment of in-house education and training plan and implementation of in-house education
- Organizing presentations, seminars or evaluation sessions more than two times a year.
- Completion of the required Quality Control education for management staff and Quality Control staff at the education institution designated by the Governor of the Industrial Promotion Administration

The 1st National Quality Control and Standardization Conference was held in 1975, and economic cabinet meeting held on March 24, 1975 made the decision to implement national Quality Control efforts and adopted the resolution for the following key projects:

- Creation of environment for national Quality Control
- Establishment of Quality Control Implementation Institution
- Promoting active participation of economic organization and inspection institutions
- Introducing efforts to improve quality of products
- Expansion of designation of target corporations for Quality Control and cultivation of Quality Control staff
- Organizing National Quality Control Conference

The implementation efforts on Quality Control provided a crucial momentum for the distribution and diffusion of Quality Control throughout industry even though the contents of the actions were innovative and adopted by trial and error. Especially, the functions of the Quality Control Implementation Institution were transferred to the Korea Standards Association which became a civil organization from 1996. Its functions include the operation of National Quality Award Program (Legal basis: Article 6 of the Quality Management and Industrial Product Safety Management Act and Article 5 of the enforcement decree of the said act), and the promotion and distribution of Quality Management such as the operation of the National Quality Management Conference.

The Quality Control Grand Prize Program, which has been held since 1975, was modified to change the name of the prize and its content going through a number of amendments. The content of major prizes awarded to corporations among the National Quality Award are as follows (As of 2010):

<Comprehensive Award >

- National Quality Grand Prize (Large size corporation, small and medium size corporation), Quality Management Award

< Award by Field >

- Production Innovation Award
- Facility Management Award
- 6 Sigma Innovation Award
- Customer Satisfaction Award
- Green Management Award
- Manpower Development Award
- Service Innovation Award

<Special Award>

- Superior Local Government Award for Quality Management Implementation
- Superior Department Group Company Award
- Superior Service Quality Award
- Superior Quality Competitiveness Award

In addition, there are various awards recognizing the outstanding performance of individuals and organizations.

The 1970s was the decade when Quality Control was introduced nation-wide as a powerful practical means for industrial modernization.

1.3.1.3. Period of Revolution - From QC to QM

The phrase, “the 1980s of great hope,” was frequently heard in business circles in the 1970s. Starting from the 1980s, almost all Koreans and corporations had to endure many changes and ordeals in economics and politics.

In 1981, a lot of efforts were made in relation to Quality Control including the implementation of the Factory Quality Control Grading System. But starting in 1989, there were considerable challenges at home and aboard in the course of implementing the Quality Control including the problems of the Factory New Village Movement in 1970s.

Domestically, Korea Standards Association constructed the Quality Control Training Institute and made significant efforts to reinforce education and training by providing systematic support through the registration system for Quality Control Task Division Team. However, changes in the international environment regarding Quality Control had to be considered and a new strategy adopted for future Quality Control activities.

The increasing competitiveness of Japanese products through Total Quality Control (TQC), and growing dominance especially in the U.S. automobile and semiconductor industries, required new reflection and innovative approach to quality policy. Especially, the adverse trade balance of the U. S. in the late 1980s led the U. S. industry as well as the government to make drastic changes to secure competitiveness in terms of quality and price. In 1980, the U. S. lost its dominance in the auto sector to Japan, and issues concerning the semiconductor and automobile industry were always raised at the U. S.-Japan Summit Talks.

Especially, a special program by NBC called “If Japan can, Why can’t we?” provided a glimpse U.S industries of Japan’s TPC. The program showed “Japan’s industrial sites that are running while America’s industries were crawling.” Dr. Deming compared the Quality Control systems in the U.S. with those of Japan, and raised the alarm in the decline of U.S. competitiveness.

In 1987, the Reagan administration and U.S. Congress enacted the Malcolm Baldrige National Quality Improvement Act based on the National Quality Improvement Act in order to restore the competitiveness of U.S. industries, which were gradually losing their competitiveness since the 1970s and to promote QM (Quality Management). The objective of the implementation of the Act was as follows:

- To be successful in market by always providing more improved value to customers.
- To improve overall performance capability of corporations.

The Malcolm Baldrige (MB) National Quality Award which began to be implemented based on this Act really helped to remarkably restore the quality competitiveness of American industry. The U.S. Quality Management (QM), which originally benchmarked Japan's TQC and Deming Award, was inversely benchmarked by Japan, and even the screening criteria for Korea's National Quality Award benchmarks the U.S. MB National Quality Award.

The 1980s was a period of revolution where QC which has been used for more than a half century, evolved to become QM. This trend became the turning point that preceded the new quality culture together with political stability and economic growth.

1.3.1.4. Period of Diffusion - Developed to TQM

Experiencing the revolution of the 1980s, each country faced new challenges of competing in an increasingly integrated global economy, with the end of the cold war. Corporations advocated that "No change will lead us to death" while pursuing management innovation to cope with new the management environment.

The corporations were motivated to pursue management innovation due to rapid changes in the general business environment is rapidly changing, as many did not achieve their desired objectives or wanted to pursue new objectives. Quality Management of the 1990s can be regarded as the period of diffusion of Quality Management which is evaluated as useful tool for management innovation activity.

In 1992, the specification on quality assurance under the ISO (ISO 9000 series) was adopted by the KS System, which was introduced by many corporations. This was the turning point for transforming the Quality Control System into the Total Quality Management System.

In line with the introduction of the KS System, the existing Industrial Product Quality Control Act was revised as the Quality Management Promotion Act in 1993. The Quality Assurance Structure Certification System based on ISO 9000 series was implemented. For reference, the number of domestic certification institutions was 34 institutions including the Korea Quality Certification center of Korea Quality Foundation while the number of corporations which received the certification was 44,990 as of April 30, 2011 (Source: www.kab.or.kr).

Moreover, as international trade under the WTO System which started in January 1995, was based on the philosophy of free trade, which sought to eliminate tariff and non-tariff barriers between countries, the level of quality of goods became an important variable for the improvement of trade balance. Words like "Limitless Competition" or "Mega Competition" do not sound strange anymore, and survival of fittest became the management strategy of corporations.

Gradually, efforts to enhance international competitiveness have grown, as advanced countries seek to protect their own industries by protecting their technologies, which give them the competitive edge. Corporations are faced with a tough environment where restructuring is unavoidable internally while the difficult problem of achieving optimum level in the utilization of manpower and material resources for survival need to be solved.

Under such internal and external environments, the 100PPM Quality Innovation Implementation Institution (currently the Single PPM Quality Innovation Implementation Institution) was founded. Around 1991, a certain Mother Corporation had been unfolded 100PPM Quality Movement for their Subcontractors but on January 20, 1995 five major economic organizations, including the Korea Chamber of Commerce and Industry, Korea Employers Federation, Korea Trade Association, Korea Federation of Small and Medium Business and Federation of Korean Industries played a key role in organizing the 100PPM Quality Innovation Implementation Institution.

The initial efforts on quality innovation which aimed to maintain a product defect rate of less than 100PPM (100 defect products out of every 1 million products) were changed in lin with the Single PPM (less than 10 defect products out of every 1 million products), which means one digit number of defect products.

This Single PPM System together with the KS Mark Certification System and ISO 9000 Series Certification System are leading the efforts on Quality Management in the period of growth so that the enhancement of quality competitiveness of Korea as well as the development of industries and the enhancement of national competitiveness can be achieved.

1.3.2. Background of the Implementation of Single PPM Quality Innovation Movement[11]

In the beginning of the 1990s, Korea's national competitiveness was far below the level of the advanced countries. This was also the case for the competitiveness of Korean products. Therefore, the enhancement of quality emerged as an important policy task.

In order to enhance quality competitiveness, the Korean government sought to implement the '100PPM Quality Innovation Movement,' previously known as the 'Single PPM Quality Innovation Movement' in 1995. '100PPM Quality Innovation Movement' promotes the participation of all managers and employees in reducing the number of defective products to less than 10 out of every 1 million products.[12]

11. Kwon Young Woo (June 2010), "Study on the Evaluation of the Efficiency and Productivity of Small & Medium Business's Quality Management Activity using DEA", Soongsil University

Parts per million (PPM) has been used to indicate the density in chemistry generally and is being used as a measure for the density of pollution. The concept of PPM was introduced to Quality Control due to the importance of managing the defect rate, since a failure to do so will adversely affect corporate image, result in customer complaints and ultimately generate losses to the company. Therefore, the management of defect to PPM level is very important activity.[13]

In the 1990's, the Acceptance Quality Level (AQL) applied by U.S. and Korean part manufacturers was set at 1/100 unit, i.e., percentage (%) whereas Japan applied PPM in setting the defect rate. For example, Matsushita Electric of Japan (currently Panasonic) applied a AQL of 0.01~0.001% for parts, i.e. 100PPM level. The idea of applying PPM based quality management originated from long-term collaboration between the TV Business Dept. of Matsushita Electric and Matsushita Electronic Parts. The implementation of PPM as a measurement of Quality Control did not yield significant at the beginning but it gradually became recognized and adopted. It is said to have taken approximately 10 years for Japanese TV manufacturers to develop Subcontractors to produce parts.[14]

The 100PPM Quality Innovation Movement in Japan served as the model for Korea's 100PPM Quality Certification System. It was started by Hyundai Motor and LG Electronics as Mother Corporations with their Subcontractors for the first time in Korea in 1991. Driven by the quality innovation movement with concrete and clear objectives, the defect rate of component parts should be less than 0.01%, i.e., 100PPM in order to attain the quality of the level of advanced countries. Achieving this does not simply require to introducing a system or management technique, it also requires initiating changes in the value system and mindset. Even after attaining the objective, the objective should be sustained to secure overseas competitiveness for domestic products.[15]

In December 1997, Korea's economy reached a major turning point when it received Relief Loans from the International Monetary Fund (IMF). As competition in the global economy became fiercer due to the Internet and trade liberalism, the importance of quality competitiveness was increasingly emphasized. Korea's national competitiveness was ranked at

12. Park, Seong Hyun, Kim, Jae Juu, Jo, Shin Seop, Koo, Il Seop, Lee, Myung Joo (2007), "Single PPM Quality Innovation Policy Evaluation & Development Strategy", Small & Medium Business Administration. Korea Chamber of Commerce and Industry Single PPM Quality Innovation Implementation Institution, pp. 7-9.
13. Jeon, Chang Hee (1996), "Real-time Process Management System for PPM Management", Konkuk University, p. 4.
14. Noh, Hyung Jin (1995), "100PPM Quality Innovation is done this way", Korea Chamber of Commerce and Industry 100PPM Quality Innovation Implementation Institution, pp. 97-98.
15. Lee, Dae Kwon, Jo, Nam Ho, Lee, Kyung Jong (1999), "100PPM Quality Certification System Improvement Plan", *Industrial Management Society Journal*, vol. 22, no. 50, pp. 267-279.

36th in 1998 but the level of quality relative to price dropped from the 31st to 41st in 1988.[16]

Table 2-2-2 | Ranking of IMD National Competitiveness and Quality Level versus Price of Korea

Competitiveness	1995	1996	1997	1998	1999	2000	2001	2002
National Competitiveness	26th	27th	30th	36th	41th	28th	28th	27th
Quality Level versus Price	-	-	31th	41th	44th	31th	-	-

Source: The International Institute for Management Development (IMD, Swiss), "2002 World Competitiveness Yearbook", April 2002.

As such, Korea faced the urgent challenge of having to raise the quality competitiveness of products. To address this, the government converted '100PPM Quality Innovation Movement' to 'Single PPM Quality Innovation Movement' from 2000. The government changed the name of '100PPM Quality Innovation Implementation Institution' to 'Single PPM Quality Innovation Implementation Institution' and handed its reigns over to the Korea Chamber of Commerce and Industry.[17]

1.3.3. Principal Agent of Single PPM Quality Innovation Movement

Small and Medium Business Administration introduced, and has been operating the 'Single PPM Quality Certification System' to promote the industry-wide adoption of the 'Single PPM Quality Innovation Movement.'. Under the Single PPM Certification System, a 'Single PPM Quality Certification' is issued after a company has submitted an application and the application is approved per Single PPM quality level.[18] The 'Single PPM Quality Certification' from Small & Medium Business Administration is the government's seal of approval of the company in terms of quality and reliability and it enhances the company's brand value thus raising its domestic and overseas competitiveness.

With the implementation of the 'Single PPM Quality Certification System,' the Small and

16. Kwon, Young Woo (2003), "Single PPM Quality Innovation Project & Certification System", Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry, pp. 3-7.
17. Kwon, Young Woo (2003), "Single PPM Quality Innovation Project & Certification System", Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry, pp. 3-7.
18. Koo, Il Seop (2006), "Single PPM Quality Certification Screening Manual", Small & Medium Business Administration. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry, pp. 19-25.

Medium Business Administration abolished the ‘100PPM Quality Certification Procedure (the Industrial Promotion Administration Notification No. 95-241, Enacted on August 1, 1999) and implemented the ‘Single PPM Quality Certification Procedure (Small and Medium Business Administration Notification No. 1999-22) beginning in January 1, 2000. The procedure was revised several times: first on March 24, 2006 (Small and Medium Business Administration Notification No. 2006-11); second on August 28, 2006 (Small and Medium Business Administration Notification No. 2006-20); third on August 25, 2008 (Small and Medium Business Administration Notification No. 2008-34); and fourth on December 18, 2008 (Small and Medium Business Administration Notification No. 2008-55).[19]

The ‘Single PPM Quality Innovation Implementation Institution’ in the Korea Chamber of Commerce and Industry provides support to large corporations and their subcontractors for more systematic and scientific implementation of the Single PPM Quality Innovation Movements. The roles and functions of the government and economic organizations (Small and Medium Business Administration, Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry, Mother Corporations and Subcontractors) in administrating the Single PPM Quality Innovation Movements are as follows respectively:

First, the Small and Medium Business Administration establishes the Single PPM Quality Innovation Movement related policies and administration such as securing funds for the implementation of Movements.

Second, the Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry develops diversified quality systems and implementation techniques required, and provides various services including education and information to corporations while establishing and operating ‘the Branch of Single PPM Quality Innovation Implementation’ in the 71 Regional Chamber of Commerce and Industry branches all over the country.

Third, large corporations provide guidance and training to their subcontractors so that the subcontractors can implement the Single PPM Quality Innovation Movements systematically. In case the subcontractor is a Single PPM Quality Certification corporation, various benefits such as increase in order quantity or more favorable payment terms are given.

Fourth, subcontractors try to reduce defect rate through the establishment of Quality Management System and continuous improvement activity to produce high quality products with lower defect rate.

19. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry website (2010), http://sppm.korcham.net/

1.4. Major Function of Single PPM Quality Innovation Implementation Institution[20]

Major functions of the Single PPM Quality Innovation Implementation Institution in Korea Chamber of Commerce and Industry are as follows:

1.4.1. Diffusion of Single PPM among Large Size and Small/Medium Size Corporations

1.4.1.1. Single PPM Quality Innovation Promotion Conference

Purpose	Supply PPM Quality Innovation activity throughout industry by selecting and awarding small and medium companies which secured Single PPM Quality level through efficient implementation of quality innovation activity
Eligibility	Small and medium companies which secured Single PPM Quality level through efficient implementation of quality innovation activity
Period	Once a year
Method	Conference with participants from government and industry
Contents	▷Promotion Conference Event: Individual & Group Awards ▷Screening candidates for award

1.4.1.2. PR and Data Distribution for Single PPM Quality Innovation Movement

Purpose	Enhancing quality competitiveness of Korean products to continuously diffuse the Single PPM Quality Innovation Movement by promoting the importance of quality to the general public.
Eligibility	▷Small & Medium Corporations which implemented Single PPM ▷Quality Innovation related experts and officials
Period	Ongoing throughout year
Method	Promotional activities through mass media and PR materials
Contents	▷PR material Production and news collection support: PR Video, PR Kit, Poster ▷Produce Single PPM Standard Materials ▷Produce Quality Innovation Information Kit and Data ▷Supplement Single PPM Homepage Contents

20. The Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry website (2010), http://sppm.korcham.net/

1.4.1.3. Domestic Industry Inspection Tour

Purpose	To obtain new information through on-site visits to successful corporations and to provide opportunity for enhancing understanding on the Single PPM Quality Innovation project and benchmarking
Eligibility	▷ Managers and employees of domestic and overseas small and medium corporation and large size corporations ▷ Quality Innovation related experts and officials
Period	About 3 times a year
Method	Industry inspection tour for management and managers/employees of Single PPM participating corporations

1.4.1.4. Overseas Industry Inspection Tour

Purpose	To benchmark the quality innovation strategy and the method of overseas advanced corporations
Period	Once a year
Method	Industry inspection tour for management and managers/employees of Single PPM participating corporations

1.4.1.5. TPS Site Training

Purpose	To provide experience for reciprocal cooperation technique of Toyota Motor and its subcontractors for world best quality level maintenance strategy
Eligibility	▷ Managers and employees of domestic and overseas small and medium corporation and large size corporations ▷ Quality Innovation related experts and person in charge of pertinent institutions
Period	About 3 times a year
Method	Site training for managers and employees of the corporations which are interested in Quality innovation activity and Single PPM participating corporations

1.4.2. Expansion of Education for Large Size and Small/Medium Size Corporations

1.4.2.1. National Tour for Single PPM Quality Innovation Education

Purpose	To conduct tailored education suitable for regional and business characteristics
Period	Occasional
Method	Corporations and the Regional Chamber of Commerce and Industry apply for education and then conduct education for officers and employees of corporations concerned and pertinent corporations to the Regional Chamber of Commerce and Industry

1.4.2.2. Education for Cultivation of Single PPM Advisor and Screening Committee Member

Purpose	Cultivate expert out of officers and employees of participating corporations for systematic implementation of the Single PPM Quality Innovation Movement and input to site
Eligibility	▷ Officers and employees of domestic and overseas small and medium corporation and large size corporations ▷ Quality Innovation related experts and person in charge of pertinent institutions
Period	About 2 times a year

1.4.2.3. Education of Korean Small and Medium Companies in Overseas

Purpose	Cultivate expert out of officers and employees of participating corporations for systematic implementation of the Single PPM Quality Innovation Movement and input to site
Eligibility	Small and medium corporations and large size corporations
Period	Occasional

1.4.2.4. E-mail Education for Quality Innovation

Purpose	To enhance quality competitiveness of our corporations and products by providing education all the year round without spatial and temporal limitation through e-mail on the need for quality innovation, method and various technique utilization method for officers and employees of domestic and overseas corporations
Eligibility	▷Officers and employees of domestic and overseas small and medium corporation and large size corporations ▷Quality Innovation related experts and person in charge of pertinent institutions
Period	Occasional
Method	Provide education materials for less than two subjects every week through e-mail

1.4.2.5. Remote Internet Training for Single PPM (e-Learning)

Purpose	To contribute to the enhancement of Quality competitiveness of corporation by acquiring the theory and technique on quality innovation through frequent education for management staff and laborers who are participating in Single PPM Quality Innovation activity
Eligibility	▷Officers and employees of domestic and overseas small and medium corporation and large size corporations ▷Quality Innovation related experts and person in charge of pertinent institutions
Application Period	By 5 days before the opening of the lecture

1.4.3. Expansion of guidance and Certification of Quality Certification System for Small & Medium Corporations

1.4.3.1. Support for Single PPM Quality Innovation System Establishment

Purpose	To cultivate quality capability for Certified corporations by selecting and guiding some corporations out of the Single PPM Quality Innovation Movement, and the corporations without certification is solicited to obtain the Single PPM Quality Certification as soon as possible and ultimately to enhance domestic and overseas competitiveness by enhancing quality level of small and medium corporations

Eligibility	▷Small and medium corporations which acquired the Single PPM Quality Certification or want to do the activity ▷Small and medium corporations acknowledged by Implementation Institution or Corporations
Period	Project announcement date ~ Occasional throughout the year (Up until budget is exhausted)
Method	Select support corporation and dispatch advisor to establish Quality Innovation System and Improvement technique for 10 days period a year.

1.4.3.2. Support for the Screening of Single PPM Quality Certification

Purpose	To provide consulting and information with individual guidance to large size corporations and small and medium corporations so that they can prepare Single PPM Quality Certification application efficiently and get screening
Eligibility	▷Small and medium corporations with the records of the implementation of the Single PPM Quality Innovation Movement for more than 6 months ▷Target item for application is the item which is more than 3% of production or sales out of whole production items from the factory manufacturing the applicable item
Period	Occasional throughout year
Method	When small and medium corporation, which established Quality Management System and reached the Single PPM level for defect rate, passes document and site screening, Small and Medium Business Administration issues Certificate. Then external reliability of the small and medium corporation is increased.

2. The Contents of Single PPM Implementation

2.1. Quality Management and Single PPM Quality Innovation

The Small and Medium Business Administration introduced 100PPM Quality Certification System in 1995 to enhance quality competitiveness of small and medium corporations and large size corporations in Korea and operated the System until 1999. From 2000. it was transformed to the Single PPM Quality Certification System which was an upgraded system.[21]

21. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry website (2010), http://sppm.korcham.net/

In order for small and medium corporations to be eligible of the Single PPM Quality Certification, they have to establish a Quality Management System first, and then, the system must meet certain requirements in regards to setting the defect rate by utilizing techniques such as Single Technique (S, I, N, G, L, E[22]) or 5 Sigma Technique (Example: DMAIC[23]).

The ISO 9001:2000 has been widely adopted all over the world compared to other quality standards. It was established by the Organization for International Standardizations (ISO), located in Geneva, Switzerland and founded in 1947. The Greek word ‘isos’ means ‘equal’.[24]The ISO 9000 Quality Management System was established in 1987, and then revised for the first time in 1994, and for the second time in 2000, becoming ISO 9001:2000. This is basically the specification to meet customer satisfactory requirements in Quality Management and Quality Assurance between suppliers and purchasers to facilitate international trade by unifying different quality assurance specifications under one international standard which stipulates the requirements of Quality Management System.[25]

The ISO 9001 Quality Management System (QMS) is based on eight principles of quality management, which are customer-centered, which include: leadership, full members’ participation, process approach, system based approach to management, continuous improvement, scientific approach to decision making and mutually beneficial supplier relationship.[26]

6 Sigma is a “Comprehensive corporate management strategy to innovate quality through quantitative evaluation of all processes under the leadership of the management, to create a culture of efficient quality by preparing courses in problem solving and specialized training, and to remarkably enhance the performance of corporate management by raising the process quality to 6 Sigma for customer satisfaction.” It is also called “Scientific management innovation strategy which seeks to achieve zero defects in all processes to thrive in the 21st century.”[27]

A comparison of the Single PPM Quality Certification System, ISO Quality Certification

22. S, I, N, G, L, E: S (Scope definition), I (Illumination assessment), N (Nonconformity analysis), G (Goal selection), L (Level-up), E (Evaluation)
23. DMAIC: Define, Measure, Analyze, Improve, Control
24. S. T. Foster (2007), *Managing Quality: Integrating the Supply Chain*, Pearson Education Inc. pp. 91-92.
25. Kim, Yon Seong *et al*. (2009), “Global Quality Management 4th Edition”, Bakyoung Publishing, p. 77.
26. Hong, Jong in (2005), “ISO Quality Management System”, Small & Medium Business Administration. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry. pp. 32-38.
27. Park, Seong Hyun (2005c), “Design Sector 6 Sigma”, Small & Medium Business Administration. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry. pp. 11-12.

System and 6 Sigma Quality Management Technique is shown in Table 2-2-3.[28]

Table 2-2-3 | Comparison of Single PPM Quality Certification System with other Systems

Category	Single PPM Quality Certification	ISO Quality Certification 6 Sigma Quality	Management
Developed by (Institution)	Korea	ISO	U.S.A (Motorola)
Nature	System / Product Warranty	System Warranty	Process Management Technique (Means)
Purpose	To reach Single PPM level of product defect rate	To establish Quality System for the satisfaction of minimum requirements	To reach 6 Sigma level quality
Quality Objective	Clear (Single PPM)	No specific objective	Clear (6 Sigma)
Quality Certification	3rd Party Certification (Government)	3rd Party Certification (Civil Organization)	Not Certification System
Degree of Use of Statistical Method	Essential	Not required particularly	Essential and requires professional statistical knowledge

Source: Kwon Young Woo (June 2010), "Study on the Evaluation of Efficiency and Productivity of Small and Medium Corporations' Quality Management Activities using DEA", Soongsil University.

The Single PPM Quality Certification System was established by the Small and Medium Business Administration of Korea, while the ISO Quality Certification System was founded and operated by the international organization ISO. 6 Sigma Quality Management is not a Certification System but a Quality Management Strategy and Technique. As to major characteristics of each system, the Single PPM is focused on Quality Management System and product assurance; the ISO is focused on System Assurance; and 6 Sigma is focused on process management technique and processes.

When it comes to objectives, the Single PPM aims to achieve a defect rate based on Single PPM, and ISO aims at the establishment of a Quality System to satisfy minimum requirements while 6 Sigma aims to achieve a level of quality at 6 Sigma.

28. Kim, Won Joong, Lee, Kyung Jong, Kim, Yon Seong, Seo, Jin Young (2000), "Single PPM Quality Innovation Theory & Implementation Strategy", Small & Medium Business Administration. Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry, pp. 59-78.

In terms of the way quality certification system operates, the Single PPM is a 3rd party certification issued by the Small and Medium Business Administration on behalf of the Korean government; the ISO is a 3rd party Certification given by a civil organization; and the 6 Sigma does not have a certification system yet.

When we look at the application of statistical methods, the Single PPM uses statistical method essentially, but the ISO does not particularly need it whereas the 6 Sigma uses it essentially utilizing professional statistical techniques.

In comparing the Single PPM Quality Innovation system with the existing Quality Management system, the Single PPM Quality Innovation system uses different criteria for measuring defect rate and sets clear concrete objectives. And in order to achieve the objective, more emphasis is put on not only qualitative analysis but also quantitative analysis, and therefore, a more scientific and high-level statistical technique is required.[29]

To secure a level of quality based on Single PPM, data analysis approach is more important than anything else instead of subjective based judgments. To achieve a defect rate of less than 10PPM, focus should be put on the causes and processes and the end product rather than the problems at hand. This approach to resolving problems relating to processes, and even potential problems, is one of the core elements of the Single PPM Quality Innovation. The 100PPM Quality Innovation was introduced as a part of efforts to enhance the level of quality among subcontractors. The Single PPM Quality Innovation is the development of 100PPM Quality Innovation, and therefore, active guidance and support of subcontractors by large corporations is needed more.

2.2. History of Single PPM and its Implementation Contents

2.2.1. Birth of Single PPM Quality Innovation Activity

The Small and Medium Business Administration which is in charge of government and economic organizations such as the Korea Chamber of Commerce and Industry has played an important role in the efforts to promote the 100PPM Quality Innovation among small and medium corporations and large corporations during 1995 to 1999. PPM is an abbreviation for Parts Per Million, which is one millionth per part. 100PPM Quality Innovation activity is a Quality Management Movement to reduce the number of defective products or services based on PPM. A ‘No defect Movement’ can realize a zero defect rate through the participation of all

29. Goo, Il Seop, Im, Ik Seong, Kim, Tae Seong (2000b), “Study on comparative review of Single PPM Quality Innovation”, *Quality Management Society Journal*, vol. 28, no. 4, pp. 184-193.

managers and employees of a corporation.

Since 2000, the Small and Medium Business Administration and Korea Chamber of Commerce and Industry have been providing Single PPM Quality Innovation activity, which is a level above the 100PPM Quality Innovation. The Single PPM Quality Innovation is Korea's model of quality innovation in which all members of the organization participate to achieve the established objective of reducing the number of defective products or services to a single digit for every one million produced with the long-term objective of reducing it to '0' PPM, or no defective products.

2.2.2. Beginning of 100PPM Quality Innovation Activity

'100PPM Quality Innovation activity' was initiated by a large corporation and subcontractors in 1991, but in fact came from the '100PPM Quality Innovation activity' which was organized by the Ministry of Commerce and Industry and Small and Medium Business Administration in 1994. The Ministry of Commerce and Industry and the Small and Medium Business Administration actively encouraged the use of the name throughout the industry. On January 20, 1995 five major economic organizations of the Korean Employers Federation including the Korea Chamber of Commerce and Industry, Korea Trade Association, Korea Federation of Small and Medium Business and Federation of Korean Industries, played a key role in organizing the 100PPM Quality Innovation Implementation Institution and Korea Standards Association. The Korea Federation of Small and Medium Business donated funding for its establishment.

The Implementation Institution within the Korea Chamber of Commerce and Industry led efforts on facilitating the participation of 706 corporations in the implementation of the 100 PPM Quality Innovation in 1994, which was the first year of its implementation. In promoting this, the institute was involved in multiple initiatives including: the creation of an atmosphere for the diffusion and distribution of the 100PPM Quality Innovation activity and the provision of education and active PR and support. As of 2011, approximately 134 large corporations and over 10,000 subcontractors have participated in the Single PPM Quality Innovation efforts (100PPM was changed to Single PPM).

As Korean companies pursue globalization to compete with leading corporations of advanced countries, the policy task of quality innovation is more urgent than anything else. From that aspect 100PPM Quality Innovation efforts were critical in in making Korean products into global leading products. The movement turned a new chapter for quality innovation of small and medium corporations in Korea.

The 100PPM Quality Innovation initiatives sought to establish a Quality Assurance System at the early stages through continuous quality innovation and to activate the production system with the goal of achieving a zero defect rate in the long run. In the short-term, the goal was to reduce the level of defect rate in shipping and delivery to less than 100PPM by realizing a reduction in defect, quality enhancement and cost saving. The ultimate purpose of this the movement was to grow revenues and to facilitate corporate development by intensifying the competitiveness of corporations and meeting customer needs through quality enhancement. Actually, the 100PPM Quality Innovation efforts have contributed to enhancing product quality, particularly for large corporations and their subcontractors that actively participated. As of the end of 1999, a total of 635 corporations showed a decrease in defects by 70.3% for final products and by 41.6% for delivery. That is to say, the average defect rate of quality certified corporations for shipping reached 25.27PPM while the delivery defect rate of large corporations reached 12.30PPM level.

As such, even though the 100PPM Quality Innovation initiatives were implemented in a relatively short period, corporations which implemented it systematically and practically are evaluated to have raised their competitiveness based on absolute enhancement of quality in the course of overcoming IMF crisis.

Table 2-2-4 | Status of Defect by Business Type of 100PPM Quality Certification Corporations

(As of the end of 1999)

Category		Number of Corporations	Number of Certified Items	Average Process Defect Rate (ppm)	Average Finished Goods Defect Rate (ppm)	Average Delivery Defect Rate (ppm)
Business type	Motor Parts	228	371	3,163.87	26.66	12.01
	Machinery	37	52	2,694.67	17.52	14.25
	Electricity	94	104	7,147.19	23.77	13.95
	Electronics	260	326	8,446.36	27.38	12.46
	Steel	2	3	2,368.60	0	0
	Chemicals	8	10	9,195.91	35.73	0.90
	Miscellaneous	6	7	8,297.00	7.73	3.29
Total		635	873	5,692.85	25.27	12.30

Source: Single PPM Quality Innovation Implementation Institution of Korea Chamber of Commerce and Industry (2000), "Single PPM Quality Innovation Theory and Implementation Strategy".

2.2.2.1. Basis of Setting 100PPM Target Quality Level

The question may be as to what is base for achieving quality objective of 100PPM. It is deemed that 100PPM is a concrete goal with symbolic meaning for driving the movement to achieve zero defect rate, which was pursued nationally or throughout industry, and should be the only objective to be accomplished. Depending on each case it is used, the goal of achieving 100PPM in quality could be too much such as the case of bricks or while it could be too little in the case of semiconductor which requires high precision and quality. In this sense, we do not need to stick to the meaning of 100 too much and the figure 100 can be adjusted with flexibility depending on the level of quality demanded.

The basis of setting the symbolic objective of 100PPM is based on C-TV, an electronic product which represents Korea in overseas market. At the time, the defect rate of C-TV of Korea was 3% whereas the product defect rate of Sony of Japan was known to be 1% level. The objective of achieving a product defect rate was set at 1% for Korean TV products and it was made a top priority to raise competitiveness. As such, the level of allowed defect rate for each part was calculated as 100PPM assuming that each TV is assembled with 100 core parts with serial connection. The value that was calculated in this way was set as the objective for 100PPM Quality Innovation.

2.2.2.2. High degree of Accuracy for Product and Objective Quality of Parts

Recently, a high degree of accuracy is required as the complexity of industrial products has increased exponentially, as we can see from Table 2-2-5. Accordingly, the level of attention on the quality of respective parts which comprise the product needs to be more and more thorough.

Table 2-2-5 | Transition of High Degree of Accuracy for Industrial Products

Product Name	Number of Component Parts (n)
Transistor Radio	102
TV Set	103
Communications Satellite	104
Automobile	2×104
Electronic Computer	2×105
Electronic Switchboard	106

When we assume that the defect rates (p) of component parts are all the same, the yield of the final product which comprised of n parts can be calculated using the equation R = (1 - p)n. For example, let us assume that the defect rate for parts, the inputs for production is 100PPM, and these parts are direct inputs for automatic assembling process without inspection, the expected yield of final product can be calculated as in Table 2-2-6.

Table 2-2-6 | Change in Yield of Final Product depending on the Number of Parts

Number of Parts (n)	10	100	1,000	10,000	100,000	1,000,000
Part Defect Rate (p)	100PPM					
Yield of Final Product (R)	0.999	0.99	0.905	0.368	0.000045	3.7×10^{-44}

As we can see from Table 2-2-6, the expected yield of the final product would be reduced to 36.8% if the number of parts exceeds 1,000, even though a defect rate of 100PPM is assumed. A yield of not more than 0.0045% can be secured if the number of parts is 100,000. After all, when the number of parts increases, even achieving a defect rate of 100PPM seems far away.

Inversely, the objective quality level(p) for the input part fixing the yield(R) of final product can be calculated using the following equation:

$$p = 1 - R^{1/n}$$

For example, when the final product yield of 99% is assumed as the objective, the level of objective quality for respective parts depending on the number of input parts is as per Table 2-2-8. That is to say, in order to secure a high quality of good of 99% for low price products like a toy, which is comprised of only 10 parts, a quality level of 1,005PPM for the respective parts will be sufficient. However, in the case of products composed of 10,000 parts, the required quality level for the parts is 1PPM. Especially, in case a product is composed of more than 100,000 parts like an electronic switchboard, a level of 0.01PPM, i.e., 10PPB (Parts per Billion: New unit to measure the number of defect product out of 1 billion items) is required.

Table 2-2-7 | Change in Objective Quality Level of Parts depending on the Number of Parts

Number of Parts (n)	10	100	1,000	10,000	100,000	1,000,000
Yield of Final Product (R)	0.99					
Objective Quality Level of Parts (PPM)	1,005	100	10	1	0.1	0.01

2.2.3. Single PPM Quality Innovation Activity

Thanks to the development of science and technology, the corporate management environment has been changing very fast. Amid increasing competition due to globalization, consumer-centered markets and environmental issues have led corporations to a point where they cannot compete unless they supply the best product at the lowest price at the time customer want it. For corporations to thrive and secure sustained growth under fierce competition, corporations needed to secure competitiveness in terms of price, quality and timeliness. Especially, the securing of high quality for products and parts is perceived as just basic condition for competition and therefore achieving a higher level of quality compared to competitors has become more important than anything else.

Accordingly, corporations had to attain a higher level of quality objective, even higher than 100PPM, which has been the standard so far. Also, changes in approach and implementation method for quality innovation were required. In other words, the level of quality of products and parts needed to be upgraded to the level of world renowned corporations. It was the time for Korea to establish and promote optimum condition utilizing more diversified quality improvement techniques. Korea needed to adjust the quality objective from existing 100PPM to Single PPM level based on the idea that the application of higher quality objective should be expanded to cover not only automobiles, electricity and electronics industries centered on assembling, cutting and processing but also machinery, chemical and material industries to intensify the competitiveness of Korea’s national industry.

The following changes in temporal situation and management environment served as the basis for pursuing a more perfect quality level:

① Activation of worldwide sourcing through Internet
② Intensification of overseas buyers’ requirement for quality level
③ Active measure to cope with the quality that is used as a means for restructuring of vendors
④ Measure to cope with the Product Liability (PL) Act which became effective from July 2002
⑤ Goodwill basis competition with newly introduced 6 Sigma

Against this background, the name of the existing ‘100PPM Quality Innovation Implementation Institution’ was changed to ‘Single PPM Quality Innovation Implementation Institution’ from January 1, 2000. The Single PPM Quality Innovation activity seeks to reduce the shipping and delivery defect rate to less than 10PPM in the short run but in the long run it means ‘No Defect and Perfect Production Movement’ which pursues zero defect rates.

The ultimate purpose of the Single PPM Quality Innovation was the same as the 100PPM Quality Innovation effort, which sought to increase the growth of revenue and the development of corporations by reinforcing the competitiveness of corporations and realizing customer satisfaction through quality enhancement.

2.2.3.1. Definition and Objective of Single PPM

2.2.3.1.1. Definition of Single PPM

When defining Single PPM using the description in the ‘Single PPM Quality Certification Procedure,’ the word single means a one digit unit of less than 10 as well as the figure one. And PPM is an abbreviation of Parts Per Million meaning the number of parts out of one million. But it also means Perfect Production Movement. In this regard, Single PPM incorporates two meanings that drive the Quality Innovation Movement which manages defect rate ultimately aiming at producing perfect products with no defect.

The Single PPM Quality Innovation initiative, which aims at enhancing the quality of products and parts of domestic small and medium corporations is a movement for securing competitiveness in order to realize revenue increase and greater competitiveness through quality enhancement, cost reduction and productivity enhancement with support from the government and large corporations, and voluntary and active participation of subcontractors.

2.2.3.1.2. Objective of Single PPM

The objective in implementing Single PPM can be set at the following three levels:

- First, Government (national) level: Reinforcement of quality competitiveness and national competitiveness
- Second, Short-term Corporate level: Management of product defect rate to less than 10PPM
- Third, Long-term Corporate level: No Defect Movement to achieve product defect rate of 0 PPM and Reinforcement of corporate competitiveness through perfect production of products

In order to actively cope with the recent changes in the corporate environment driven by globalization, networking, speed and flexibility, Korean corporations need to reinvent themselves. Based on recent reports conducted by reputable world institutions, Korea’s national competitiveness is less than expected.

According to the national competitiveness ranking of 61 countries analyzed by the Graduate School of International Management Development of Switzerland in 2006, Korea was ranked 38th. The survey on national competitiveness conducted by IMD computes the national ranking by adding up the scores from the evaluation of 238 items for 4 fields classified in the following: 38 economic items, 61 in government efficiency, 60 in corporate efficiency and 79 in development infrastructure. Considering the fact that the size of Korea’s GDP is ranked 12th in the world, a ranking of 38 in 2006 for national competitiveness is very much unsatisfactory.

Particularly, Korea was ranked at 47th for information administration efficiency and the 45th for corporate management efficiency. Korea needs to pay special attention to improving corporate efficiency as it is falling behind, and this was has been assessed due to a lack of flexible labor market, and nationalism in corporate management. In this regard, it will be meaningful to find the way to overcome these issues effectively by addressing the challenges and preparing for growth based on the intensification of quality competitiveness at the national level through Single PPM Quality Innovation initiatives. The objective of Single PPM Quality Innovation is to strengthen the quality competitiveness and national competitiveness.

2.2.3.2. Philosophy of Single PPM

The philosophy of Single PPM Quality Innovation is pursue fundamental solutions in raising quality standards. This starts from the reduction of the defect rate to less than 10PPM in the short run. It also requires that all the organizations and processes involved in the production process should be conscientized and stabilized from quality aspect. It is crucial that all subcontractors and suppliers who are part of the manufacturing process understand this to achieve high quality.

Before implementing Single PPM Quality Innovation, consensus on the importance of achieving top level quality should be reached both at national and corporate level.

When we think about how the tragedy of the space shuttle disaster was caused by a malfunction of a small part worth only a few cents and the loss of the Mars space probe was due to a mistake in the conversion of weight measurements, , we can see the importance of building consensus and promoting wide participation to undertake fundamental changes in improving quality standards. For state-of-the-art products or systems to be able to function properly as designed, the production system and quality level of part manufacturers should be enhanced first. Strong parts are essential to produce solid products.

As a standard of quality based on Single PPM cannot be realized by words or slogans alone, it is necessary to demonstrate results based on action. As such, new methods are required to control and manage the process and result simultaneously. In this regard, Single PPM Quality Innovation, which is being introduced and adopted by small and medium-sized corporations in Korea, should bear meaningful fruit.

- **Objectives of Implementation**

- Reinforcing the growth of large and small/medium size corporations together.

The growth base of large and small/medium-sized corporations will be strengthened by promoting Quality Innovation System and techniques at small and medium-sized corporations through large corporations, which should help to reduce the defect rate and improve quality.

- Enhancing the quality standards of the Part/Assembly Industry.

Promoting quality improvement techniques and strengthening the criteria used to screen for Quality Certification to raise the quality of parts manufacturers in the automobile, electricity and electronics industries to international standards.

● Implementation Direction

1. Promoting the growth of large and small/medium size corporations together through Single PPM
2. Expanding Single PPM education for large and small/medium corporations
3. Providing guidance on the establishment of Quality Innovation System to small and medium-sized corporations, and the expansion of Certification

2.2.3.3. History of Single PPM Quality Innovation Implementation Institution

- 1991. Introduction of '100PPM Movement' by Hyundai and LG to improve quality standards of subcontractors
  - 100PPM Movement: An initiative to reduce the number of defective products to less than 100 out of 1 million
- December 1994. The Ministry of Commerce and Industry and five major economic organizations agreed to expand the promotion of the 100PPM Movement to other industries
  - Small and Medium Business Administration designated as administrating organization (Considering it involved mostly small and medium-sized corporations)
  - Korea Chamber of Commerce and Industry in charge of leading the initiative with financial and administrative support from 5 major economic organizations
- January 1995. '100PPM Quality Innovation Implementation Institution established in Korea Chamber of Commerce and Industry
- July 1995. Established '100PPM Quality Certification Procedure (Small and Medium Business Administration Notification)
- August 1995. First 100PPM Corporation Certificate No. 1 issued (Seoul Motor Wheel Ind. Co.)
- January 1999. Funding and administrative support to other organizations suspended due to foreign exchange crisis in 1997 and subsequent IMF rescue package
  - 1999. Korea Chamber of Commerce and Industry initiated efforts along with staff of three and budget of 100 million won
- October 1999. First Certification issued to overseas corporation (China Sunkwang Electronics Baegeon Ltd.)
- January 2000. Converted to Small and Medium Business Administration funding project

and adopted Single PPM as new quality standard.

- Project Funding Source (600 million won): Funding from Small and Medium Business Administration (500 million won) with additional funding from Korea Chamber of Commerce and Industry (100 million won)
- Single PPM: Number of defective products should be less than 10 out of 1 million

- September 2000. Announced the Quality Certification Procedure for Public Administration Sector (Korea Chamber of Commerce and Industry Procedure)
  - The sectors other than small and medium-sized corporations are certified in the name of Korea Chamber of Commerce and Industry.
- October 2000. First Public Administration Sector Certification issued to public institution (Chungnam Province Office)
- November 2001. Changed the governing Act (The Small and Medium Business Basic Act → The Small and Medium Business Technology Innovation Promotion Act)
- January 2007. Revised Single PPM Quality Certification Procedure
  - Further breakdown of Grade Classification (Single PPM, 100PPM → Perfect, Single PPM, 100PPM, 1,000PPM)
  - Systemization of Post Control (Site screening every year → 1st year: Document screening, 2nd year: Site screening, 3rd year: Screening for renewal)
- December 2007. Second Public Administration Sector Certification issued (Small and Medium Business Administration)
- September 2009. First Certification to the corporation in Gaeseong Industrial Complex issued (Seongrim Precision Ind. Co.)
- December 2009. Total number of Certifications issued (Accumulated): 1,758 items

2.2.4. Need for Single PPM Quality Innovation

The competitiveness of goods can be largely categorized into price and quality competitiveness. Under infinitely competitive market, quality competitiveness becomes more important than price competitiveness. In an environment where developing countries continue to catch up to Korea and advanced countries are more protective of their technology, Korean goods are gradually being pressured from lower price goods from developing countries and high quality products from advanced countries.

The “Booz,Allen Hamilton Korea Report (December 1997)” mentioned that “Korea is just like a nut which was put into nutcracker because of the attacks from both sides of Cost of China and Efficiency of Japan. It is destined to be cracked if not changed.” American buyers perceive the same thing, noting that the quality of Korean product is better than Chinese products but inferior to Japanese products while its price competitiveness is better than Japanese products but higher than Chinese products.

Country		Korea	Japan	Taiwan	China	Mexico
Quality Competitiveness	2001. 1.	0.35	0.93	- 0.35	0.19	- 0.62
	2002. 12.	0.42	0.71	- 0.40	0.08	- 0.80
Price Competitiveness	2001. 1.	0.03	- 0.69	0.76	0.21	0.01
	2002. 12.	0.06	- 0.69	0.67	0.20	- 0.13

Note: This is based on the processing of the result of survey and analysis conducted by New York Branch of Korea Trade Association on American buyers (550 corporations in 2001 and 445 corporations in 2002) who have business relationship with Korea, and '1' represents high level of competitiveness and less than '1' represents lower competitiveness.

- the quality competitiveness of Korean corporations was only 66.0% of top global corporations, and it is estimated to take approximately 4.7 years for Korean corporations to reach their level.

Category	Quality Competitiveness (A)		Price Competitiveness (B)		Composite Competitiveness (A+B)	
	Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation
Our Corporation level vs. Comparing Corporations (%)	70.9	66.0	78.3	74.0	74.4	70.4
Time required to reach to the level of Comparing Corporation (Year)	3.5	4.7	3.3	4.1	3.7	4.8

Note: The result of analysis of "Single PPM Quality Innovation activity related questionnaire Survey" conducted by Single PPM Quality Innovation Implementation Institution for 862 officers and employees of corporations in 2004.

- Based on corporation size, the quality competitiveness of small and medium-sized corporations was at 68.7% level of top global corporations, which was below large size corporations (77.0%), while the quality competitiveness of non-certified corporations, which could not obtain Single PPM Quality Certification, was at 67.1% which was lower than that of Single PPM certified corporations (69.4%).

Category		Quality Competitiveness (A)		Price Competitiveness (B)		Composite Competitiveness (A+B)	
		Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation
D(%)	Large Corporation	80.3	77.0	87.3	76.7	83.3	75.3
	Small/ Medium	71.3	68.7	74.0	71.1	67.1	66.7
	Certified	71.6	69.4	75.5	73.3	67.5	66.9
	Non-Certified	70.3	67.1	70.5	65.8	66.3	65.1
E(yr)	Large Corporation	2.0	2.3	2.2	2.5	2.2	2.6
	Small/ Medium	3.1	4.2	2.6	3.4	2.9	3.8
	Certified	3.0	3.8	2.5	3.0	2.7	3.3
	Non-Certified	3.2	5.3	2.8	4.4	3.2	4.9

Note: 'D' represents the level of our corporation vs. comparing corporations(%), and 'E' represents the period(Year) required to reach the level of comparing corporations.

- Based type of business, the quality competitiveness of electricity industry was relatively higher at 83.3% compared to other businesses while other industries were at the level of 60%.

Category		Quality Competitiveness (A)		Price Competitiveness (B)		Composite Competitiveness (A+B)	
		Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation	Overseas Competing Corporations	Top Global Corporation
D(%)	Automobile	67.9	61.3	74.2	68.9	71.4	65.8
	Electricity	83.3	83.3	73.3	66.7	76.7	76.7
	Electronics	76.5	67.8	76.4	70.7	74.7	68.9
	Chemical	76.5	70.2	78.5	75.2	75.0	71.0
	Others	73.8	68.0	78.5	73.0	74.1	70.3
E(yr)	Automobile	3.9	5.1	3.4	4.5	3.8	4.9
	Electricity	2.3	2.3	2.0	2.3	2.3	2.3
	Electronics	2.8	3.9	2.6	3.2	3.1	3.9
	Chemical	3.2	4.3	3.6	5.2	4.3	5.3
	Others	2.8	3.9	2.1	3.0	2.5	3.5

Note: 'D' represents the level of our corporation vs. comparing corporations (%), and 'E' represents the period (Year) required to reach the level of comparing corporations.

- According to IMD of Switzerland, the quality of Korean products relative to price (the level of domestic products is better than foreign products) is lower than that of major competing countries.

Competitiveness	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
National Competitiveness	26th	27th	30th	36th	41th	29th	29th	29th	37th	35th	29th
Quality Level vs. Price	-	-	31th	41th	44th	31th	-	-	-	-	-

Source: IMD of Switzerland, "2005 Global Competitiveness Yearbook," May 2005.

- The management of Korean corporations mention the deterioration of quality competitiveness as a challenge for exports.

Problem Factor	Deterioration of Quality Competitiveness	Deterioration of Price Competitiveness	Depression of Overseas Business Cycle	Others	Total
Response Ratio	21.3%	32.2%	41.4%	5.1%	100.0%

Note: Survey analysis data for 205 corporations by Korea Trade Association (August 2001).

Top Korean corporations prefer 'quality improvement and high level service strategy' to 'price cutting' for the expansion of market share in the future.

Market Share Expansion Strategy	Quality/ Service	Low Price	Customer Needs Satisfaction	Specialized Sales Strategy	Alliance	Others	Total
Response Ratio	35.4%	3.0%	16.7%	16.7%	16.7%	11.5%	100.0%

Note: Result of Questionnaire Survey on the management strategy of 90 domestic first class product manufacturing corporations (72 products) conducted by Industrial Research Institute at the request of the Ministry of Knowledge & Economy (February 2002).

- Korea implemented the Product Liability Act effective from July 1, 2002.
  - The Act addresses the liability of manufacturers, in terms of losses and damage incurred by consumers due to the defect of manufactured goods.
  - Kinds of Defects: Manufacturing defects, design defects, and marking defects
  - Parts and raw material manufacturers bear joint liability with finished goods manufacturers

- Accordingly, the most urgent challenge is to reduce poor quality and defective products and to secure reliability of products from consumers in the world amid the trend of globalization.

3. Single PPM Process

3.1. Procedures of the Single PPM Quality Innovation Movement

The Single PPM Quality Innovation Movement is considered to be an upgraded version of the Korean "100 PPM Quality Innovation Movement." Each company adopts the approaches to solving problems, taking the following steps of the initiative. According to the Single PPM Quality Innovation Movement, however, the 12 steps offered under the 100 PPM Quality Innovation Movement were simplified into 6 steps, while methods used in each step were strengthened. This is viewed as new systematic approaches to improve the final product as well as causes and processes.[30]

Table 2-2-8 | Steps of 100PPM Quality Innovation Enhancement

Steps	Details	Steps	Details
1	Making preparations	7	Taking, evaluating, and making up for countermeasures
2	Selecting a target product	8	Standardization
3	Analyzing types of defects	9	Evaluating improvement plans
4	Analyzing causes	10	Following-up control
5	Establishing countermeasures	11	Spreading
6	Making improvement plans	12	Presenting results

In order to succeed in the Single PPM Quality Innovation Movement, the achievement of Single PPM Quality Innovation should be set up as the primary goal of a company, and all management and staff should persistently push ahead with quality innovation. Additionally, techniques appropriate for the six steps of 'S · I · N · G · L · E' should be utilized and systematically pushed ahead, from the preparation to completion stage, to achieve the goal.

The six steps of 'S · I · N · G · L · E' are designed to ensure success in the Single Quality Innovation Movement. They are as follows:[31]

① S (scope definition) step: The company establishes a unit in charge of the efforts and

30. Koo, Il Seob, Lim, Ik Sung & Kim, Tae Sung (2000b), "A Comparative Study on Single-PPM Quality Innovation Movement," *Journal of the Korean Society for Quality Management*, Vol. 28, No. 4, pp. 184-193.

31. Lee, Kyung Jong (2006), *Techniques Used for Single PPM Quality Innovation Movement*, Small and Medium Business Administration & Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry, pp. 9-12.

clarifies CTQ (Critical to Quality), or the elements that decisively impact the quality of goods supplied to its customers, to select an improvement project that is suitable.

② I (illumination assessment) step: The company identifies current quality issues and investigates its processes to define response variables and analyze its measurement system. The company can assess the credibility of its data at this stage.

③ N (nonconformity analysis) step: The company can study and analyze response variables that were found at the previous stage and specifically find out when, where, how and why they were incurred, by using statistical skills.

④ G (goal selection) step: The company can assess its current quality level. By benchmarking, it can set a suitable goal and estimate outcomes.

⑤ L (level-up) step: As to the core elements that have been analyzed at the N stage, the company can establish and take improvement measures to achieve objectives that have been defined at the G Stage. Furthermore, the company can evaluate its work and implement standardization to secure continued improvement effects.

⑥ E (evaluation) step: To maintain the improved quality level, the company continues to monitor and evaluate overall improvement projects and quality systems. Afterwards, the company can declare the completion of the Single PPM movement for the given item and apply the Movement to the other items.

Table 2-2-9 | Details of Action Agenda for the SINGLE Stages

No.	Stages	Details of Action Agenda
1	S Stage	Establishment of movement pursuit unit & inauguration ceremony, selection of application items, preparation of the master plan
2	I Stage	Analysis of defect types, identification of quality demand, establishment of improvement categories
3	N Stage	Data analysis, cause analysis, decision on core causes
4	G Stage	Establishment of improvement stages, establishment of PPM targets by stage, posting a current situation board
5	L Stage	Establishment of quality improvement measures, implementation and evaluation of improvement measures, standardization for technology and management
6	E Stage	Application for Single PPM certification, follow-up control, expanding application to the entire items

Source: Kwon, Young Woo (Jun 2010), *A Study on the Efficiency and Productivity Evaluation of Quality Management Activities of Small and Medium-sized Enterprises by Using DEA*, Soongsil University.

Activities for the Single PPM Quality Innovation Movement at each stage (S-I-N-G-L-E) are as follows:

- Activities for Single PPM Quality Innovation by stage[32]

1. S Stage: Preparation

Stages	Activities	Details	Practical Techniques
S Stage: Preparation	1.1 Creating a company-wide boom	1) Developing a common bond 2) Education, training, and promotion 3) Doctrines, mottos, slogans, a current situation board, declaration of TOP 4) Welcoming ceremony (doctrines, certificate of appointment, adopting a resolution) 5) Forming an organization and work allotment 6) Team leader, assistant administrator, secretariat, collaboration company, team members, messengers 7) Single PPM education 8) Training a person in charge 9) Day of Quality	Diagnosis sheet Establishing a system inside the company
	1.2 Establishing plans	1) Making improvement and innovation plans 2) Priority lists 3) Policy administration 4) Estimating activities	Gantt Chart List of goals
	1.3 Priority Promotion Lists	1) Operating a council(daily, weekly, monthly quality meetings) 2) Managing a current situation board 3) Managing quality rating 4) Quality exhibition 5) Reporting system on quality problems 6) Benchmarking of top companies 7) Examination of standards and change control 8) Diagnosis inside the company 9) Computerization of quality information	Minutes Utilization of QISS Training examinants inside the company
	1.4 3Jung5S	1) Posting a bulletin board 2) Conducting 3Jung5S activities 3) Total inspection 4) My Machine Movement 5) Statistical process control	Activities of 3Jung5S Diagnosis Sheet SPC

32. Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry (2010), <http://sppm.korcham.net>.

2. S Stage: Data Collection and Application

Stages	Activities	Details	Practical Techniques
S Stage: Data Collection and Application	2.1 Quality analysis of product items	1) Productivity, quality, defect rate/ability of process	Process and inspection documentation Analysis of Q-Cost
	2.2 Selecting target items	1) Activities based on data (Investigation on defect rates) 2) Emphasis-oriented 3) Team-centered 4) Preventing recurrence 5) Prevention beforehand	Quality history card Table for quality problems SPC software
	2.3 Analysis of product function and process	1) Selecting CTQ 2) Arrangement of quality problems	Selecting CTQ Matrix QFD
	2.4 Administration by eye inspection	1) Red label, sign area, danger levels, board on defects, sign arrangement 2) TPM	Various charts Control chart Check sheet

3. I Stage: Illumination Assessment

Stages	Activities	Details	Practical Techniques
I Stage: Illumination Assessment	3.1 Analysis of measurement system(R&R)	1) Collection of measured data 2) Analysis of measured system 3) Correction	Table of Data Collection MSA Cpk
	3.2 Human examination		
	3.3 Process examination	1) Understanding of measured characteristics 2) Analysis of deficient numerical value	Control Chart Histogram Cpk/Cp
	3.4 Rate of inconsistence		
	3.5 Managing a claim		
	3.6 Rate of quality problem arrangement	Analysis of defect types	

4. N Stage: Nonconformity Analysis

Stages	Activities	Details	Practical Techniques
N Stage: Nonconformity Analysis	4.1 Differential	1) Data Collection 2) Analysis of key figures	Data collection by type Differential Cause and effect diagram Interrelation charts 5W1H analysis Control chart Brainstorming Analysis of correlation between processes Comparative analysis of other types
	4.2 Caution present	Analysis by site, phenomenon, matter	
	4.3 Present condition of process control	SPC	
	4.4 Analysis of causes	1) 4M +measurement 2) Standard floor plan, working environment 3) Lay out flow of distribution, safety	
	4.5 Correlation between processes	1) Analysis of correlation between factors 2) Analysis of causes for defect types	

5. G Stage: Goal Selection

Stages	Activities	Details	Practical Techniques
G Stage: Goal Selection	5.1 Benchmarking for goal setting	1) Management philosophy (mindset) 2) Benchmarking process 3) Analysis and comparison data of other companies 4) Analysis of benchmarking differences	Benchmarking
	5.2 Goal setting for each improvement project	Setting improvement steps based on priority	Table of matrix
	5.3 Forecasting expected effectiveness	Managing by goal	Goal
	5.4 Goal setting at each stages (period terms)	Current situation board on the company's long-term strategies	Managing policies

6. L Stage: Level up

Stages	Activities	Details	Practical Techniques
L Stage: Level up	6.1 Establishing improvement measures	1) Measures to eradicate defect causes 2) Measures to downsize quality distribution 3) Measures to improve machine ability 4) Measure to improve process ability	Analysis of causes Analysis of 5 whys
	6.2 Three-dimensional measures	1) Measures to prevent recurrences 2) Retention and management measures 3) Prevention measures	Analysis of causes Fool p proof control chart Check sheet
	6.3 Interchange appraisal		
	6.4 Evaluation appraisal		

7. E Stage: Evaluation

Stages	Activities	Details	Practical Techniques
E Stage: Evaluation	7.1 Evaluation	1) Record of total, sample and check inspection 2) Evaluation of improvement results based on FMEA process	Achievement for examination records
	7.2 Progress Management	Managing posted results	Using minutes
	7.3 Defective item improvement results	Trends for process ability improvement results	Index for process SPC diagnosis sheet
	7.4 Index management	1) Index management (process ability, defect rate, productivity, period of delivery, regular position) 2) Using the current situation board	
	7.5 Diagnosis and evaluation	1) Daytime plant manager 2) 3Jung5S management	3Jung5S Check sheet
	7.6 Process for disorder treatment	1) Handling of abnormality 2) Process of handling abnormality 3) Evaluation and making up	Notification of unusual quality, report on countermeasures
	7.7 Evaluation and making up	Examples of Single PPM improvement cases	Feedback system

8. E Stage: Data Adjustment and Confirmation

Stages	Activities	Details	Practical Techniques
E Stage: Data Adjustment and Confirmation	8.1 Standardization	1) Regulations 2) Standardizing business process	QC process chart Job standards Table for priority management
	8.2 Adjustment management	Standard revision	
	8.3 Post management	1) Management of distribution 2) Decision on completion 3) Evaluation on quality results	Table for 5M adjustment Index management SPC diagnosis sheet 3Jung5S activities Check sheet
	8.4 Spreading	Progressive spreading out	
	8.3 Post management	1) Management of distribution 2) Decision on completion 3) Evaluation on quality results	Table for 5M adjustment Index management SPC diagnosis sheet 3Jung5S activities Check sheet

9. E Stage: Self-Evaluation and Application for Certification

Stages	Activities	Details	Practical Techniques
E Stage: Self-Evaluation and Application for Certification	9.1 Reorganizing the evaluation system	Confirmation on satisfaction of standard conditions	Sales, defect rate, Cpk
	9.2 Processes of self-evaluation	1) Check evaluation lists of Single PPM quality certification 2) Confirmation on trained judges 3) Application for certification	Certification of Single PPM quality Evaluation list certification application form Attachments
	9.3 Confirmation and guarantee of TPM-level quality	1) TPM activities 2) Check sheet for 3Jung5S	Self-preservation activities Table for progressive evaluation

3.2. Techniques Used for Single PPM Quality Innovation

According to Shin Hyun Jae's research (2007) on companies, that pursued Single PPM quality innovation, companies used the following the techniques: 3Jung5S (21.7%), the process capability index (15.1%), the control chart (10.4%) and Graph · Pareto Diagram · Histogram (10.4%). Table 2-2-10 shows the ratio of using A-cost, the QC process chart, the cause and effect diagram and TPM.[33]

Table 2-2-10 | Major Techniques Used for Single PPM Quality Innovation by Companies

Techniques	Response rate (%)	Techniques	Response rate (%)
3Jung5S	21.7	Fool-Proof	3.8
Process Capability Index	15.1	Check Sheet, Scatter Diagram	3.8
Control Chart	10.4	Benchmarking	2.8
Graph · Pareto · Diagram · Histogram	10.4	Division of Tasks	2.8
A-Cost	7.5	FMEA	1.9
QC Process Chart	6.6	Service and Quality Improvement Techniques	0.9
Cause and Effect Diagram	5.7	Sampling	0.9
TPM	4.7	Experimental Design	0.9
-	-	Total	100

Source: Shin, Hyun Jae (2007), "The Role of Parent Companies and Suppliers for Single PPM Movement Revitalization," *Journal of the Korean Institute of Plant Engineering,* Vol. 12, No. 4, pp. 19-33.

According to Shin Hyun Jae's research (2009)[34] based on decisions of the steering committee, more than 50% of the committees used four techniques including: Q-cost, the Process Capability Index, three-dimensional improvement measures and management interviews, as shown in Table 2-2-11.

33. Shin, Hyun Jae (2007), "The Role of Parent Companies and Suppliers for Single PPM Movement Revitalization," *Journal of the Korean Institute of Plant Engineering,* Vol. 12, No. 4, pp. 19-33.
34. Shin, Hyun Jae (2009), "Analysis of Utilization Level of Quality Tools during Single PPM," *Journal of the Korean Institute of Plant Engineering*, Vol. 14, No. 1, pp. 89-95.

Table 2-2-11 | Techniques Used for Single PPM Quality Innovation

Ratio of Use	Utilized Techniques
Over 50%	Q-cost, Process Capability Index, three dimensional improvement measures, management interviews
From 40% to 50%	Education (QC 7 tools), welcoming ceremony (Adopting resolution, promotion meeting), standardization at work places, Pareto, external customers' satisfaction index, creating boom (badges, slogans, mottos, labels), QC process chart (flow of process, process introduction), internal audit, 6 steps of Single PPM
From 30% to 40%	Cause and effect diagram, benchmarking, control chart, analysis of defect causes, defect control, graphs
From 20% to 30%	SPC, FMEA process
From 10% to 20%	Division of tasks, proposal
Below 10%	45 techniques including brainstorming, 5 whys

Source: Shin, Hyun Jae (2009), "Analysis of Utilization Level of Quality Tools during Single PPM," *Journal of the Korean Institute of Plant Engineering,* Vol. 14, No. 1, pp. 89-95.

3.3. Single PPM Quality Certification System

3.3.1. Single Parts Per Million

The term "Single PPM" was created when the 100 PPM Quality Innovation Movement was renamed the Single PPM Quality Innovation Movement. The Single PPM Quality Innovation Movement seeks to reduce the number of defects to below 10 out of one million industrial items produced.

The unit "PPM (parts per million)" is originally derived from PPM (particle per million), which is applied in the field of chemistry. PPM means Parts Per Million, and it ultimately pursues 100% Perfect Production Movement with a 0% defect rate. Thus, the Single PPM Quality Innovation Movement seeks to achieve the concept of Single PPM through quality innovations. Table 2-2-12 shows the definition of relevant terms.

Table 2-2-12 | Major Terminologies of Single PPM

▶ PPM: Parts Per Million
▶ Single PPM: Single Parts Per Million
▶ Single PPM Quality Innovation Movement: In a short-term perspective, the Single PPM Quality Innovation refers to quality innovation efforts that involve all participants of a company to achieve the goal of reducing the number of defect products to a single-digit PPM level, meaning less than 10 out of one million units. In a long-tem perspective, the Single PPM Quality Innovation refers to efforts to create Zero-Defect products by pursuing to diminish the defect rate to 0%.
▶ Single PPM Quality Certification: Single PPM is certificated when the defect rate is below 10PPM and 100PPM is certificated when the defect rate is from 10PPM to 100PPM.

3.3.2. Summary of Single PPM Quality Certification System

The Small and Medium Business Administration (SMBA) grants the Single PPM Quality Certificate to small and medium-sized enterprises (SMEs) that have a quality management system and maintain their product defect rate at a certain level. Parts of the ISO 9000 Series, a set of international standards for quality, are used to examine whether a company is equipped with a quality management system.[35] Moreover, the product quality certification criteria are set to evaluate whether a product has achieved a Single PPM level defect rate through consistent upgrading activities.

The grading system of Single PPM Quality Certification is as follows: 1,000PPM grade applies to a company that produces more than 100 and less than 1,000 defective products among a million manufactured products, while 100PPM grade applies to a company that produces more than 10 and less than 100 defective products. Single PPM grade applies to a company that produces less than 10 products with defects, while Perfect Quality grade applies to a company with zero defective products.[36] The four-tier grading system is designed to make it easier for new companies to take a phase-by-phase approach to reach the Single PPM grade, since it is extremely difficult to obtain the Single PPM grade with a first try.

35. Koo, Il Seob (2006), *Manual for Single PPN Quality Certification Screening*, Small and Medium Business Administration & Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry, pp. 53-55.
36. "Outline for Single PPM Quality Certification," December 18, 2008, Small and Medium Business Administration Notice No. 2008-55.

- Four-tier Grading System for Single PPM Quality Certification

Grade	Perfect Quality	Single PPM	100PPM	1,000PPM
Defect Rate	0	Less than 10	Between 10 and 100	Between 100 and 1000
Grade Title	Perfect	Best	Excellent	Satisfactory

However, if a defect rate cannot be metrizable because of a product's characteristic, special standards set by a deliberation committee can be used for certification. Factories or divisions that produce relevant products are separately certified.

3.3.3. Criteria for Single PPM Quality Certification

Two criteria are used to determine Single PPM Quality Certification. First, when an applicant company supplies products to its parent company, (a) counting from the previous month from the time the application is submitted, the average defect rate for the past six months inspected at the buyer side and at the supplier side meets the Single PPM Quality Certification Criteria, and (b) the combined total for plant evaluation using the Plant Evaluation Criteria exceeds 70 points.[37]

Second, when an applicant company supplies products to companies other than its parent company, (a) counting from the previous month from the time the application is submitted, the average defect rate inspected at the supplier side and the average defect rate calculated on the number of accounts for claim and follow-up measures of claim for the past six months meets the Single PPM Quality Certification Criteria, and (b) the combined total for plant evaluation using the Plant Evaluation Criteria exceeds 70 points.

An applicant for Single PPM Quality Certification has to fulfill the following two conditions. First, the applicant has to have six month's record to prove that it pursued the Movement. In other words, it must have a monthly record of average defect rate for six consecutive months. Second, the item for application has to take up more than 3% of total revenue or output, out of all products manufactured from the plant that produces the item. However, the 3% rule is not applied to additional items for certification.

This is because it is difficult for an SME to simultaneously launch the Single PPM Movement for its entire product lineup. This condition is designed to induce an applicant to start

37. "Outline for Single PPM Quality Certification," December 18, 2008, Small and Medium Business Administration Notice No. 2008-55.

small by targeting one item and expanding the number gradually.

To obtain Single PPM Quality Certification, SMEs must first draw up plans to systematically implement quality innovation. SMEs that lack expertise may seek guidance and submit an application form to SMBA. If a company is selected, a member of the Administration's advisory committee will lead the company's Single PPM Movement.

When a company has built a quality management system and lowered its defect rate to Single PPM grade, it can apply for Single PPM Quality Certification. Auditors evaluate the application form, and when a certain score level is obtained, the Administrator of SMBA issues the Single PPM Quality Certificate. The application form for certification is submitted to and evaluated by the Single PPM Quality Innovation Promoting Center, and if the form is in good order, the Center Director must order the submission of supplementary documents within seven days.

● Process of Single PPM Quality Certification

Apply for Single PPM guidance and selections are made ➡ Experts provide guidance ➡ Apply for Single PPM Certification ➡ Evaluate documents / plants ➡ Issue certificate upon passing

The Center Director selects two auditors to carry out on-site inspections, and notifies schedules for on-site inspections and provides a list of auditors to the applicant company.

• On-site inspection is performed within two days
  - The period can be extended when necessary due to reasons such as the scale of a factory and the characteristic of a product.
• Exemptions for on-site inspection
  - Factories that have ISO9000, ISO/TS16949, PMS[38], ISO22000, ISO13485, TL9000, and AS9000 certificates.
  - Companies that already have Single PPM Quality Certificate and are applying for the certification of additional products or applying for a change of grades.

Additionally, should the Center Director find, on the basis of the on-site inspection report, that the applicant company meets the selection criteria, the Director shall request the Administrator of SMBA for certification. Upon receipt of such request, the SMBA Administrator shall review, produce and deliver the Single PPM Quality Certificate to the applicant company.

38. PMS (Productivity Management System), PMS has been conducting by Korea Productivity Center to level-up productivity of domestic manufacturing industry from 2004

3.3.4. Plant Evaluation Criteria for Single PPM Quality Certification[39]

Group Items	Sub-Group	Points	Remarks	
I. Single PPM Quality Achievement & Business Outcome	(8)	(35)		※SMEs that have certificates such as ISO9000, ISOTS16949, GQ, PMS, ISO22000, ISO13485, TL9000, and AS9100 are exempted from evaluation items indicated with the ★sign (13 out of 25, 25 points out of 100)
★ 1. Single PPM Achievement	2	20	* Common evaluation item	
2. Business Performance	6	15	* Common evaluation item	
II. Continuity in Process Improvement	(13)	(11)		
1. Measurement, Analysis and Improvement Plans	1	1		
★ 2. Measurement and Monitoring	3	2	* Common evaluation item	
3. Management of the Nonconformity	2	1		
4. Data Analysis	1	1		
5. Improvements	3	1		
★ 6. Approach Depending on the Process of Single PPM Improvement	3	5	* Common evaluation item	
III. Quality Network System Management	(19)	(15)		
1. Realization Process Planning	1	1		
2. Customer-related Process	2	2		
★ 3. Design and Development	5	3	* Common evaluation item	
4. Purchasing	3	2		
★ 5. Production and Service Operation	6	5	* Common evaluation item	
6. Control of Measuring and Monitoring Devices	2	2		
IV. Customer Satisfaction and Quality Management Strategy	(5)	(7)		
1. Customer Focus	2	3		
2. Quality Directive Objective and Planning	3	4		
V. CEO's Leadership and Management Responsibility	(12)	(17)		
1. Management Resolve	1	1		
2. Quality Management System	7	5		
3. Management Review	1	1		
★ 4. Management's Resolve and Participation Level	3	10	* Common evaluation item	
VI. Training and Development Human Resources	(8)	(15)	* Common evaluation item	
1. Resource Management	1	1		
2. Human Resources	2	1		
3. Information	1	1		
4. Facility	1	1		
5. Working Environment	1	1		
★ 6. Single PPM Training Performance	2	10		
TOTAL: 6 Classifications and 26 Group Items	65	100		

39. Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry (2010), <http://sppm.korcham.net>.

3.3.5. Meaning of Single PPM Certification Evaluation

If a finished good, through quality innovation activities, is deemed to have met the evaluation standards for Single PPM Quality Certification, on-site inspection will be placed in accordance with the evaluation criteria and method to be discussed in Chapter 3 of Standards Textbook. Moreover, if the product quality satisfies the Single PPM evaluation standards, a certificate will be issued. These processes are explained in detail in Chapter 2 of Standards Textbook.

Here, we will discuss what a company can expect from adopting quality management and undergoing processes to receive Single PPM quality certificate, and what meaning it has on overall management.

① Quality of past, present and future are subject to evaluation.

Even if the quality of a product meets the criteria at the time of evaluation, this does not guarantee Single PPM Quality Certification. Certification requires confirmation that product quality have been maintained at the Single PPM standards up to the present, and will be maintained or even improve in the future. In other words, past quality must have been maintained at the present level, present quality must satisfy the Single PPM Quality Certification requirements, and future quality must be kept and managed at the present level for a certain period. Table 2-2-13 shows the meaning of quality certification.

Table 2-2-13 | Structure of Quality Certification[40]

	Requirements	Methods
Past Quality	Whether records of quality and management for the past six months meet evaluation criteria	Document evaluation
Present Quality	Whether quality of application item meets Single PPM quality certification requirements	On-site product and record inspection
Future Quality	Whether present quality can be maintained in the future	Evaluation of overall quality system

"Past Quality" checks whether the quality of a product not only satisfies the Plant Evaluation Criteria at the time of plant inspection but also has been satisfying the standards for more than six months. It can be understood as a way of demanding managerial requirements for quality assurance. If numerous factors that influence quality are not maintained under

40. Kim, Won Joong, Lee, Kyung Jong, Kim, Youn Sung & Seo, Jin Young (2000), *Single PPM Quality Innovation Theory and Movement Strategy*, Small and Medium Business Administration & Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry

managerial control, product quality cannot be stably maintained at a certain level.

For instance, even if an athlete who had been hospitalized until yesterday has a good health record today, the athlete cannot be expected to give a good performance again tomorrow or in the future. To expect a solid performance, the athlete must have maintained his or her health at least for the past six months. A game record cannot improve in a single day. The athlete needs to attain perfect health through health management.

Managerial requirements can be explained by the PDCA cycle below.

- P (Plan)

All requirements for Single PPM Quality Certification are prepared for, and quality management system is built. Consulting by external experts and Single PPM quality education for management administrators are also included in this step.

- D (Do)

This is an overall implementation step. In accordance with the revised Single PPM Quality Innovation System, all management processes such as raw material inspection and process control are implemented through newly planned methods that are deemed the most rational. In this step, various management records can pile up more than before, but these are necessary. Rather, this means all processes are being properly managed now.

- C (Check)

This step is to check and evaluate the results of implementation. Everything cannot be controlled in the most economical and rational way like originally planned. Thus, improvements or supplements may be necessary on a whole or in part. For example, after a company has used the method of "sampling inspection by attributes for continuous production" to carry out intermediate inspection of a manufacturing process, if the manufacturing process is stable for a while, it may consider switching to the method of "management sampling inspection." Without this reviewing step, the desired effect from management cannot be expected.

- A (Action)

This is a step to take actions against problems discovered in step C. A significant change can be made or methods of omitting, combining, modifying, and supplementing can be used. These methods can incur great costs and take up considerable time in some cases.

It is difficult to say that these steps require several years because a company may already have a Single PPM system, and may be performing better than the Plant Evaluation Criteria. However, it is hard for a company that is unfamiliar with these steps to acquire the Single PPM Quality Innovation System in a short term.

Therefore, after a company has built a comprehensive quality management system that fits its situation, it needs to operate under this system for at least six months before applying for certification. “Past Quality” is evaluated based on records of operation during this period.

Plant auditors check the “Present Quality” when they inspect a plant to confirm the quality level of application items. Of course, not only quality, but also records of quality management are subject to evaluation. If present quality satisfies the criteria but past quality does not, the certification process cannot proceed further.

“Future Quality” is an extension of past and present quality. Certification is not possible based on the fact that quality criteria were satisfied at the time of plant inspection. The quality must be kept at this level at least until future inspection for follow-up measures to be implemented. Therefore, a tool is needed to assess whether present quality is sustained in the future, a practice that cannot resort to self-regulation by certified companies or observation by the certification authority.

In this regard, the reason the Plant Evaluation Criteria evaluate a company’s Single PPM promotion strategy and education and training performance is because this information can be used to assess whether quality is and will be managed and kept at the current level.

② Single PPM Quality Certification requires both quality products and quality assurance system.

The Single PPM Quality Certification System checks whether the quality of products meets the Plant Evaluation Criteria, and whether an overall quality assurance system is equipped and operated for maintaining quality. If certification was awarded based on only product quality, this would be a mere practice of inspection.

The ISO 9000 series are one of the most widely known tools that certify organizations for quality management systems. The focus of ISO 9000 series is placed on quality management system. ISO awards certification to companies whose minimum requirements for quality management have satisfied the standards set by ISO 9000 series. Therefore, even if a company received the ISO 9001 certificate, it would be a misleading to advertise that the company’s quality of products manufactured under the system has met certain standards. ISO certification does not mean product quality is good or is at a certain level, but guarantees that a quality management system meets minimum requirements.

Single PPM Quality Certification is different from ISO. Quality of certified products is below 100PPM or Single PPM. Moreover, it certifies that the management system for quality assurance is suitable for quality management.

For companies that accept Single PPM plant inspection, this is a good opportunity not only to obtain broad knowledge, but also to receive objective analysis and evaluation by experts.

To acquire quality products and establish quality management system, more efforts need to be taken other than just checking the company's preparation and product quality and comparing them with the evaluation criteria. The Single PPM Quality Certification System can be utilized as a tool to establish the most efficient quality management system for a company's specific industry and size. To realize such synergy effects, it is important who examines the certification and what processes are taken.

For a company applying for certification, the inspection process itself can serve as a beneficial opportunity to receive analysis and guidance on quality management. Auditors and companies under inspection should take into consideration that, in some cases, the effect of guidance and advice from experts may be better than the effect of certification.

Therefore, the inspection process of Single PPM Quality Certification can be a good opportunity for applicant companies to introduce and promote a quality management system. Also, it can help these companies build a technical bond and relationship based on trust with their parent companies. It is important for companies to be aggressive in utilizing these opportunities given by the Single PPM Certification System.

③ Comparison of Quality Certification System

The Single PPM Quality Certification System has further improved and developed its operation system and evaluation standards since it was launched. It is similar to KS Certification in that it certifies good quality, but is different in that it differentiates the level of quality. Moreover, the combined ISO 9001 places importance on the quality of products, but it only specifies requirements for a quality management system. These certification systems can have merits and demerits depending on the objective and conditions of applicant companies. However, instead of wasting time on comparing these systems, companies should focus on how they can efficiently utilize these systems to realize quality innovation and management improvement.

Table 2-2-14 summarizes the similarities and differences of Single PPM Quality Certification, KS Certification, and ISO 9001 Certification.

Table 2-2-14 | Comparison of Quality Certification Systems[41]

	Item	Single PPM	ISO 9000	KS
Differences	Focus of Certification	Quality of a product	Quality management system	Quality of a product
	Applicable Law	Minor Enterprise Basic Law	Quality Management and Industrial Products Administration Law	Laws for Industrial Standardization
	Supervisory Authority	Government	Private organization	Government
	On-Site Product Testing	No	No	Commissioned to a certified organization
	Inspection Exemption	ISO certified companies	None	ISO certified companies
	Third Party Certification	Not regulated	Regulated	Not regulated
	Preliminary Inspection	No	Yes	No
Similarities	Classification	Certification, not permission		
	Obligation	Recommendation, not obligation		
	Inspection Areas	Plant inspection and document screening		
	Follow-Up Control	Evaluation for follow-up control		
	Inspection Authority	Private organization		
	Certification Areas	Quality is the key word		

3.3.6. Qualifications of Auditors

Qualifications of Single PPM Quality Certification auditors are prescribed in Clause 15 of the Outline for Single PPM Quality Certification (under Small and Medium Business Administration Notice No. 2008-55, announced on December 18, 2008).

1. A person who completed the S-PPM Certification Reviewer and Advisor Course (for more than 20 hours) at the S-PPM Quality Innovation Special Education Institute and is either one of the following:

a. A person with B.A. degree and above (or with the same level of degree from overseas), who took courses on Quality Management or the respective fields of items to be reviewed, and has more than five years of field experience.
b. A person with junior college education, who has more than 7 years of field experience.

41. Kim, Won Joong, Lee, Kyung Jong, Kim, Youn Sung & Seo, Jin Young (2000), *Single PPM Quality Innovation Theory and Movement Strategy*, Small and Medium Business Administration & Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry

c. A person with high school degree, who has more than 10 years of field experience.

d. Quality Innovation Scheme Reviewer, in accordance with the Quality Management Promotion Act Article 7 Section 2.

e. Ph.D. or Licensed Technician in Quality Management or the respective fields of review items, who is accredited in Korea or Overseas.

2. A person who is an active S-PPM Review Committee member.

3.3.7. Logo of Single PPM Quality Certification

Single PPM Quality Certification logo[42] is as below.

The model of design for Single PPM Quality Innovation Movement is designed to emphasize the need for action to drastically reduce defect rate and enhance competitiveness, and ultimately to keep pace with the globalization trend. Furthermore, the model symbolizes the need for precision in quality management, by graphically displaying the hand and eye. Also, the design is made to show an OK sign meaning completion and perfection, which implies the successful achievement of the movement's ultimate objective.

3.3.8. Government's Support for Holders of Single PPM Quality Certificate

- Additional points granted in SMBA's evaluation process to select SMEs for providing SME Start-up & Promotion Fund
- Preferential treatment given when SMBA designates companies eligible to hire industrial skilled workers, meaning that they will be assigned with surplus military draftees who will substitute their work for their mandatory military service
- Preferential treatment given when SMBA allocates foreign industrial technical trainees
- Preferential treatment given in SMBA's evaluation process to select companies for SME Technology Innovation Development Project
- Preferential treatment given when SMBA allocates sales booths in SME-exclusive Department Store and Permanent Exhibition Hall

42. The Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry (2010), <http://sppm.korcham.net>

3.4. Law Enactment and Amendment and Financing

3.4.1. Law Enactment and Amendment for Single PPM Quality Innovation Project

Year	Enactment and Amendment
Jul 1995	Enacted the 100PPM Quality Certification Guideline
Sep 2000	Announced Public-Administration Quality Certification Guideline * Certification granted by the Korea Chamber of Commerce and Industry in case of companies other than SMEs
Nov 2001	Changed applicable law (Minor Enterprise Basic Law → Promotion Law for Minor Enterprise Technique Innovation)
Jan 2007	Amended the Single PPM Quality Certification Guideline * Level segmentation (Single PPM → 100PPM → Perfect, Single PPM, 100PPM, 1,000PPM) * Systematized follow-up control (on-site inspection every year → document screening in the first year, on-site inspection in the second year, and renewal inspection in the third year)

3.4.2. Financing

- December 1994 the Ministry of Commerce and five leading economic organizations in Korea agreed to expand 100PPM Movement to all industries

- January 1995 Established the 100PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce and Industry (KORCHAM)

Allotment of Funding and Labor Force Dispatch by Organization

	KORCHAM	FKI	KITA	KBIZ	KSA	FPS	SBC	Total
Contribution (million won)	310	310	310	35	35	-	-	1,000
Number of Dispatched Manpower	3*	1	1	1	-	1	1	8

* The KCCI personnel (3 persons) consist of a director general (executive director), a team leader (manager), and a staff member (director).

- January 1999 Ceased funding and labor force dispatch due to the Korean financial crisis
  • In 1999, Enforcement the project by KORCHAM Labor (Three Labor) and Financing (One hundred million won)

- January 2000 SMBA was made in charge of funding and quality target was revised up to Single PPM
  • Project Finances (600 million won): SMBA contribution 500 million won + KORCHAM 100 million won (matching fund)

Contributions

(Unit: million won)

Classification	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
SMBA	500	700	730	730	600	600	600	600	700	700	700	7,160
KORCHAM	100	100	100	100	100	100	100	100	100	100	100	1,100

* Before 2000 (1995-1999), the project was operated by the five leading economic organizations' funding.
* Since 2000, KORCHAM contributed one hundred million in cash and five hundred million in kind (offices, etc.), totaling six hundred million won.

4. Achievements from Promoting Single PPM Quality Innovation

4.1. Achievements from Promoting Single PPM Quality Innovation[43]

Companies that promote Single PPM Quality Innovation activities ultimately see improvement in competitiveness. Looking at the outcome specifically, they can be largely divided into two groups. First are quantitative results that include 1) reduction of product defects, costs, rework and retouching, number of claims, overdue payments, and quality costs, and 2) increase of sales and profit through customer satisfaction. In other words, fewer product defects reduce costs, and through improvement of quality, customer satisfaction rises, and accordingly, sales and profit grow, enhancing the company's operational performance. Second are qualitative results that include building of a quality system, change of quality mindset and

43. Kwon, Young Woo (Jun 2010), *A Study on the Efficiency and Productivity Evaluation of Quality Management Activities of Small and Medium-sized Enterprises by Using DEA*, Soongsil University.

behavior, establishment of customer-oriented thinking, improvement of product and corporate public image, and realization of a more efficient working and operating environment. That is, a quality system is established; a mindset of quality is embodied by all including the CEO; and the company's, along with its products, brand image improves.[44]

The main achievements of the 100PPM Quality Innovation Movement promoted between 1995 and 1999 as the forerunner of the Single PPM Quality Innovation Movement are as follows.

According to a report by Koo Il Seob et al. (2000b),[45] Seoul Wheel Industry, Co., an automotive disc wheel producer, was the first to receive the 100PPM Quality Certificate on August 31, 1995. Since then, a total of 636 companies obtained the 100PPM Quality Certificate by December 31, 1999. These achievements are largely contributed to the active support of the Korean government as well as the guidance and support of 40 parent companies in electrical and electronics industries to raise the quality level of suppliers.

Even when Korea was placed under the IMF bailout program in December 1997, companies promoting 100PPM Quality Innovation enjoyed positive effects such as sales growth, increased customer base, and lowered factory and delivery defect rates. In particular, these Korean companies revealed their strength by overcoming domestic demand contraction through exports.

Excellent quality became a very useful tool when tapping into the global market. However, a more important achievement than this tangible effect was that these Korean companies became aware of the importance of quality and gained a strong confidence in quality innovation by actually realizing the 100PPM quality level, which was considered an absolute level that no one could easily reach. Such confidence, an intangible effect of the 100PPM Quality Innovation Movement, can work as a foundation to produce high quality products when parent companies and suppliers cooperate mutually.

According to an analysis by Koo Il Seob et al. (2000b)[46] on the business performance of companies that applied for 100PPM award in 1998, these companies showed much better performances than other SMEs in terms of sales as well as productivity per capita and the

44. Kwon, Young Woo (2005), *Single PPM Quality Innovation Project and Certification System*, Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry, pp. 3-7.
45. Koo, Il Seob, Lim, Ik Sung & Kim, Tae Sung (2000b), "A Comparative Study on Single-PPM Quality Innovation Movement," *Journal of the Korean Society for Quality Management*, Vol. 28, No. 4, pp. 184-193.
46. Koo, Il Seob, Lim, Ik Sung & Kim, Tae Sung (2000a), "A Study on the Direction of the Development of 100PPM Quality Innovation Activities," *Journal of the Korean Society for Quality Management*, Vol. 28, No.2, pp. 147-160.

number of customers. The analysis pointed out that this indicates the effectiveness of 100PPM Quality Innovation Movement.

Assuming SiVEX (Single PPM Value Evaluation Index), an enterprise value of Single PPM Quality Certification, at an average 48 million won per company, Kim Ki Chan estimated in his research (2004)[47] that SiVEX totaled 44.4 billion won between 1995 and 2003 when 925 companies acquired Single PPM (including 100PPM) certification.

Achievements from promoting Single PPM Quality Innovation, analyzed by the Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce and Industry, are as follows. First, looking at the performance of Single PPM Quality Innovation guidance, a total of 2,295 SMEs received Single PPM guidance from 1995 to 2008. During the three years between 2006 and 2008, SMEs that received guidance for Single PPM increased added value by 78.9 billion won, meaning each company boosted added value by an annual average of 113 million won. Major reasons behind such increase in added value seem to be the fostering of quality mindset and education on quality improvement techniques. Also, SMEs that received guidance cut down their factory defect rate by an annual average of 69.9%.

Table 2-2-15 | Major Achievements of Companies that Received Guidance for Single PPM Quality Innovation

Classification	1995～99	2000～05	2006	2007	2008	Total
Number of companies that received Single PPM guidance	769	828	221	217	260	2,295
Increase in added value (100 million won) (average per company)	- (-)	- (-)	267 (1.21)	228 (1.05)	294 (1.13)	789 (1.13)
Decrease in factory defect rate (%)*	-	-	-76.8	-59.9	-72.5	-69.9

Note: Sum and weighted average between 2006 and 2008.

Most of the SMEs that received guidance in 2008 responded that the Single PPM guidance contributed to establishing the virtuous cycle of profit generation by improving product quality and customer confidence, which bolstered sales and curtailed costs, ultimately resulting in an increase in net profit.

47. Kim, Ki Chan (2004), *Single PPM Quality Innovation and Corporate Competitiveness*, Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce & Industry, pp. 98-100.

Table 2-2-16 | Qualitative Results of Companies that Received Guidance for Single PPM Quality Innovation in 2008

Business Performance	Great Contribution	Contribution	Average	Minimal	None	Sum (%)
Quality Improvement	39.8	42.6	14.5	2.7	0.4	100.0
Customer Confidence Improvement	38.7	43.3	14.1	3.9	0.0	100.0
Sales Increase	6.6	40.2	39.9	8.6	4.7	100.0
Cost Reduction	16.4	50.0	27.0	5.1	1.5	100.0
Net Profit Increase	9.4	45.7	32.4	9.4	3.1	100.0

Note: Results are from a 2008 survey by the Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce and Industry conducted to 260 SMEs that received guidance for Single PPM quality innovation.

Looking at the outcome of certification, 1,651 SMEs acquired Single PPM Quality Certification from 1995 to 2008. During the three years between 2006 and 2008, Single PPM Quality certified companies achieved the outcome of lowering factory defect rate by an annual average of 96.8%.

Table 2-2-17 | Main Achievements of Single PPM Quality Certified Companies

Classification	1995～99	2000～05	2006	2007	2008	Total
Number of Single PPM Quality Certified Companies	636	483	206	215	111	1,651
Decrease in Factory Defect Rate (%)	-		-97.2	-99.5	-90.6	-96.8*

Note: Sum of Decreases in Factory Defect Rate is a weighted average between 2006 and 2008.

Table 2-2-18 | Desired Activities to Improve Quality by SMEs

Classification	Single PPM Quality Innovation Movement	ISO	Six Sigma	Etc.	Total
Response Rate (%)	37.4	37.4	17.4	0.7	100.0

Note: Results are from a 2008 survey by the Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce and Industry conducted to 1,241 business executives and staff members.

Regarding the question about which tool Korean SMEs would aggressively utilize to improve their quality level, 44.5% of respondents chose Single PPM, 37.4% ISO, and 17.4% Six Sigma.

In order to achieve the desired results from promoting Single PPM Quality Innovation Movement, the management and workers must first set a clear and concrete quality goal and take the initiative to accomplish such goal with a strong will. According to a survey asking the interested parties of SMEs about what they thought was needed to efficiently promote Single PPM Quality Innovation, 76.1% of respondents replied "managers and workers' awareness and change of attitude," 14.7% answered "intensified education," 5.2% replied "stronger support by the government," and 4.0% answered "stronger support by parent companies." The survey results show that the most important driving force behind Single PPM Quality Innovation is the awareness of organization members.

Table 2-2-19 | Major Tasks of Companies to Promote Single PPM Quality Innovation

Task	Managers and workers' awareness and attitude change	Intensified education	Stronger government support	Stronger parent company support	Total
Response rate (%)	76.1	14.7	5.2	4.0	100.0

Note: Results are from a 2008 survey by the Single PPM Quality Innovation Promoting Center at the Korea Chamber of Commerce and Industry conducted to 1,241 business executives and staff members.

The regional distribution of Single PPM Quality certified companies is shown in Table 2-2-20. Gyeonggi Province took up the largest portion with 456 companies (27.6%), followed by Gyeongnam with 275 (16.7%), Gyeongbuk with 219 (13.3%), Busan with 135 (8.2%), and Incheon with 116 (7.0%).

Table 2-2-20 | Regional Distribution of Single PPM Quality Certified Companies

(As of Dec 31, 2008)

Region	Number of Enterprises	Portion (%)	Region	Number of Enterprises	Portion (%)
Seoul	51	3.1	Chungbuk	42	2.5
Busan	135	8.2	Chungnam	81	4.9
Daegu	112	6.8	Jeonbuk	25	1.5
Incheon	116	7.0	Jeonnam	17	1.0
Gwangju	29	1.8	Gyeongbuk	219	13.3
Daejeon	4	0.2	Gyeongnam	275	16.7
Ulsan	63	3.8	Jeju	0	0.0
Gyeonggi	456	27.6	Overseas	17	1.0
Gangwon	9	0.6	Total	1,651	100.0

Meanwhile, looking at the regional distribution of Single PPM Quality certified companies in overseas, as shown in Table 2-2-21, a total of 17 companies located in four countries received the certification. China accounted for the largest portion with 12 companies, followed by Malaysia with three companies.

Table 2-2-21 | Regional Distribution of Single PPM Quality Certified Companies in Overseas (As of Dec 31, 2008)

Year	China	Malaysia	Thailand	Indonesia	Total
1999	1	-	-	-	1
2000	4	3	-	-	7
2001	2	-	1	-	3
2002	-	-	-	1	1
2003	1	-	-	-	1
2004	-	-	-	-	-
2005	3	-	-	-	3
2006	-	-	-	-	-
2007	1	-	-	-	1
2008	-	-	-	-	-
Total	12	3	1	1	17

Despite the considerable amount of achievements made by the Single PPM Quality Innovation Movement since its introduction in 1995, many SMEs, large conglomerates, and related organizations in Korea are still not aggressive in promoting the movement, a matter that needs to be reexamined.

4.2. Implications

The Single PPM Movement is a quality innovation movement and a management innovation movement as well. The Single PPM Quality Innovation Movement, which has been promoted for over 15 years since 1996 embracing parent companies and SMEs, is the most appropriate management innovation action plan in the era of global competition.

For 15 years, 2,599 SMEs established quality systems and 1,758 companies acquired Single PPM Certification through the Single PPM Quality Innovation Movement as of December 2009.

In particular, the Movement, which had been limited to the automobile, electrical, and electronics sectors, has been spreading widely since 2006 to the shipping, electricity, chemical, and metal sectors. It has also been adopted in the medical equipment consumer goods sectors as well as the distribution sector such as home shopping. Growth in the machinery industry was noticeable in 2009, with 49 out of 107 certified companies (45.8%) in the machinery business.

The Single PPM Movement carries out quality certification as well as system establishing activities, and it supported 304 companies in establishing a quality system last year. As a result, the sales of companies that received support increased by 71.5% on average compared to the previous year, and their process defect rate and delivery defect rate both decreased 38.9% and 74.1%, respectively. Also, according to a survey of 304 companies on the need and expected outcome of the Single PPM Movement, 91.1% (276 companies) replied that they needed continuous support, and more than 80% answered that product quality and customer confidence improved.

The purpose of green growth is to minimize emissions and protect the environment, and the Single PPM Movement contributes to green growth. If defect rate is lowered and productivity is improved through Single PPM, this not only reduces wastes generated from product defects but also enables the efficient usage of energy and curtails the usage of raw materials. The Single PPM Movement is also useful for promoting co-prosperity among SMEs as well as between large conglomerates and SMEs. Medison, a medical equipment manufacturer, has been supporting 69 suppliers on quality innovation activities for three years since 2007, and 14 companies among them have acquired Single PPM Quality Certification. In addition, Medison makes on-site visits to directly give guidance on manufacturing from scratch, attempting to achieve a shared growth through cooperation. This is a good example of the Single PPM Movement through which a parent company improved productivity by finding ways to attain co-prosperity with suppliers.

It is not too much to say that the Single PPM Quality Innovation Movement is a survival strategy in the era of infinite competition. Excellent quality is the best weapon for Korean companies to pull down the barrier of cost competition, and also a useful tool to secure global competitiveness by attaining co-prosperity between SMEs and large conglomerates.

The most important success factors behind Korea's economic development were industrial policies that well reflected historical situations, and also R&D investments and excellent workforce. In this regard, human resources development must come first before promoting quality management.

4.2.1. Technology Development and R&D Results

R&D investments in Korea have reaped fruitful results under the support of legal systems and social infrastructure. The following Table 2-2-22 shows the growing trend of R&D investments. Total economic development expenses, 10.9 billion won in 1970, soared by almost

60 times to 621.78 billion won in 1983. Moreover, the ratio of R&D investments to the Gross National Product (GNP) rose from 0.39% in 1970 to 1.06% in 1983. The ratio between government R&D spending and private R&D spending reversed from 71:29 to 28:72, indicating that private companies are leading R&D spending instead of the government.

Table 2-2-22 | R&D Investments during 1970 and 1983

(Unit: million won)

Year	R&D investments	Government funds	Private funds	Government funds: private funds(%)	GNP (billion won)	R&D to GNP (%)	Number of researchers	Number of researchers per thousand population
1970	10,947	7,414	3,023	71:29	2,735	0.39	-	-
1971	10,666	7,285	3,380	68:32	3,375	0.32	-	-
1972	12,028	7,965	4,062	66:34	4,154	0.29	5,599	0.17
1973	15,628	8,271	7,356	53:47	5,378	0.29	-	-
1974	38,182	25,051	13,130	66:34	7,530	0.51	7,595	0.22
1975	42,663	28,458	14,204	67:33	10,092	0.42	-	-
1976	60,900	39,461	21,438	65:35	13,881	0.44	11,661	0.33
1977	108,285	51,705	56,580	48:52	18,115	0.60	-	-
1978	152,418	74,447	77,971	49:51	24,225	0.63	14,749	0.40
1979	173,038	94,790	79,247	54:46	31,249	0.56	-	-
1980	211,726	109,281	102,445	52:48	37,204	0.57	18,434	0.48
1981	293,131	121,726	165,226	43:57	45,775	0.64	-	-
1982	457,688	187,898	268,747	41:59	51,787	0.88	-	-
1983	621,749	169,554	451,047	28:72	58,428	1.06	32,117	0.80

Source: KAIST (statistics on R&D investments were officially complied from 1970).

The number of research organizations expanded from 297 in 1970 to 1,061 in 1983, while the number of privately-funded R&D organizations increased sharply from 107 in 1970 to 723 in 1983. During this period, the number of researchers also surged to 32,117 in 1983 from 2,458 in 1970, but unlike the quantitative expansion, the qualities of Korean researchers failed to reach those of their counterparts in developed countries.

Korea’s most valuable resource is its human resource, and the nation’s remarkable economic growth was achieved on the backs of scientists, engineers, and skilled and semiskilled technicians. Therefore, in discussing science and technology policies and industrialization, human resource development has to be mentioned.

The number of students registered in formal education institutions of different educational levels, has soared since 1960, and the number of students enrolled in elementary school increased by five times until 1983. The increase was even greater in higher level education: the number of students enrolled in high schools surged by more than 18 times from 1945 to 1980, and the number of students enrolled in college or higher education institutions skyrocketed by more than 51 times during the same period. Table 2-2-23 shows the percentage of educational enrolments by conresponding age group.

The percentage already surpassed 100% before 1970 in the case of elementary schools. As for middle and high school, the percentage exceeded 90% in the early 1980s, and in the case of university, it almost approached 25% in 1982. Wider educational opportunities rapidly lowered the nation’s illiteracy rate from 27.9% in 1960 to 11.6% in 1970 and 5.0% in 1975. In 1980, it was hard to find anyone that was illiterate in Korea.

Table 2-2-23 | Percentage of Educatinal Enrolments by Age Group

(Unit: %)

School	1953	1955	1960	1965	1970	1975	1979	1982
Elementary school (age 6-11)	59.6	77.4	86.2	91.6	102.8	107.6	113.1	104.6
Middle school (age 12-14)	21.1	30.9	33.3	39.4	53.3	74.0	93.2	95.7
High school (age 15-17)	12.4	17.8	19.9	27.0	29.3	40.5	57.1	77.4
College (age 18-21)	3.1	5.0	6.4	6.9	9.3	8.6	13.5	24.7

Source: Economic Growth and Productivity Improvement Movement in Korea, Korea Productivity Center (1986).

Several other developing countries also showed rapid growth in elementary education, but it was unusual for Korea to achieve a balanced growth across all educational levels considering its low per capita income. This worked as a very important basis for the nation’s economic development.

In case of vocational training centers, there were a few places already built with the assistance of developed countries even before 1966. However, a systematic plan for vocational training took off in earnest after the revision of the Vocational Training Act in 1966, which supplemented the formal training system to nurture skilled technicians. Since then, a large number of public and private vocational training institutions have been established. Moreover, in 1976, the Vocational Training Act was revised again to oblige business organizations with more than 300 employees to build in-plant vocational training centers. The number of students who completed vocational training also grew steadily during the past 10 years. While the number of high school graduates increased from 20,100 in 1972 to 55,000 in 1980, the number of vocational training graduates grew from 11,500 to 81,200 during the same period. In conclusion, it can be said that Korea’s rapid economic development was attributed to the expansion of educational opportunities across all educational levels, which was achieved at least 10 years earlier than the initial economic development plan.

Table 2-2-24 is a comparison with other developing countries on the percentage of workers with two-year college degrees or higher to total employment. Korea's percentage has shown a steady increase each year, rising from 14.6% in 1991 to 35% in 2007. This implies that the nation's superior human resources have contributed to its economic development.

Table 2-2-24 | College Graduates among Workers Compared with Developing Countries

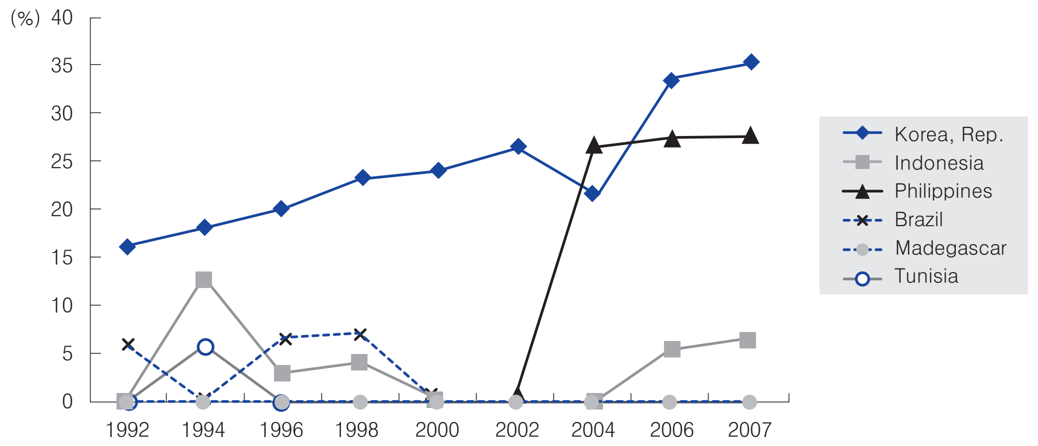
(Unit: %)

Country Name	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Korea, Rep.	14.6	16.2	17.8	18.2	19.2	20	20.3	23.2	23.5	24	24.9	26.7	30.3	21.5	32.3	33.7	35
Indonesia	..	..	..	12.8	..	3	..	4.2	..	..	..	..	..	..	..	5.6	6.5
Philippines	..	..	..	..	..	..	..	..	..	..	..	..	..	26.5	..	27.5	27.7
Brazil	..	5.7	5.9	..	6.3	6.5	6.9	6.9	6.9	..	..	..	..	..	..	8.6	..
Madagascar	..	..	..	..	..	..	..	..	..	..	..	..	3.4	..	3.1	..	..
Tunisia	..	..	..	6	..	..	7.1	..	..	..	..	..	..	..	..	..	..

Source: World Bank (Labor force with tertiary education (% of total)).

Figure 2-2-5 | Labor Force with Tertiary Education

(Unit: % of total)



There are many ways to acquire or transfer skills from abroad. As mentioned earlier, these methods can be divided into two groups: those that pay separate fees and those that do not. In the case of the former, it is not accurate but technology transfer can be measured. However, in the latter case, it is very difficult to measure the technology transfer, so only rough measurements are possible even with considerable effort.

Moreover, technology transfer and acquisition without separate payment carries more significance in every aspect compared to when it is paid separately.

For example, according to a study conducted by the World Bank in 1976 to analyze the relative importance of product innovation and process technology sources in the case of 112 Korean exporters, technology sources that do not entail separate fees, such as personal experience in the past, suppliers and buyers, and self-developed technologies, were used much more frequently than technology sources that entail separate fees, such as technology import agreement and technology support. However, a serious obstacle is faced when measuring technology import due to the lack of comprehensive statistical data. This is because technology import and technology sources are not and cannot be controlled by the government except for a few clearly identifiable trading methods.

Technology import contracts, approved or controlled by the government, can be measured by the number of contracts or licensing fees. Moreover, because technology import and transfer through foreign direct or joint investment can be measured directly, the number of foreign direct and joint investment cases or the investment amount can be tabulated into a statistical table and be used as an alternative statistical index for analysis. Technology transfers that occur during capital goods trade or bulk trade (i.e., turnkey-based plant construction) are measured by alternative indicators such as the number of loan approvals and the amount of loans. With regard to the trading of domestic technology through various sources, this is excluded in macro analysis because there is no government funding in the macro level. However, private companies should conduct micro analysis.

The following Table 2-2-25 presents overall statistics on various ways technology is adopted, including technology import contracts, foreign investments, and capital goods transactions. First, the number of technology transfer cases through technology import contracts totaled 2,641 during 1962 and 1983, while the total licensing fee amounted to \$830 million. In the case of foreign investments, there has been no discrimination between foreign direct investment and joint investment in terms of legal restrictions in Korea. During 1962 and 1983, the number of foreign investment cases totaled 956 with total investment amount recording \$1.7 billion. Total remittance amounted to \$490 million.

The number of business cases using loans is not clarified, but plant construction using commercial loans and other business practices using public loans made major contributions to Korea's economic growth and technology transfer. Also, the scale of capital goods import is much bigger than foreign investment and technology licensing fees, which shows the importance of capital goods import for technology development.

In the early days of industrialization in the early 1960s, the number of technology import contracts and the scale of foreign investments and capital goods imports were minimal, but they increased rapidly until 1973 when the Korean government changed policies to restrict foreign direct investments, supported by export-led economic policies, reasonable revision of foreign investment laws, and formulation of specific guidelines. Since then, while technology import contracts and capital goods imports increased continuously, foreign direct investment remained at a stable level, but began to regain momentum with policy shift to liberalization since the mid-1980s.

Table 2-2-25 | Total Trading Volume

Year	(Path a)		(Path b)		(Path c)	
	Number of foreign investment approval cases	Foreign investment ($million)	Capital goods import ($million)	Foreign investment in capital goods ($million)	Number of approval on technology import contracts	Technology licensing fee ($million)
1962	1	0.58	69.8	-	7	0.78
1963	1	2.08	116	2.08	2	0.78
1964	2	3.05	69.5	3.05	2	0.78
1965	5	10.8	60	0.63	4	0.78
1966	6	4.82	172	0.091	8	0.78
1967	12	12.7	310	1.19	35	0.73
1968	20	14.7	533	4.47	50	1.34
1969	25	6.96	593	3.13	60	2.13
1970	51	25.3	590	10.4	92	2.39
1971	57	36.7	685	17.6	47	3.36
1972	108	61.2	762	20.0	54	6.71
1973	196	158	1,160	101	67	9.87
1974	86	163	1,850	78.1	88	19.5
1975	29	69.2	1,910	27.8	99	26.6
1976	35	106	2,430	37.4	126	30.4
1977	38	102	3,010	17.2	168	58.1
1978	43	100	5,080	24.6	296	85.1
1979	42	127	6,310	42.2	288	93.9
1980	36	97	5,130	27.4	222	107
1981	42	105	6,160	20.8	247	107
1982	55	188	6,230	36.1	308	116
1983	75	268	-	36.0	360	150
Total	965	1,662.09	43,230.3	511.24	2,640	824.03

Source: *Economic Development and Productivity Improvement Movement in Korea*, Korea Productivity Center (1986).

4.2.2. Role of R&D in the Economic Development of Developing Countries

As generally recognized and discussed, technology development along with labor and capital are the major drivers of a nation's economic growth. According to a study by the Korea Development Institute (KDI), the contribution of technology was low in the 1960s and 1970s. As shown in Table 2-2-26, the contribution of technology development to Korea's economic growth stood at a mere 6% during 1966-1976, and is expected to record 13% during 1977-1991. In comparison, the contribution rate reached 22% in Japan during 1953-1971, and up to 30% in the U.S. during 1948-1964.

Table 2-2-26 | Contribution of Technology Development to Economic Growth

(Unit: %)

	Korea		Japan	U.S.
	('66~'76)	('77~'91)	('53~'71)	('48~'69)
Economic growth rate	(9.7%) 100.0	(9.5%) 100.0	(8.9%) 100.0	(4.0%) 100.0
Labor	40.0	24.0	21.0	32.0
Capital	22.0	33.0	24.0	20.0
Etc.	32.0	30.0	33.0	18.0
Technology	6.0	13.0	22.0	30.0

Source: *Long-term Outlook for the Development of a Technological Society* ('77-'91), KDI.

The relatively low contribution proves that the Korean economy has been led by labor-intensive light industries, such as textiles, footwear and electronic parts. However, the relative importance of technology is gradually rising as the nation's industrial structure changes from labor-intensive industries to technology-intensive heavy and chemical industries including semiconductor, genetic engineering, CAD/CAM and robotic technologies.

Technology did not play a significant role in Korea's economic growth in the 1960s and 1970s. In addition, R&D activities for technology development still are not considered that important compared to the adoption of foreign technologies. However, this does not mean that our own research activities and technological capabilities, which include the supply of competent and skilled workers, are not important. On the contrary, these factors are essential for the national and economic development. But we must be aware that strategies or alternatives for technology development should differ depending on the national and economic development phases.

Meanwhile, comparing the percentage of R&D investments to GDP among developed countries and China, Japan was at the top with 3.42% and Korea ranked second with 3.36% in 2008. Korea's percentage noticeably soared by about 10 times by the year 2008 compared to 1966.

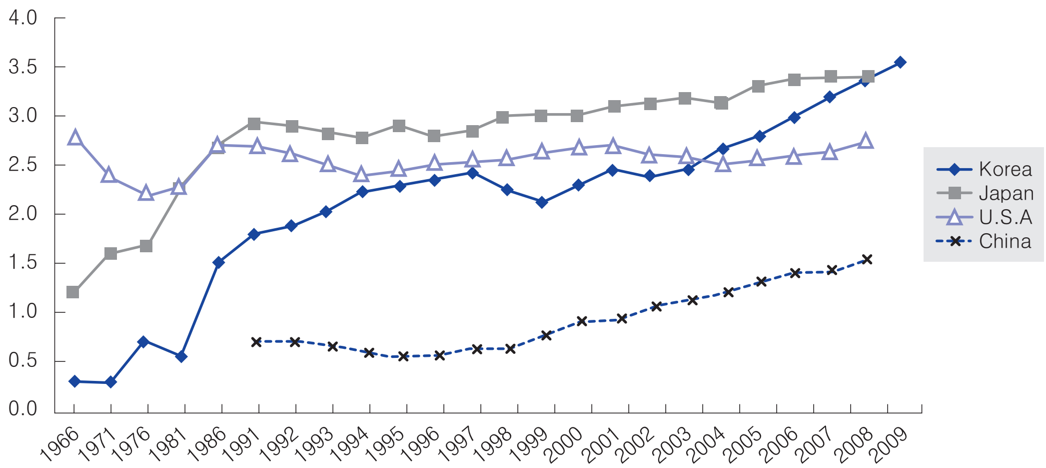
Table 2-2-27 | R&D Investments to GDP

(unit: $million)

year	Korea	% to GDP	Japan	% to GDP	U.S.A	% to GDP	Germany	% to GDP	France	% to GDP	U.K.	% to GDP	China	% to GDP
1966	12	0.31	1,360	1.24	23,846	2.84	2,240	1.81	2,200	2.05	2,590	2.40		
1971	29	0.31	3,853	1.63	26,676	2.43	4,930	2.29	2,999	1.87	3,322	2.09		
1976	200	0.70	9,919	1.72	39,018	2.21	9,857	2.20	6,230	1.75	0	0.00		
1981	430	0.59	27,126	2.33	72,750	2.34	16,806	2.35	11,495	1.90	12,106	2.35		
1986	1,728	1.52	54,551	2.73	120,562	2.72	24,573	2.63	16,353	2.15	12,640	2.22		
1991	5,670	1.80	102,233	2.96	161,388	2.72	44,605	2.47	28,906	2.32	21,396	2.03	2,995	0.73
1992	6,391	1.89	109,825	2.92	165,835	2.64	48,454	2.35	31,995	2.33	21,703	1.99	3,591	0.74
1993	7,666	2.06	123,286	2.85	166,147	2.51	45,691	2.28	30,675	2.38	19,781	2.02	4,304	0.70
1994	9,826	2.26	133,023	2.79	169,613	2.41	46,885	2.18	31,621	2.32	20,942	1.97	3,553	0.64
1995	12,240	2.30	153,182	2.92	184,077	2.50	55,217	2.19	35,880	2.29	22,146	1.91	4,185	0.57
1996	13,522	2.36	130,127	2.81	197,792	2.54	53,509	2.19	35,693	2.27	22,367	1.83	4,865	0.57
1997	12,810	2.41	122,274	2.87	212,709	2.57	48,340	2.24	31,193	2.19	23,994	1.77	6,142	0.64
1998	8,089	2.26	115,879	3.00	226,934	2.60	49,627	2.27	31,487	2.14	25,594	1.76	6,657	0.65
1999	10,028	2.17	131,973	3.02	245,548	2.64	51,342	2.40	31,459	2.16	27,390	1.82	8,201	0.76
2000	12,245	2.30	142,017	3.04	268,121	2.71	46,636	2.45	28,518	2.15	26,808	1.81	10,819	0.90
2001	12,479	2.47	127,894	3.12	278,239	2.72	46,534	2.46	29,429	2.20	26,324	1.79	12,595	0.95
2002	13,848	2.40	124,027	3.17	277,066	2.62	50,222	2.49	32,495	2.23	28,818	1.79	15,556	1.07
2003	16,002	2.49	135,280	3.20	289,736	2.61	61,554	2.52	39,016	2.17	32,488	1.75	18,601	1.13
2004	19,370	2.68	145,876	3.17	300,293	2.54	58,251	2.49	44,319	2.15	37,072	1.68	23,757	1.23
2005	23,587	2.79	151,270	3.32	323,047	2.57	69,317	2.49	45,053	2.10	39,421	1.73	29,898	1.34
2006	28,641	3.01	148,526	3.40	347,809	2.61	73,737	2.53	47,550	2.10	42,693	1.75	37,664	1.42
2007	33,684	3.21	150,791	3.44	373,185	2.66	84,148	2.53	52,953	2.04	50,016	1.79	48,771	1.44
2008	31,304	3.36	168,125	3.42	398,194	2.77	96,492	2.64	57,748	2.02	47,138	1.77	66,430	1.54
2009	29,703	3.57	-	-	-	-	-	-	-	-	-	-	-	-

Source: 1. *Main Science and Technology Indicators (Jan 2010), OECD.*
2. Bank of Korea.

Figure 2-2-6 | Trend of R&D Investments to GDP



4.2.3. Increase in Total Factor Productivity

The following is the estimated result of an analysis that examined whether R&D expenses worked as a determinant of total factor productivity in the case of large conglomerates and SMEs[48].

4.2.3.1. The Case of Total R&D Expenses

Total R&D expenses were used to calculate R&D intensity in estimating the impact of R&D on total factor productivity. The results are shown in Table 2-2-28.

First, in the case of total R&D expenses, the regression coefficient showed a statistically meaningful positive (+) relationship (0.053) in conglomerates. The SME group was estimated to have a negative relationship, but this did not carry any significance statistically. Therefore, a positive relationship between total R&D expenses and total factor productivity was confirmed only in the conglomerate group, and not in the SME group.

48. *Total Factor Productivity Analysis by Firm Size (2010)*, Korea Productivity Center

Table 2-2-28 | Determinants of Total Factor Productivity by Firm Size (Manufacturing Industry: 1997-2008, Model 1)

	Total size		Small businesses		Conglomerate	
	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect
Constant	3.657*** (10.10)	2.722*** (7.47)	2.625*** (8.00)	2.347*** (7.07)	1.487*** (4.49)	1.188*** (3.58)
R&D intensity (total R&D expense)	0.031* (1.96)	0.032** (2.16)	-0.008 (-0.80)	-0.008 (-0.81)	0.050*** (2.71)	0.053*** (2.87)
Value added rate	-0.054 (-0.83)	0.069 (1.05)	0.151** (2.54)	0.188*** (3.10)	0.311*** (5.84)	0.339*** (6.26)
Labor costs	0.300*** (12.26)	0.369*** (14.50)	0.401*** (18.06)	0.420*** (18.39)	0.380*** (13.71)	0.406*** (14.24)
R^2	0.53	0.64	0.65	0.72	0.45	0.62
Hausman m	99.26***		12.86***		16.24***	
F value		15.13***		13.71***		15.18***
Observations[2)]	20*12	20*12	20*12	20*12	20*12	20*12

Note: 1) Observations refer to industry year.
2) R&D expenses refer to total R&D expenses.
3) ***, **, * means level of significance of 1%, 5%, 10%, respectively.

Second, as for the added value ratio, which indicates the extent of added value creation, a positive significant relationship[49] was found in both conglomerates and SMEs. Thus, industries with higher capability to create added value are expected to display higher growth in total factor productivity, which can be confirmed both in the case of conglomerates and SMEs.

Third, labor cost (wage per worker), which represents the quality of labor, showed a positive significant relationship[50] in both conglomerate and SME groups. This means that improving the quality of labor including gender, age, education and technology level, contributes positively to the increase of total factor productivity in both conglomerates and SMEs.

4.2.3.2. The Case of Product-Related R&D Expenses

R&D spending on product development was used to calculate R&D intensity in estimating

49. The regression coefficient for added value ratio is estimated at 0.188 in the case of SMEs and 0.339 in the case of conglomerates.
50. The regression coefficient for labor cost is estimated at 0.420 in the case of SMEs and 0.406 in the case of conglomerates.

the impact of R&D on total factor productivity. The results are shown in Table 2-2-29.

First, in the case of R&D investment for product development, the regression coefficient showed a positive significant relationship (0.060) in conglomerates. The SME group was estimated to have a negative relationship, but this did not carry any significance statistically. Therefore, a positive contribution of R&D investment on total factor productivity through product innovation (i.e., new product development) was confirmed only in the conglomerate group, and not in the SME group.

Second, as for the added value ratio, which indicates the extent of added value creation, a positive significant relationshi[51] was found in both conglomerates and SMEs. Thus, industries with higher capability to create added value are expected to display higher growth in total factor productivity, which can be confirmed both in the case of conglomerates and SMEs

Table 2-2-29 | Determinants of Total Factor Productivity by Firm Size (Manufacturing Industry: 1997-2008, Model 2)

	Total size		Small businesses		Conglomerate	
	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect
Constant	3.672*** (10.20)	2.743*** (7.57)	2.603*** (7.96)	2.324*** (7.02)	1.142*** (3.91)	0.908*** (3.12)
R&D intensity (product development)	0.029** (2.10)	0.030** (2.27)	-0.004 (-0.46)	-0.004 (-0.47)	0.060*** (4.06)	0.060*** (4.03)
Value added rate	-0.052 (-0.79)	0.070 (1.07)	0.151** (2.54)	0.189*** (3.10)	0.342*** (7.20)	0.366*** (7.58)
Labor costs	0.295*** (11.86)	0.363*** (14.07)	0.402*** (17.95)	0.420*** (18.27)	0.418*** (16.72)	0.439*** (17.19)
R^2	0.53	0.67	0.65	0.72	0.57	0.69
Hausman m	100.19***		12.81***		17.07***	
F value		15.25***		13.72		17.76***
Observations[2)]	20*12	20*12	20*12	20*12	19*12	19*12

Note: 1) Observations refer to industry year.
2) R&D expenses refer to R&D expenses for product development.
3) Printing industry in the conglomerate group is excluded from the analysis due to lack of data.
4) ***, **, and * means level of significance of 1%, 5%, and 10%, respectively.

51. The regression coefficient for added value ratio is estimated at 0.189 in the case of SMEs and 0.366 in the case of conglomerates.

Third, labor costs (wage per worker), which represents the quality of labor, showed a positive significant relationship[52] in both conglomerate and SME groups.

4.2.3.3.The Case of Manufacturing Process-Related R&D Expenses

R&D spending on manufacturing process improvement was used to calculate R&D intensity in estimating the impact of R&D on total factor productivity. The results are shown in Table 2-2-30.

First, in the case of conglomerates, there was a positive relationship between total factor productivity and R&D investment on manufacturing process upgrade, but statistical significance was not confirmed. For SMEs, a negative relationship was estimated, but also did not carry any statistical significance. Thus, as mentioned above, the positive impact of R&D on total factor productivity through product innovation (i.e., new product development) was confirmed in the conglomerate group, but the effect of R&D on total factor productivity through process innovation was not clear in both the conglomerate and SME groups. Accordingly, it is an important task for SMEs to make R&D investments systematically and effectively to improve productivity.

Second, as the for added value ratio, which indicates the extent of added value creation, a positive significant relationship[53] was found in both conglomerates and SMEs, as in the case of Model 2.

Third, labor cost (wage per worker), which represents the quality of labor, showed a positive significant relationship[54] in both conglomerate and SME groups, as in the case of Model 2.

The analysis on the determinants of total factor productivity revealed that R&D investment in new product development, which provides opportunities for opening up new markets, is more effective than R&D spending on upgrading manufacturing processes in improving total factor productivity. However, the problem is that the positive relationship is observed only in conglomerates and not in SMEs. As mentioned earlier, this is probably because SMEs are relatively inactive in technology innovation activities including product and manufacturing process innovation. In fact, R&D investment by SMEs for technology innovation accounts for a mere 25% of that of conglomerates.

52. The regression coefficient for labor cost is estimated at 0.420 in the case of SMEs and 0.439 in the case of conglomerates.
53. The regression coefficient for added value ratio is estimated at 0.190 in the case of SMEs and 0.308 in the case of conglomerates.
54. The regression coefficient for labor cost is estimated at 0.415 in the case of SMEs and 0.424 in the case of conglomerates.

Table 2-2-30 | Determinants of Total Factor Productivity by Firm Size (Manufacturing Industry: 1997-2008, Model 3)

	Total size		Small businesses		Conglomerate	
	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect
Constant	3.763*** (10.39)	2.814*** (7.71)	2.621*** (8.06)	2.345*** (7.13)	1.769*** (5.90)	1.487*** (4.94)
R&D Intensity (Process Improvement)	0.006 (0.87)	0.005 (0.75)	-0.004 (-0.59)	-0.005 (-0.71)	0.003 (0.55)	0.004 (0.67)
Value added rate	-0.056 (-0.85)	0.071 (1.07)	0.152** (2.56)	0.190*** (3.12)	0.277*** (5.50)	0.308*** (5.97)
Labor costs	0.305*** (12.49)	0.376*** (14.74)	0.396*** (17.75)	0.415*** (18.11)	0.400*** (15.36)	0.424*** (15.85)
R^2	0.52	0.66	0.65	0.72	0.52	0.65
Hausman m	92.20***		12.90***		16.60***	
F value		14.48***		13.81***		15.43***
Observations[2]	20*12	20*12	20*12	20*12	19*12	19*12

Note: 1) Observations refer to industry year.
2) R&D expenses refer to R&D expenses for manufacturing process improvement.
3) ***, **, and * means level of significance of 1%, 5%, and 10%, respectively.

Effective measures to boost R&D investment by SMEs are urgently needed so as to increase total factor productivity in each type of business and in the whole industry. However, there is a limit to inducing SMEs to voluntarily foster R&D investment and innovation activities. In this regard, the government's support, tax benefits or financial incentives for example, is required. The Korean government decided in its 2009 tax reform bill to offer tax deductions to SMEs for R&D activities. The tax deduction rate was set at 25% for general R&D spending and at 30% for R&D expenses incurred with respect to projects to nurture the nation's new growth engines and develop new technologies.[55] Furthermore, the tax credit system was to be enforced

55. The 2009 Tax Reform Proposal submitted by the Ministry of Strategy and Finance (2009) specified the scope of R&D expenses on new growth engine industries and source technologies that are eligible for tax benefits as follows. First, among the 200 detailed projects promoted to nurture 17 new growth engines in three core fields, R&D spending on projects that inevitably require R&D activities is subject to tax incentives. These projects include the following.
① Green technology industry: Renewable energy, high-performance water-processing, LED application, green transportation system, etc.
② High-tech fusion industry: Broadcasting-communication conversion, IT-fusion system, robot application, bio-pharmaceutical and medical equipment, etc.
③ Value-added service industry: Global healthcare, green financing, contents and software, etc.

temporarily, but the time limit was abolished to increase R&D investment.[56] These measures are expected to stimulate innovation activities in the SME sector.

As discussed above, product development accounts for a larger portion of SMEs' R&D investment than process innovation. However, in the short term, SMEs need to reinforce R&D activities for process innovation instead of new product development. Since new product development takes a long time and has a higher level of uncertainty, it is desirable for SMEs whose technological prowess is weaker than that of large companies, to increase the effectiveness of R&D investments by focusing on process improvement or innovation.[57]

Next, in most cases, higher added value ratio is expected to increase the total factor productivity of the entire industry. Therefore, to improve productivity, both conglomerates and SMEs should come up with measures to maximize the creation of added value from a product.

Finally, improvement of labor quality is also a very important factor in raising the total factor productivity of the entire industry. Most of all, continuous investment and interest for education and training is called for, in order to acquire technological know-how required on site. Individual companies are making efforts to train skilled workers because improving labor quality and accumulating human capital boost productivity.

Second, R&D spending for the development of source technologies is eligible for tax incentives. The term "source technologies" here is based on the definition given by the National Science and Technology Council. In particular, the Council defined "source technologies" in Jul 2009 as "original technologies that are essential in developing products or services and can create added value and be applied to other technology fields."

56. *2008 Tax Reform Proposal*, Ministry of Strategy and Finance

57. According to a study by Lee Keun Jae Lee and Kang Sang Mok (2007), innovation has different influence on productivity depending on its type (i.e., product innovation, product upgrade, process innovation, etc.). Product innovation opens up new markets and expands existing markets by supplying new products. In contrast, process innovation cuts down costs, reduces defect rate, and shortens lead time, enhancing productivity and ultimately boosting sales and profit. Cost savings, lowered defect rate, and improved efficiency instantly result in productivity improvement. However, development of a new product does not directly affect productivity. It takes a long time for a new product to gain recognition in the market, and thus an instant boost in productivity is unlikely. Moreover, new products entail high defect rate and initial adjustment costs.
Due to reasons mentioned above, product innovation can have a negative impact on productivity in the short term. On the other hand, process innovation is likely to have a positive impact in the short term. Process innovation is efficiency oriented and has an advantage over product innovation in terms of efficient growth. However, product innovation will contribute more to productivity improvement in the long term. This is because the rate of technical change in the case of product innovation is faster than that of process innovation (p. 357).

5. Conclusion

To enhance quality standards, the Small and Medium Business Administration played a leading role in promoting the implementation of 100PPM Quality Innovation during 1995 to 1999. As the objective of 100PPM Quality Innovation is to improve quality management by reducing the number of defective products down to less than 100 out of 1 million products or services. More specifically, the Single PPM Quality Innovation initiative has established a goal of reducing the number of defective products down to less than a single number out of 1 million products or service in the short run with the long-term goal of achieving 0 PPM. To this end, it has promoted the participation of all organizations and its members in the quality management movement.

The Small and Medium Business Administration and Korea Chamber of Commerce and Industry have been carrying out Single PPM Quality Innovation initiatives since 2000.

So far, the Single PPM Quality Innovation initiative under the direction of the Small and Medium Business Administration and Korea Chamber of Commerce and Industry has implemented many projects and made great progress. The organization have provided consulting and guidance for the systematic implementation of quality innovation and also conducted on-line and off-line training and education for management and employees of SMEs. After receiving consulting and education on establishing a quality management system, SMEs granted eligibility to apply for the Single PPM Quality Certification if the required level of defect rate has been achieved. For the corporations which have submitted an application for certification, the Small and Medium Business Administration administers the application screening and on-site screening, and once the requirements have been met, it issues the Single PPM Quality Certification.

The number of SMEs which have received guidance on implementing Single PPM Quality Innovation totaled 2,295 companies for the period from 1995 to 2008. During 2006-2008, a total of 698 SMEs have received Single PPM guidance, resulting in an average increase in added value of 113 million won per company and a reduction in the defect rate by annual average of 69.9%. Based on a survey of SMEs conducted by the Korea Chamber of Commerce and Industry in 2008, many companies responded that the initiatives in Single PPM contributed to enhancing quality and customer satisfaction, increasing sales, reducing cost of production, and increasing profits, a virtuous cycle. On the other hand, the result of Single PPM Quality Certification showed that the number of SMEs which obtained Single PPM Quality Certification for the period from 1995 to 2008 totaled 1,651. During 2006-2008, companies that received Single PPM Quality Certification reduced the shipping defect rate for the certified items to an annual average of 96.8%. Based on a survey of for 1,241 managers and employees by the Korea Chamber of Commerce and Industry in 2008, a total of 44.5% of the respondents believed implementation of Single PPM Quality Innovation was needed to enhance quality standards, while 17.4% considered the implementation of the ISO Quality Management System and 17.4% believed the implementation of 6 Sigma Management Innovation Technique to be important. The results of the survey indicate that the importance SMEs put on the Single PPM Quality Innovation initiative.

Even though Single PPM Quality Innovation efforts, which achieved quite significant results, began in 1995, many SMEs, large corporations and other organizations, have yet to implement Single PPM Quality Innovation activity, which needs to be reassessed.

More results can be achieved if SMEs, large corporations and institutions implement Single PPM Quality Innovation. Developing countries will have a greater chance of succeeding in adopting Single PPM quality management if the problems that were found in the course of its implementation in Korea are addressed and supplemented so that developing countries can learn from Korea’s experiences.

First, SMEs have to understand the needs of their customers systematically and to establish the system that would reflect it in the management of SMEs. SMEs also have to adopt other Management Innovation Techniques such as 6Sigma, Toyota Production System (TPS) and Lean Management, in a way that is suitable to their context and needs.

Second, SMEs have to get out of process-centered Single PPM Quality Innovation activity and to expand and apply it to business management and technology development areas.

Third, SMEs, large corporations and institutions, should seek to develop and apply custom tailored procedures or techniques based on the characteristics of their company and industry to further enhance the performance of Single PPM Quality Innovation activity. It would be ideal to scientifically assess SMEs and to implement a tailored action plan based on the results of the assessment.

If the government (hosting institution), or large corporations, operates and support the implementation efforts of SMEs, then it will be expected that the efficiency and productivity of Single PPM Quality Innovation activity will be increased.

Lastly, Quality Innovation education and technical guidance need to be reinforced and government’s interest and support need to be continued. To implement Single PPM successfully in the developing countries, it will be necessary to develop and promote the training and education of the Single PPM that is on-going and more diversified. Together with education, technical assistance and consulting on Quality Management Technique and new Quality

Management Activity in general should be provided to companies which need Single PPM Quality Innovation activity.

The introduction of the U.S. Quality Management System by Japan during 1960s-1980s emphasized that “Quality Management begins with education and ends with education,” which was supported by Professor Ishigawa. All the programs for company-wide Quality Management should be conducted as education programs by layer of all areas, and the results of the education program should be closely monitored at the Quality Management stage.

The supporting role and efforts of government-affiliated institutions must be reinforced for a nation-wide implementation of Quality Management. Policy and method related to the management of quality are basically determined based on the need of companies. However, the government and organizations in charge of quality management have important functions and roles in assisting and facilitating the decision-making and efforts of companies for management rationalization.

Ultimately, the management of a company makes a decision and takes responsibility for the implementation of Single PPM Quality Innovation activity, but the role of the government and other institutions is to promote the importance of Single PPM Quality Innovation, as Lopez said, “What the CEO has to do is to make right decision.”

The decision to do the right rights to get good results falls on the manager but the decision of what to introduce and whether to implement it or not falls on the CEO. It is the duty and responsibility of the government, large corporations, and pertinent institutions, to inform companies on the right way of achieving good results and to provide the necessary help. The government will have to actively prepare a more meaningful system so that large corporations and subcontractors participate together.

In conclusion, as in Korea’s experience of implementing the Single PPM, the Korean model of Quality Innovation Movement, developing countries can benefit considerably from promoting awareness in quality management. It’s implementation should match the country’s level of industrial development and political environment. The effects of quality management could be reduced significantly if it is not suitable for the country, or company, even though it is the best system. Therefore, developing countries need to establish a major agency that can promote Quality Management first.

Benchmarking ‘Korea’s Single PPM Quality Innovation Center’ can be of some value. It is important to train experts who will be able to guide implementation. In this respect, the Small and Medium Business Association has a business plan for promoting ‘Single PPM Quality Innovation Movement’ that can be used in other countries. This will likely lead to cooperation between Korea and other countries if it is used successful.

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1. Overview of Company

1.1. Status of Corporation

1.1.1. General Status

Established in 2003, Koyo Jico Korea specializes in the manufacturing of Water Pump Bearing for automobiles, and supplies all of its production quantity to Hyundai Motor. The company is a typical SME with the quality level and technology acknowledged by customer based on continuous development of production technology and accumulated work know-how. Under fierce competition, Koyo Jico Korea steadily expanded facility investment and realized process automation, and now they have the production capacity for more than 2.4 million each a year.

Since the commencement of mass production in 2003, Koyo Jico Korea actively carried out quality management efforts and experienced no customer complaints, not even one. The company introduced the ISO/TS 16949:2002 Quality Management System and ISO 14001:2004 Environment Management System. They were able to modify the system to be suitable for their situation, and obtained Certifications in 2006.

To not disrupt the processes and continuity of the established systems, Koyo Jico Korea received guidance on Single PPM Quality Innovation through the recommendation of Hyundai Motor, its main buyer, which reviewed each area and took appropriates steps after identifying the problem areas. As a result, the company received Single PPM Certification in October 2008, and it served as the basis for further management-centered work method improvement and process stabilization.

To maintain continuity in Quality Innovation throughout their organization, Koyo Jico continued to carry out factory innovation and Quality Innovation initiatives under direct and indirect guidance of Single PPM Advisor. This led sales to grow by approximately 20% compared to the previous year demonstrating the trend of further diversification of customer layers.

All the managers and employees of Koyo Jico Korea are making every effort to reform the company as a small but strong company and to continuously make improvements and increase customer satisfaction under the motto of “Progressive Behavior, Creative Challenge and

Positive Thinking.”

- Status of Company

Name of Company	KOYO JICO KOREA CO.. LTD.	
Date established	May 19, 2003	
Representative Director	Lee Won-Shik	
Number of Staff	23 persons	
Annual Turnover	8,350 million won (2008)	
Location	28-12, Yulpo-ri, Godeok-myeon, Pyeongtaik city, Gyeonggido	
Major Product	WATER PUMP BEARING for automobile	
Quality Certification	Single PPM Quality Innovation Certification (October 2008) ISO/TS16949, ISO41001	

1.1.2. History of Company

KOYO JICO KOREA Co., Ltd. was established in May 2003, and commenced mass production from September of that year. In December 2004, the achieved an annual production capacity of 1 million for Water Pump Bearings. But the company realized that a quality management system was needed to support their rapidly increasing production capacity. After preparing for approximately 1 year, the company established a system of quality and environmental standards, and subsequently, obtained both Quality Certification and Environment Certification in June 2006 (ISO/TS 16949 and ISO14001). Through steady investment and product improvement, the company expanded production capacity to more than 5 million annually in June 2007, three years after the establishment of the company.

To respond to rapidly changing requirements of the customer in terms of quality and to become a leading company, the need for better quality management and innovation was raised and the company introduced Single PPM Quality Innovation in 2007. It carried out improvement activities throughout the whole organization for approximately two years, and in October 2008, the company obtained Single PPM Quality Innovation Certification. After certification, the company was in the running for the Grand Prize on Single PPM Quality Certification and was honored with the Presidential Award on April 29, 2009 at the Mutual Cooperation Promotion Conference, an unimaginable achievement for such a small company.

Koyo Jico Korea is focusing on accommodating all customers’ need and is earnestly carrying out quality innovation efforts to reduce the defect rate to zero.

1.1.3. Patent and Certification Status

As the Japanese auto parts manufacturer JTEKT has technology development capability to produce the products of Koyo Jico Korea, it is not easy for the company to secure patent rights for its technology. Therefore, the company has put top priority on producing high quality products and achieving customer satisfaction. Thus, all managers and employees of the company are exerting their best efforts to fulfill their duties.

Koyo Jico Korea introduced quality management to control and manage overall organization in 2006 by adopting the Quality Management System ISO/TS16949: 2000, which is a requirement in the automobile industry. At the same time, the company also introduced the Environment Management System ISO14001: 2004 to foster an environmentally friendly workplace. The company also introduced Single PPM Quality Innovations, which was supported by Small and Medium Business Administration in 2007, and implemented it for more than two years. As a result, the company obtained Single PPM Quality Innovation Certification in October 2008.

2. Contents of Guidance

2.1. Background and Purpose of the Implementation of Single PPM

2.1.1. Background of the Implementation of Single PPM

2.1.1.1. Domestic Environment

Under the situation where continuous innovative activities are needed to maintain market share and strengthen competitiveness due to the a growing trend of upgrading functions and performances and achieving high standards of quality, it was judged that the only way to stay ahead of the situation was to introduce Single PPM Quality Innovations. In this regard, the company has sought to reach the top position in this field before anyone else by getting all of its member thinking and acting in-step.

2.1.1.2. Global Environment

Today completion from surrounding countries is getting fiercer, in which leading Korean products are threatened to be pushed out or replaced altogether. Most of the products could grow and enjoy their positions through increased protectionism rather than through enhanced technology and competitiveness. However, it has been a long time since various protection barriers were abolished, and now it is a game of pure competitiveness. Under such situation, the company decided to introduce Single PPM Quality Innovation to unify the mind and efforts of all members of the organization while exerting its best efforts to become the best in this field at least.

2.1.2 Motive and Purpose of Implementation

After management expressed their intention to actively support and reinforce quality management, the mindset of all employees had to be focused on achieving zero-defect. In this regard, the introduction of Single PPM Quality Innovation was implemented to form the base for continuous growth and long-term development by meeting customer demands. The purpose of the Single PPM Quality Innovation activity was to secure overseas competitiveness and to turn the company into a leading supplier based on quality assurance and customer satisfaction through the establishment of Quality Management System setting basic standard and technology standard.

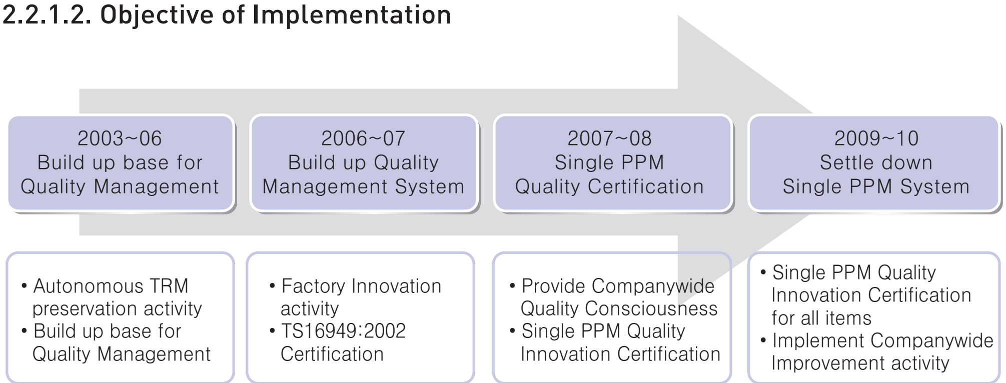
2.2. Goals and Direction of Implementation

2.2.1. Direction and Goals of Implementation

2.2.1.1. Direction of Implementation

By carrying out Single PPM Quality Innovation, Koyo Jico Korea sought to establish a system for zero-defect product, to meet quality and production standards and to secure customer satisfaction and quality competitiveness.

2.2.1.2. Objective of Implementation



● Goals for the Implementation of Single PPM

Category	Item	1st Stage	2nd Stage	3rd Stage
		2008	2009	2010
In-House	Process Defect rate (PPM)	2,000	1,000	500
	Shipping defect rate (PPM)	0	0	0
Outside	Delivery defect rate (PPM)	0	0	0

As the standard of quality is driven by the goal of zero defect rate, the factors that cause poor quality should be eliminated. Accordingly, it is important to cultivate a mindset for achieving high quality among all members of the organization. As a plan to achieve quality improvement, the implementation of Single PPM Quality Innovation can be put into the period of introduction, period of diffusion and the period of settlement with the objectives of the stage continuously seeking to maintain high standards of quality.

2.2.2. Contents of Implementation by Stage

The contents of Koyo Jico Korea's implementation of Single PPM Quality Innovation activity is shown in the above figure. Simultaneously with the introduction of Single PPM Quality Innovation activity in 2007, the company has concentrated on supporting basic education to the members of the organization for quality management to enhance the quality level while promoting the basic concept for "3 Jung 5S" and acquiring the practical method of arranging things through "3 Jung 5S" first. From 2008, the company tried to educate all members of the organization on basics of quality management to establish zero-defect quality standard. It also sought to establish technical standards and basic standards required by products based on the Quality Management System established through work standardization throughout the organization.

2.2.3. Operation of Quality Meetings

Under the Single PPM Quality Innovation activity, meetings were organized to induce the participation of all members of the organization. The Implementation Secretariat organized the meetings in each area of quality management.

The meetings included daily meetings, weekly meetings, monthly meetings and quarter meetings. Daily meetings dealt with important issues that occurred on that day and was in the form of discussion; weekly meetings dealt with Task Division Team activities with the participation of all members; monthly meetings were held by factory managers to address major issues of the Task Division Team and was attended by the Representative Director; quarterly meetings were held by the representative director to discuss problems that occurred during the period and was attended by managers from different areas. The meetings had visible effects through the linkage with standardization while weekly meetings were conducted depending on the TF Team organization for Single PPM Quality Innovation.

2.2.4. Status of Items for the Application for Implementation

In designating products to be subject to Single PPM Quality Innovation, the product's share of production out of total production should be more than 30%. For Koyo Jico, the Water Pump

Bearing was one of its major products.

The products manufactured by Koyo Jico Korea constitute core parts of the automobile. The rationale for the designation of Water Pump Bearing is that it is critical to the assembly of the engine Water Pump and performs the role of transmitting rotating power of Clank Shaft to Impeller of Water Pump. It is in charge of major function to maintain the duration of product under high-speed rotation with water-proof function and requires absolute need for the maintenance of quality. Therefore, the cause of potential problems should be resolved in advance, and power transmission device should be built so that it can function fully.

The reason this product was designated for quality management was that it accounted for a high share of total production and shipments. Also, the spill-over effects of this product to other products were great through the operation of mutually supplementing and organic management system at the time of diffusion and post management.

2.2.5. Introduction of the Process for the Items for Implementation

The process of the applied items largely consists of 11 kinds of process as follows: Starting with washing initial input item, grade selection is done through paddle wheel selector. Then ball and roller are assembled to axle and paddle wheel and then assemble cage. Washing and deoiling is done for the assembled half-finished goods through automatic washer and then test should be conducted to find comprehensive abnormality such as inner clearance. When any problem is found as a result of the test, rectification action should be taken and then Seal assembling and inspection and slinger press-in and inspection should be done. Then weight inspection and appearance inspection is done and then packing should be done. The shipping is done pursuant to customer’s schedule. The following figure shows the process of the applied items.

2.3. Organization for Implementation

The organizational structure of Koyo Jico Korea for the implementation of Single PPM Quality Innovation activity included the Representative Director, Factory Manager, Secretariat, Implementation Team Leader concerned and employees.

The Representative Director was responsible for overall operation and made policy decisions on the implementation of the Single PPM Quality Innovation. The director played an important role in making decisions including the evaluation, review and approval of the implementation and the review and approval of the operational results of various meetings.

The Factory Manager was responsible for the implementation reports on various issues and problems which occurred in the course of implementation. The manager reported on the direction of implementation and the contents of implementation to Representative Director.

The Secretariat was responsible for planning, managing, and reporting the results of the implementation. The secretariat was also a presenter for TF Team and site management and was responsible for the overall operation and management of the Single PPM Quality Innovation activity.

The Implementation Team Leader was responsible for work schedule management, job assignment for team members, job training and delivery of 6 Stage technique of Single PPM. Especially, the Team Leader was responsible for maintaining contact with Suggestion activity and Task Division Team activity to identify impractical issues or ideas of team member while reflecting the outcomes at each stage of implementation to the management of the company

Team Members were responsible for performing given tasks, and were assigned roles and tasks in a specific area based on the suggestion of the secretariat. They identified issues or problems through pertinent activity or meetings while ensuring that the results reflected improvement activity.

2.4. Contents of Guidance by Date

2.4.1. Implementation Stage of Single PPM Quality Innovation Activity

Single PPM Quality Innovation activity of Koyo Jico Korea was carried out after a plan was prepared and all members of the organization were familiarized with the plan based on the six methods of SINGLE.

In the first stage of Single PPM implementation, Scope Selection (S stage), the organization of the Single PPM is prepared by identifying the applicable process and delegating job assignments and roles to the team members. To motivate and encourage the team, a ceremony was conducted and the Representative Director of the company provided supporting words. Certificate of appointment was given to each team member, and the advisor delivered the purpose of implementation to team members. After the designation of items for implementation, the problems and solutions for the problems were discussed by the TF Team, and a Master Plan was established. The Master Plan was posted on the Comprehensive Single PPM Bulletin Board so that all members of the organization would be able to monitor its progress. The 3Jung 5S Activity Plan for overall process and TPM Activity Plan for facility part were simultaneously carried out, and the schedule for implementation and the assignment of roles were determined and carried out.

As the total number of employees in the organization is small, the number of workers assigned to a particular area was limited, and therefore, all members of the organization were asked to participate without being divided into teams and were given a job assignment by area.

As this stage is very important to the success or failure of the Quality Innovation Activity, the selection of items, implementation schedule and implementation method were concretely planned and implemented.

At the Identification stage (I stage), identification of phenomena pursuant to the selection of scope and its cause were analyzed in detail through problem solving technique. Especially the analysis of defect type and its solution for the selected items were presented through characteristics factor chart which is basic method of quality management and induced Task Division Team to solve major problems by applicable process through their Task Division Team activities. The cost for quality for organization as a whole was calculated by presenting the calculation method. The cost for quality was managed by dividing it into Prevention cost (A-Cost) and Evaluation cost (P-Cost) against Failure cost (F-Cost).

Analysis of Measuring System for the target items (Gage R&R) was also conducted at this stage to secure the reliability on pertinent measuring instruments.

At the cause analysis stage (N stage), detailed schedule management was done after the deduction of major problems pursuant to the selection of scope, identification of phenomena and the establishment of concrete goal. And investigation for cause of problem and the status of the problem was done so that target setting for improvement is done at this stage.

At the goal setting stage (G stage), solution goal for concrete problems was set based on the results of the selection of scope, identification of phenomena and the analysis of cause, and schedule for the solution was designated in discussion with person in charge in each area.

Especially at this stage, major problems for the items other than applicable items were derived from the raw material warehousing stage to shipping stage for overall organization and person in charge of the problem was designated. After the designation of the person in charge, TF Team was asked to set the schedule for the solution for implementation. What is particularly important at this time is the solution process should be unfolded in line with the category of 6 stage of Single PPM and the completed results were posted on the bulletin board so that all employees can see the result of progress management.

At the improvement stage (L stage), improvement plan pursuant to goal setting was established in consideration of the 3 dimensional conditions for improvement plan and the result of implementation was induced toward improvement. At this time, improvement was done by preparing concrete alternatives for the analysis of cause and goal setting, and especially basic standards (eg.: Quality Management, Process Chart, Work Standard and Inspection Criteria) were arranged systematically to eliminate the source of problem occurrence while standard modification works were done steadily so that the members of the organization can easily understand the standards while mission items in the standards were covered by new standard. And also at this stage, quality level (Process defect rate, shipping defect rate and delivery defect rate) and process capacity index (Cpk) was frequently checked to see if there is any problem or shortage in process and improvement actions were taken as necessary. As to the result of improvement, comparison for before and after the improvement was done and pictures for the peak were taken to identify the effect. The pictures for the effect were posted on the board at the relevant place so that the member of the organization concerned can benchmark it.

At the evaluation state (E stage), problems were derived through the above 5 stages and the results were evaluated together with the member of Implementation Team and used the result of evaluation as a case for improvement. Especially in this stage, TF Team was asked to do comprehensive evaluation for the comprehensive Master Plan, which was established at the scope selection stage, the designated Department in charge and the solution schedule. After the evaluation by TF Team, the problem occurrence area appeared on the result was analyzed again and then detailed improvement schedule was established to induce toward improvement. And through this stage detailed plan for post management was established. After reviewing all the above process, we judged that there was no problem for the screening of Single PPM Certification, but overall adjustment and arrangement were made to prepare firm base for the certification and asked to get the screening of Single PPM Quality Certification.

2.4.2. Establishment of Implementation Plan for Single PPM Quality Innovation Activity

It is important to establish Implementation Plan based on detailed contents of implementation in order to implement Single PPM Quality Innovation activity. Especially it was necessary to make the members of the organization recognize the importance of the members' cooperation than anything else as Single PPM Quality Innovation activity is improvement activity. The detailed implementation plan was prepared using 6 methods of Single covering all potential problems as well as quality problems occurred at overall process from raw material management stage to shipping management stage and included it in the Master Plan.

2.4.3. Detailed Contents of Implementation by Date

Before the implementation of major contents which were prepared in line with the visit schedule of advisor, a ceremony to create boom was done to unite all members of the organization together as one unit. Implementation Team prepared Master Plan and selected target items through the Characteristics to Quality (CTQ). And education and training for the members on Single PPM Quality Innovation was separately planned and was conducted every week at the time of visit the team. The education and training was focused on basic method of quality management with adjustment to make it suitable for small and medium corporations. The education and training sessions were done for all members of the organization whenever advisor visited them. In the education and training session, the cases of other companies were presented. As a result of education and training, clearly visible effect was generated from the participants in the form of increase of the members' voluntary participation, prompt suggestion of opinion and actual effects at the pertinent areas. Single PPM Quality Innovation activity was unfolded for total 10M/D and the contents of major guidance by date are as follows:

The 1st day of guidance visit was done in the form of meeting with management staff including Representative Director and the direction and purpose of Single PPM Quality Innovation activity was explained to the members of the organization. At the meeting, mutual discussion on overall implementation and company situation in general were analyzed. Especially there was a ceremony with all members of the organization with preliminary explanation on the direction and the purpose of Single PPM Quality Innovation activity. Certificates of Appointment were conferred to the members of Implementation Team to ensure smooth processing works. Guidance journal and tasks necessary for future implementation of Single PPM Quality Innovation activity were provided for continuous management and observation.

On the 2nd day of guidance visit, comprehensive Implementation Plan for Single PPM Quality Innovation activity was established, and the result of overall factory inspection, which was carried out on the 1st day of guidance visit, was explained to all members of the organization together with future schedule. And the mind setting (mental armament) for the implementation of Single PPM Quality Innovation activity was requested to the members of the organization, and issues such as organization of meetings and their roles and internal and external cases for Single PPM Quality Innovation activity and their contents were explained. Implementation Plan for the improvement of major problems based on factory diagnosis was established.

On the 3rd day of guidance visit, implementation method for Single PPM Quality Innovation activity was explained and the established comprehensive Master Plan was discussed and reviewed. And education on the quality innovation mind setting for Single PPM Quality Innovation activity was conducted to all members of the organization. Separate items which require cooperation were presented to the members and especially Implementation Team members were asked to be familiarized with Single PPM Quality Innovation activity implementation procedure and were informed about the contents of urgent items at present, tasks by department and implementation procedure based on management by sight.

On the 4th day of guidance visit, the tasks, which were presented at the previous visit were checked first and in most cases TF Team was asked to present the results. During this visit, education and training sessions were given to the members of the organization mainly covering major contents of issues by stage versus handling procedure for the issues together with the explanation on major contents of implementation and approaches by the detailed stages for Single PPM Quality Innovation activity. At the guidance visit this time, site improvement tools for Single PPM, program description and site improvement method were mainly covered.

The 5th day of guidance visit began with the review of Implementation Plan versus actual performance and then explanation on other company's implementation status of Single PPM and education on the need and method for Task Division Team activity were given to the members while providing guidance to TF Team about 6 implementation method of Single, utilization method of statistical technique, Q-Cost utilization method (Calculation of Failure/Prevention/Evaluation Costs) together with implementation method. And guidance on how to use 5 Way technique for TPM operation method and improvement case deriving method was provided and the explanation on the implementation plan/actual performance for education and training and how to prepare education and training sessions was given.

The 6th day of guidance visit started with the checking plan versus actual result, and then education was given to all members of the organization with the subject of "Change of thinking and Mind formation method" while explaining about the implementation status of other company's Single PPM for benchmarking purpose. And guidance was given to TF Team as to the utilization of alternative for improvement program (Induce effect identification) and the operation method for Single PPM screening. Guidance was given on practical approaches and implementation method for the process covering from raw materials to shipping in general. And guidance was given to the method of comparative evaluation for before and after improvement of major problems as an explanation on the method of management for the major problems using the improvement results.

On the 7th day of guidance visit, guidance was given to the areas of the review of regulation for Task Division Team, Team activity method, activity effect calculation method, programs concerned with idea-deriving method. Through Single 6 stage technique, guidance was given to the method of data arrangement to post outputs and the analysis on the trend of defect rate (Process, shipping stage) to post it on site to inform the state of management. Autonomous inspection method for work site was checked while giving guidance to the checking of the result of autonomous inspection for the first output and end output (Interface with program) and the method of arrangement. Apart from Guidance Journal, operating system for Single PPM Quality Innovation activity was requested to recheck by stage. Especially guidance was given so that status management can be done systematically. At this stage, guidance was given with emphasis on the management method for actual performance results.

On the 8th day of guidance visit, explanation on the checklist for Single PPM Certification screening was given, and guidance was given to the method of data management and data arrangement for shortage and insufficient data. Explanations on the utilization method for the management diagram prepared and its inspection method (no inspection and disposition method, inspection rules, and abnormal action disposition method) were given to the members of Implementation Team, and guidance was given mainly to the field works such as defect rate handling method, first good and last goods produced management method, limit sample handling method. Also the Status Board indicating the result of implementation of Single PPM so that the members concerned can directly confirm the result.

On the 9th day of guidance visit, the possibility of the screening of Single PPM Quality Certification was discussed with TF Team, and guidance was given on the contents of the stipulation in the Single PPM Quality Innovation activity Guide prepared and its suitability with practical situation. Comprehensive Master Plan which was prepared at the scope selection stage and detailed plan versus actual state which was prepared at the stage of goal setting were reviewed together with TF Team.

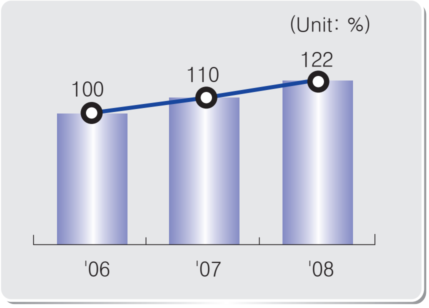
On the 10th day of guidance visit, the result of TPM operation was checked and guidance was given to the result of implementation by respective step and major improvement items in linkage with OPL. And the casebook for the improvement for Single PPM Quality Innovation activity was prepared while posting the comparative evaluation before and after improvement on the Status Board so that all members of the organization could see. The area from which problems could not be derived during the period of guidance or the area which was regarded as problem were derived and linked to the issues for post management. Also the utilization method of program to prepare for the screening of Single PPM Quality Certification was explained, and reviews were done for the methods of guidance output arrangement, application preparation, Mother Corporation’s recommendation letter preparation and application submission.

3. Performance and Evaluation

3.1. Management Index versus Actual Performance

Koyo Jico Korea has experienced an increase in sales by more than 25% every year, and the sales amount per capita is approximately 440 million won, which is considerably high for a small sized corporation. Composite facility efficiency of the company also showed increase every year thanks to the result of steady improvements and checking. The following figures show the sales trend for Koyo Jico Korea.

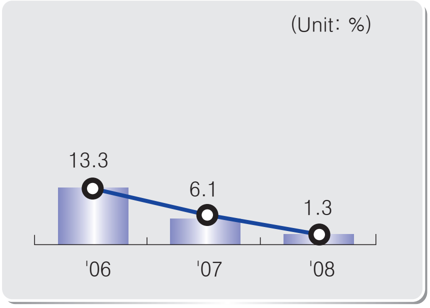
Increase rate in Sales



Category	'06	'07	'08
Sales increase rate	100	110	122

Note. Trend of increase by year on '06 Sales basis

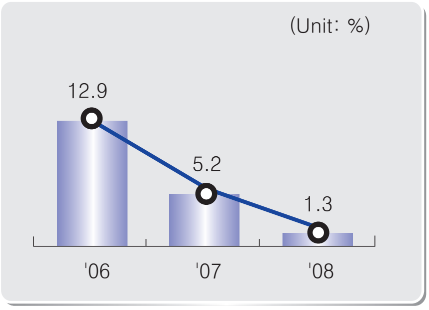
Ordinary Profit Rate of Sales



Category	'06	'07	'08
Sales increase rate	13.3	6.1	1.3

Note. Decrease of ordinary profit rate due to the increase of the unit price of raw material import from FX loss

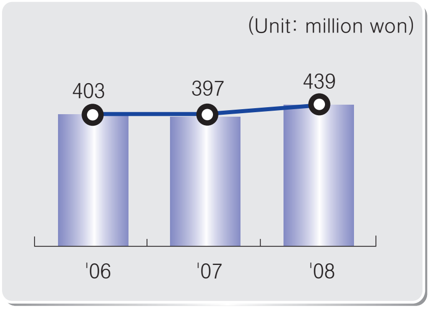
Net Profit Rate of Sales



Category	'06	'07	'08
Sales increase rate	12.9	5.2	1.3

Note. Decrease of ordinary profit rate due to the increase of the unit price of raw material import from FX loss

Sales per Capita

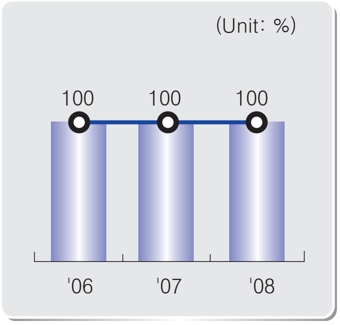


Category	'06	'07	'08
Sales increase rate	403	397	439

3.2. Quality Index versus Actual Performance

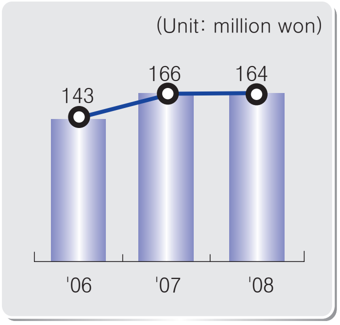
Also, the ratio of defective products, which was 3,216 PPM as of the end of 2006, has been steadily declining, falling to approximately 2,012 PPM. The ratio of defective products is maintained at "0" PPM level which means zero defects, not even one item from past to the present. This is the result of the fundamental principle to ensure zero defects through the improvement of manufacturing method as well as the improvement of inspection method. The following figures show the general status of the ratio of defective products management.

Inspection FOOL PROF Rate



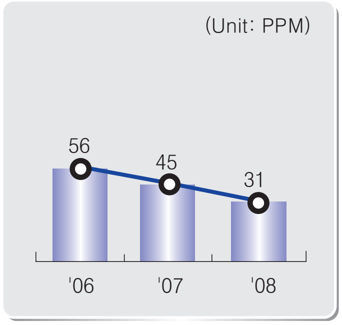
'06	'07	'08
100	100	100

Quality Cost



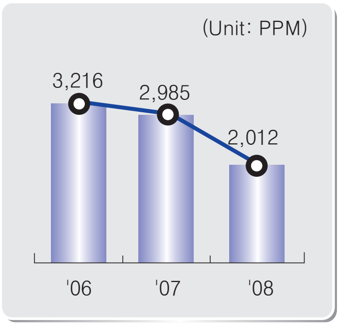
'06	'07	'08
143	166	164

Import Inspection Defect Rate



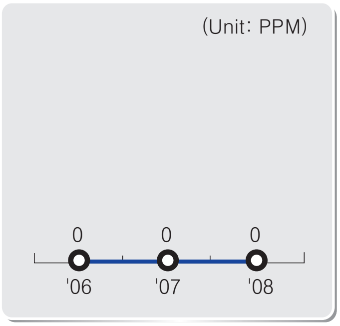
'06	'07	'08
56	45	31

Process Defect Rate



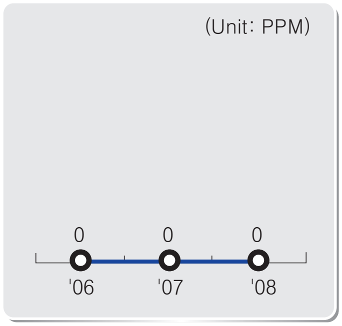
'06	'07	'08
3,216	2,985	2,012

Finished Products Defect Rate



'06	'07	'08
0	0	0

Mother Corp. Delivery Defect Rate



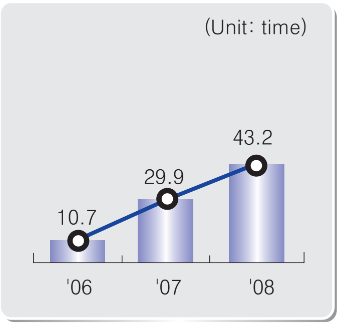
'06	'07	'08
0	0	0

Quality cost (Q-Cost) has been calculated on a monthly basis through Single PPM guidance also from 2007 and they are proud of 100% of product inspection related Full Proof rate.

As to training and education of employees, the number of hours employees received training and education was only 10.7 hours per person in 2006 but was increased to 43.2 hours which represents an increase of more than 400%. This resulted in higher satisfaction of employees and thus the rate of absenteeism has significantly decreased.

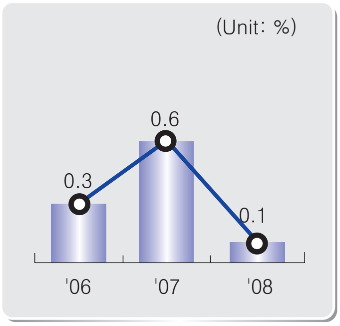
● Status of Employee Satisfaction versus Education Investment Hours

In-House/Outside Education Hours per Capita



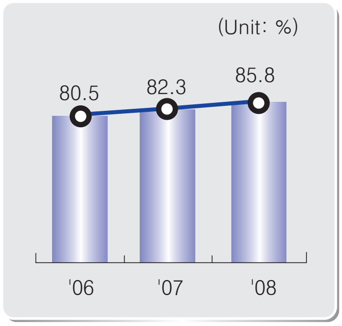
'06	'07	'08
10.7	29.9	43.2

Rate of Absenteeism



'06	'07	'08
0.3	0.6	0.1

Employee Satisfaction



'06	'07	'08
80.5	82.3	85.8

3.3. Comprehensive Evaluation

It has been seven years since Koyo Jico Korea was established but the company has become very reliable and has met the demands of its customers due to stabilized management and high quality standards for an SME in Korea. The company built up the base for Quality Management System in 2006 and introduced Single PPM Quality Innovation in 2007 to instill a mindset of high standards and to secure high quality. As a result, this has led to many tangible and intangible effects throughout the factory.

Above all, from the introduction of the Single PPM Quality Innovation, the employees have realized the importance of their accomplishments on their own and have the ability to play an important role in meeting the needs of the company and customers. Especially, the company's successful education and training program, which has contributed to improving quality management, is worth emulating by other companies as a model. Factory Manager's experience and know-how on manufacturing is helping to eliminate the source of product defects in manufacturing facilities. Also, the occurrence of shipping defect is fundamentally controlled and managed based on system based management method (Raw material ~ overall shipping).

4. Benchmarking Point

It is judged to be important as a benchmark for all members of the organization to recognize the concept of Single PPM in advance before the implementation of Single PPM Quality Innovation activity. It is also necessary for workers involved in implementation to acquire the technique or method for Single PPM Quality Innovation activity through advance education, for management to provide strong support of the implementation, and for the large corporate to provide direct and indirect support.

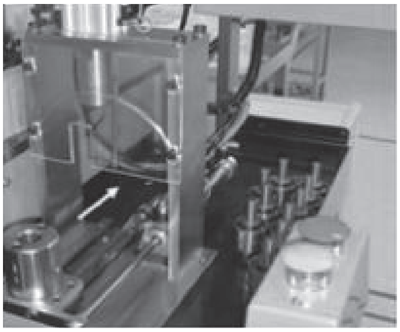
At the initial stage of implementing Single PPM Quality Innovation activity, it is important to promote unity and teamwork among all members of the organization through a ceremony, to make the appointment of implementer of Single PPM official and to focus on the management of members' level-up through the creation of consensus between the members and advisor. Employees' right attitude for advance preparation and guidance at the time of advisor's guidance visit is also important, and output should be printed for checking.

In the Single PPM Quality Innovation activity, it may be necessary to consider the application of the following methods as fundamental to prevent problems and issues related to product quality complaints using 6 methods of SINGLE, which outline methods to manage from the stage raw material are warehoused and shipped in general for finished products.

That is to say, core issues involved here are thorough management method for warehoused raw materials, management of raw materials at the process stage, management of applicable facilities, inspection method, overall management of the shipping of finished products, establishment and application of basic standards, action plan for unsuitable products and education and training for staff in charge. And also mutually organic harmony among all the above items will be important. The arrangement of outputs generated pursuant to daily sequence is the point to remember.

Especially in order to implement these works, TF Team should be organized at the initial stage while overall Master Plan to ensure clear assignments as well as Action Plan by respective Team unit to ensure given assignment by team should be established and implemented. It is necessary to post the results of actions taken on the status board so that the members concerned can see. In order to induce the participation of site workers, the standards required for work site should be prepared in easy format so that site workers can easily understand the standards. And it will be important to have frank discussion on the problems and their improvement through regular meetings between advisors and CEO.

5. Cases of Single PPM Site Improvement

<table>
<tr><th>Name of Project</th><td>Semi-automation of ball cage assembling</td><th>Period</th><td>Apr. 2-Jun. 10, 2008</td></tr>
<tr><th>Effect</th><td colspan="3">Productivity enhancement by eliminating arm muscle pain from ball cage press-in work for long hours</td></tr>
<tr><th colspan="2">Before Improvement</th><th colspan="2">After Improvement</th></tr>
<tr><td colspan="2">Manual work of Ball cage press-in</td><td colspan="2">Improve work method by installing semi-automatic ball cage press-in device</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
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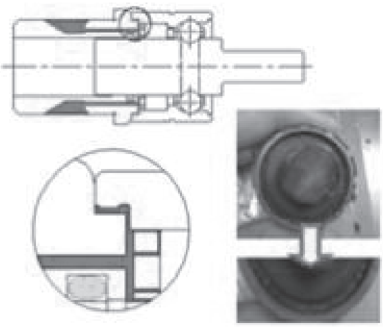
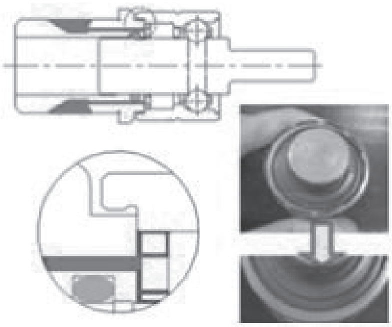
<table>
<tr><th>Name of Project</th><td>Improve grease attachment</td><th>Period</th><td>May 6- Jul. 19, 2008</td></tr>
<tr><th>Effect</th><td colspan="3">Productivity and quality improvement by eliminating grease attached externally</td></tr>
<tr><th colspan="2">Before Improvement</th><th colspan="2">After Improvement</th></tr>
<tr><td colspan="2">Attachment of grease at front SEAL (BLUE SEAL) part</td><td colspan="2">No attachment of grease on outside of finished products</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
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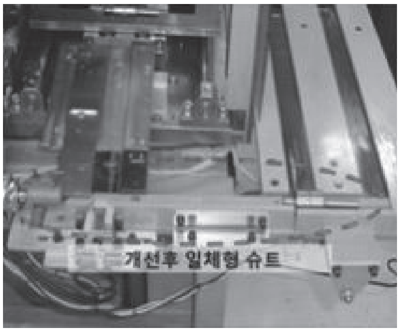
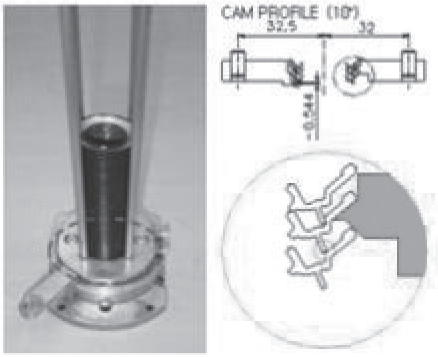
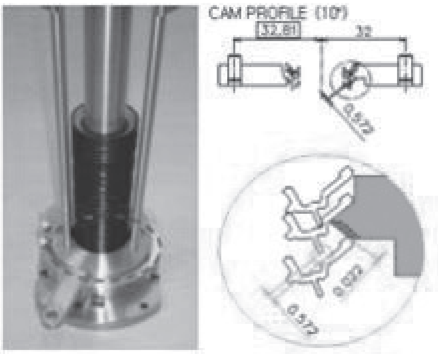
Name of Project	Reduce machine type change time	Period	Jul. 18-Aug. 27, 2008
Effect	Material was changed from acryl to aluminum to increase durability and separate type shoot was improved to all-in-one type to reduce machine change time and enhance productivity		
Before Improvement		**After Improvement**	
At the time of machine change, too many separation spots and machine change time was long and durability of acryl material is short.		All-in-one type shoot in aluminum material was manufactured and installed	
			

Name of Project	Improve SEAL supply defect	Period	-
Effect	Seal separation pitch of Seal Magazine of post processor was improved to prevent Seal hung-up phenomena and cost saving and productivity enhancement through reduction of Seal wastes		
Before Improvement		**After Improvement**	
SEAL lip part was not accurately separated and thus Seal hung-up phenomena was occurred		SEAL lip part is accurately separately and SEAL hung-up phenomena was improved	
			

Name of Project	Improve Torque check defect	Period	Dec. 1-Dec. 11, 2008
Effect	WORK (Bearing shaft) is not rotated at the torque check process of Slinger press-in device and thus facility operation is stopped due to torque check problem. But by increasing fastening force of Collet, WORK (Bearing) was improved for normal rotation and thus productivity was enhanced.		

Before Improvement	After Improvement
1. Used 1 Spring outside of HOUSING 2. Small angle of COLLET (4 degree) 3. Fastening force: 5.28kg	1. Used 8 Spring inside HOUSING 2. Changed the angle of COLLET to 16 degree 3. Fastening force: 17.20kg
 	 

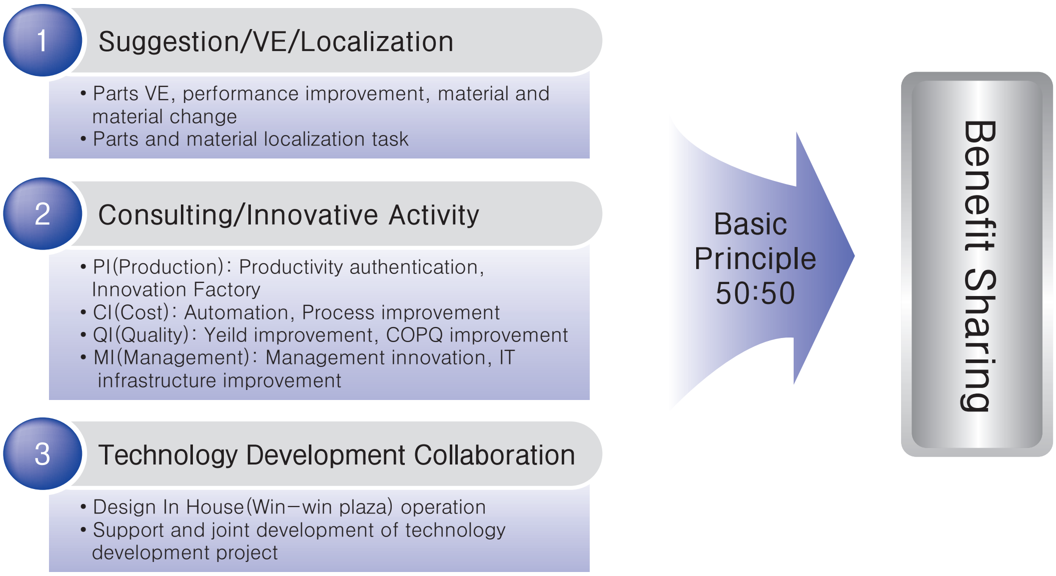
Appendix 2 | **Case of Mutual Growth and Benefit between Large and Small/Medium Corporation (Samsung Electric)**

1. Background

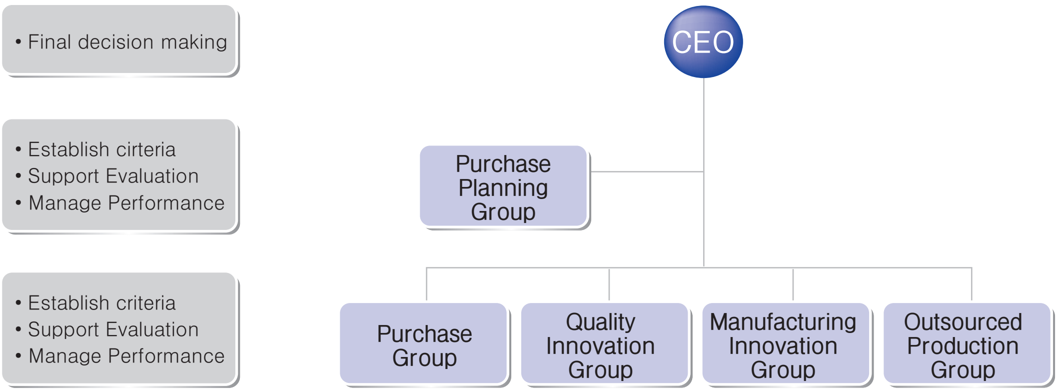
Under the perception that the competitiveness of a large, parent corporation is reflected by the competitiveness of its cooperative relationship with subcontractors, systematic efforts were made to support and foster superior subcontractors including funding support, management improvement support and officers/employees cultivation education from 2004 with funding size of 30 billion won for the purpose of intensifying the constitutions of the subcontractors and helping them secure self-survival capability. From 2005, the company introduced and implemented the Benefit Sharing System for establishing mutual cooperative programs in full scale and prepared the framework for mutual growth together with subcontractors.

2. Basic Direction for Benefit Sharing

Benefit Sharing Program of Samsung Electric is operated based on three pillars (1) Subcontractor's suggestion/Value Engineering (VE) and localization task, (2) Management improvement consulting and factory innovation task, and (3) Technology development collaboration task, and improvement/collaboration activities will be jointly carried out for the selected implementation tasks sharing the benefits together pursuant to the pre-determined method.

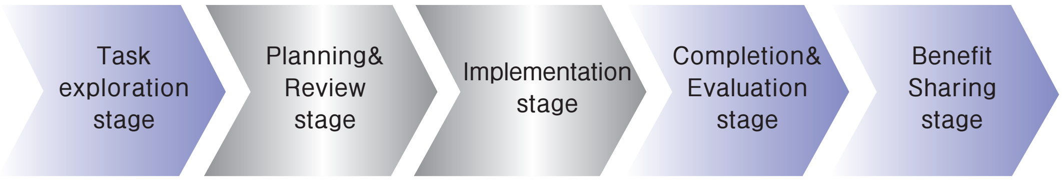


3. Implementation Organization for Benefit Sharing



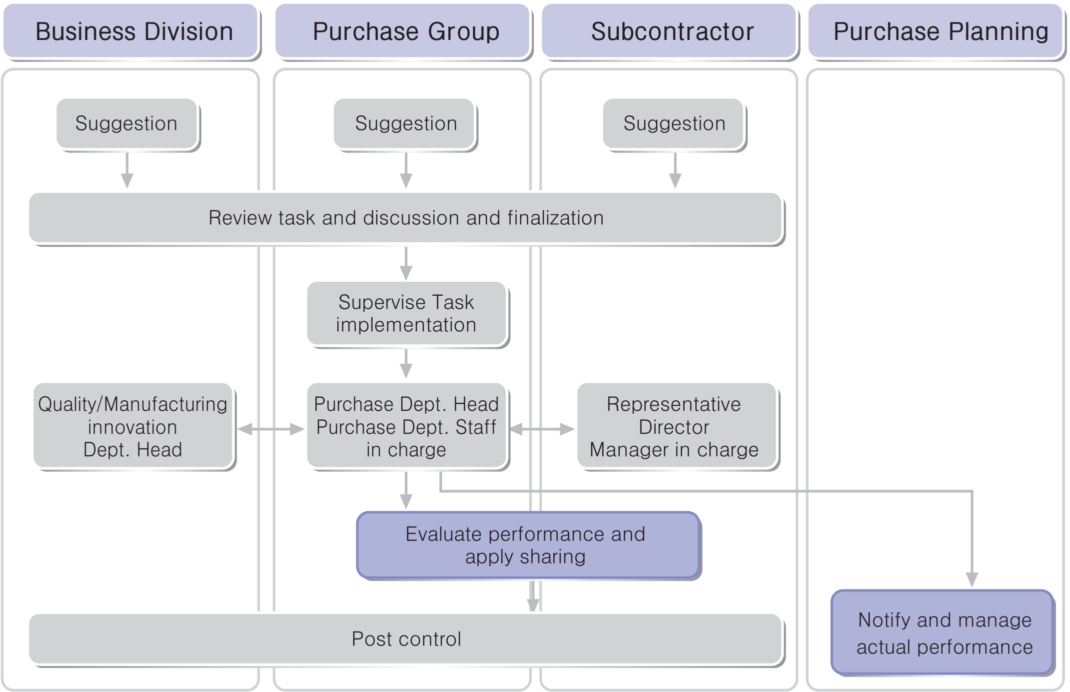
4. Benefit Sharing Process

4.1. Implementation Process



• Submit reciprocal proposal • Initiate joint task	• Receive system task • Schedule/Plan/Effect calculation	• Implement improvement of purchase area • Implement approval for research area	• Report proposal completion • Evaluate preformance	• Monetary benefit sharing • Materialistic benefit sharing
• Subcontractor applies consulting • Select self improvement/ guidence	• Define/plan Activity • Set scope of initical diagnosis	• Guide improvement of Consultant • Quality/ manufacturing innovative activity	• Report consulting completion • Joint evaluation of performance	• Financial benefit sharing
• Win–win Plaza task • Explore technology collaboration task	• Register system task • Select target national task	• Implement improvement of purchase/research areas • Implement development & collaboration	• Report task completion • Evaluate final task performance	• Monetary/ Materialistic benefit sharing • Benefit amount/performance sharing

4.2. Role by Department



5. Evaluation of Performance and Reward System

Benefit Sharing Program of Samsung Electric is basically conduced on a 50:50 joint basis with subcontractors provided, the period of application is more than six months in principle. Allocation ratio varies depending on who proposed and who plays leading role.

6. Post Management

When a task is completed, reward type is decided through discussion based on financial performance, and depending on the nature of task, selective application of the benefits such as monetary benefit sharing for applicable product, increase in quantity, preferential benefit for investment fund support for part development/mass production facilities, priority of participation for new product development, priority for moving into Win-win Plaza, Point addition for comprehensive evaluation of subcontractor and priority for management improvement support.

7. Case of Implementation with TSP Co., Ltd.

Established in 1985, Taeseok Precision Co., Ltd., or TSP, is a manufacturer specializing in lead frame and ultra precision metal fabrication and processing for semiconductors. TSP is located in Gumi, Gyeongbuk Province, and is a solid middle sized corporation with technology that was given the Presidential Award in Single PPM in 2004, and Export Tower Award for recording exports of 50 million US dollars in 2006.

In trying to realize cost savings as profitability deteriorated due to increased raw material costs, the company derived an improvement idea of changing Ag+Sn (Ni) type which was existing plating ingredient of Lead frame for tantalum capacitor to Sn (Ni). In case Ag plating process was deleted, remarkable cost reduction and increase in yield were expected but the difficult tasks of securing steady quality and customers' approval were waiting for them.

TSP decided to officially present this proposal to its main buyer, and registered the idea at the Innovation Proposal Plaza in the Supplier Portal System of Samsung Electric. The Innovation Proposal Plaza was a system designed to encourage and foster ideas by subcontractors that could be developed into a new growth engine. The proposal was reviewed by the Research and Development group, and then, adopted as a joint initiative.

The joint working team of both companies faced several difficulties in the course of implementing the proposal: 3 quality related problems of occurrence of Silver at the compression part at the time of stamping, deterioration of wire welding at the time of Sn plating and change in color at the time of passing IR. Engineers of both companies could solve respective problems by optimizing through the change in coining quantity, process of Al-wire weld ability evaluation and minimizing heat transmission rate through the change of the thickness of plating after a number of trial and error.

Through the savings of plating and medicine manufacturing costs based on successful performance of the task, financial effect for annual 1.5 billion won was generated and lead time for plating process was reduced by 50%(20 to 10 hour/lot) with the effect of higher utilization of idle facilities thanks to the elimination of Ag plating process.

The success case of TSP demonstrates the benefits of encourage new ideas for improvements that lead to results, and facilitating technical cooperation between large corporations and SMEs. This case study can be used as a model for subcontractors with similar difficulties.

As TSP continues to pursue ways to improve the plating process and is exploring other methods such as process optimization and VE for other raw materials, further increases in competitiveness based on continuous innovation is anticipated.

1. The Small and Medium Business Technology Innovation Promotion Act [Law # 8852, February 29, 2008]

Article 17 (Acquisition of Overseas Specification and Quality Enhancement Support)

② Governor of Small and Medium Business Administration may implement the project for each of the following items(hereinafter referred to as Quality Enhancement project) for the quality enhancement of small and medium corporations:
1. Management of quality defect rate for small and medium corporations' products
2. Professional manpower cultivation project required for quality enhancement

③ In case Governor of Small and Medium Business Administration deems it necessary for the implementation of overseas specification acquisition support project and quality enhancement project, it may either make necessary contribution to the institution or organization based on the provision of the Article 29-2 or assist them.

④ Matters necessary for the selection and support for overseas specification acquisition support project and quality enhancement project shall be stipulated as the Presidential Decree.

Article 17-2 (Quality Certification pursuant to Auality Defect Rate of Small and Medium Corporation Products)

① Governor of Small and Medium Business Administration may grant Quality Certification (hereinafter referred to as Quality Certification) pursuant to the quality defect rate of small and medium corporation products in order to promote the quality enhancement of small and medium corporation products pursuant to the provision of the Article 17-2.

② The small and medium corporation which wishes to get the Quality Certification pursuant the provision of the item 1 shall apply the Quality Certification to Governor of Small and Medium Business Administration.

③ In case Governor of Small and Medium Business Administration received the application for Quality Certification pursuant to provision of the item 2, it shall perform the screening for the factory of the corporation and grant Quality Certification with validity when the application meets the criteria for the certification.

④ In case the small and medium corporation which received Quality Certification becomes applicable to any one of the following items, Governor of Small and Medium Business Administration may cancel the Quality Certification. Provided, Quality Certification shall be cancelled in case the corporation is applicable to item 1.

1. In the case of receiving the Certification based on deception or other fraudulent method.
2. In case the Certification criteria were not fully met.

⑤ For the small and medium corporation which wishes to get Quality Certification, Governor of Small and Medium Business Administration may collect necessary cost from the corporation in relation to Quality Certification.

⑥ The Quality Certification procedure, cost, certification criteria, quality certification mark, designation of quality certification work handling institution, expiry of quality certification and other matters shall be stipulated as the Presidential Decree.

Article 29 (Entrustment of Authority)

① Part of the authority of Governor of Small and Medium Business Administration based on this Act may be entrusted to the head of a specialized technology promotion institution.

② Governor of Small and Medium Business Administration may entrust a part of business based on this Act to an institution or organization based on the stipulation in the Presidential Decree.

2. Enforcement Decree of the Small and Medium Business Technology Innovation Promotion Act (the Presidential Decree # 20728, February 29, 2008]

Article 14-2 (Application of Quality Certification) The small and medium corporation which wishes to get Quality Certification pursuant to the provision of the Article 17-2-2 of the Act shall submit Quality Certification application with the attachment of the status of quality defect rate of product to Governor of Small and Medium Business Administration.

Article 14-3 (Criteria for Quality Certification)

① Criteria for Quality Certification pursuant to the Article 17-2-3 of the Act shall be each of the following items:

1. The company shall have management strategy and quality management system for the quality enhancement for the product
2. Quality defect rate of product shall be less than 1000/1,000,000.

② Detailed criteria for Quality Certification pursuant to the provision of each of the item shall be stipulated and notified by Governor of Small and Medium Business Administration.

Article 14-4 (Designation of Quality Certification Work Handling Institution)

① Governor of Small and Medium Business Administration may designate the equity who meets each of the requirements in the following items among the institution stipulated in each item of the Article 14-2 as a Quality Certification work handling institution to have the institution handle the factory screening related work pursuant to Article 17-2-3:
1. The equity shall be equipped with an exclusive organization to carry out Quality Certification works.
2. The equity shall be equipped with an exclusive manpower to handle Quality Certification works.

② Detailed criteria for the designation of Quality Certification work handling institution pursuant to the provision of each of the item shall be stipulated and announced by Governor of Small and Medium Business Administration.

③ When the institution was designated pursuant to the provision of the item 1, Governor of Small and Medium Business Administration shall announce it.

Article 14-5 (Issuance of Quality Certificate)

① When a small and medium corporation which applied for Quality Certification was acknowledged to be suitable for the Quality Certification criteria pursuant to provision of the Article 14-3, Governor of Small and Medium Business Administration shall issue Quality Certificate.

② The small and medium corporation which received Quality Certificate pursuant to the provision of the item may affix Quality Certification Mark to the applicable product or publicize it.

Article 14-6 (Expiry of Quality Certification) Expiry of the Quality Certification pursuant to the provision of the Article 17-2-3 of the Act shall be 3 years from the date on which Quality Certification was given.

Article 14-7 (Collection of Quality Certification Expense)

① The cost that can be collected in relation to Quality Certification pursuant to the provision of the Article 17-2-5 of the Act shall be each of the following items:
1. Manpower cost required for factory screening work
2. Expenses required for the trip for factory screening

② Detailed items necessary related to Quality Certification pursuant to the provision of the item 1 shall be stipulated and announced by Governor of Small and Medium Business Administration.

Article 19 (Entrustment of Authority)

② Governor of Small and Medium Business Administration shall entrust each of the following works pursuant to the provision of the Article 29-2 of the Act to the Quality Certification work handling institution pursuant to the provision of the Article 14-4-1:
1. Reception of Quality Certification application pursuant to the provision of the Article 17-2-2 of the Act
2. Factory screening pursuant to the provision of the Article 17-2-3 of the Act
3. Collection of cost related to Quality Certification pursuant to the provision of the Article 17-2-5 of the Act

3. Enforcement Rule of the Small and Medium Business Technology Innovation Promotion Act [the Ministry of Knowledge and Economy #379, December 21, 2006]

Article 2-2 (Application for Quality Certification)

① The small and medium corporation which wishes to apply for Quality Certification pursuant to the provision of the Article 14-2 of the Enforcement Decree of the Small and Medium Business Technology Innovation Promotion Act (hereinafter referred to as "Decree") shall submit Quality Certification application (Separate Form #1) together with the attachment of the status on quality defect rate of product to the head of the quality certification work handling institution (hereinafter referred to as "Quality Certification work handling institution") designated pursuant to the provision of the Article 14-4 of the Decree.

② When the head of Quality Certification work handling institution received the Quality Certification application pursuant to the provision of the item 1, he/she shall conduct the factory screening of the small and medium corporation concerned according to the Quality Certification criteria and submit the result of the screening to Governor of Small and Medium Business Administration without delay.

③ Quality Certificate pursuant to the provision of the Article 14-5-1 of the Decree is as per the Separate Form #2.

4. Single PPM Quality Certification Procedure [Small and Medium Business Administration Notification # 2008-55, December 18, 2008]

In order to stipulate the matters necessary for Quality enhancement project for small and medium corporation pursuant to the provision of the Article 17-2 of the Small and Medium Business Technology Innovation Promotion Act and Quality Certification pursuant to the quality defect rate of small and medium corporation product according to the provision of the Article 17-2 of the Act, Single PPM Quality Certification Procedure is announced as follows:

December 18, 2008
Governor of Small and Medium Business Administration

Article 1 (Purpose) The purpose of this Procedure is to stipulate on the matters necessary for the project for quality enhancement of small and medium corporation pursuant to the provision of the Article 17-2 of the Small and Medium Business Technology Innovation Promotion Act (hereinafter referred to as 'Act') and Quality Certification pursuant to quality defect rate of small and medium corporation product pursuant to the provision of the Article 17-2 of the Act.

Article 2 (Definition) Definitions of the terms used in this Procedure are as follows:

1. "Single PPM" means the management of defect rate with the objective of manufacturing perfect product with no fault and no defect (PPM: Parts Per Million)
2. "Mother Corporation for the implementation of Single PPM" (hereinafter referred to as "Mother Corporation") means the corporation which supports Subcontractor to be able to implement Single PPM Quality Innovation activity.
3. "Single PPM participating Corporation" (hereinafter referred to as 'Participating corporation") means the corporation which implements Single PPM Quality Innovation activity.
4. "Single PPM Quality Innovation Implementation Institution" is the institution which handles quality enhancement project based on the provision of the Article 14-2 of the Enforcement Decree of the Small and Medium Business Technology Innovation

Promotion Act (hereinafter referred to as "Decree") and Quality Certification work based on the provision of the Article 14-4 of the Decree. This institution is designated by Governor of Small and Medium Business Administration pursuant to the provision of the Article 3 of the Decree (hereinafter referred to as "Implementation Institution").

Article 3 (Designation of Implementation Institution)

① Governor of Small and Medium Business Administration may designate the institution, which is judged to successfully implement Single PPM Quality Innovation project and which is equipped with each requirement in the following items, among the institutions based on the provision of the Article 14-2 of the Decree as an Implementation Institution.
1. The institution shall be equipped with separate exclusive organization and manpower to handle Quality Certification works.
2. The institution shall be equipped with the registration and maintenance training system for Single PPM Quality Certification Screening person (hereinafter referred to as "Certification screening person") based on the provision of the Article 15.
3. The institution shall be equipped with internal and external network which can induce the participation of large corporation to the said project.

② The institution which wishes to get designation as an Implementation Institution shall apply to Governor of Small and Medium Business Administration submitting each of the following documents before 3 months from the commencement date of the project (January 1 of every year):
1. Certified registration and the Articles of Incorporation for the corporation or organization
2. List of the members of exclusive organization and Certification screening persons in the organization and their personal histories
3. Implementation Plan for Quality Innovation project which includes the content of the item 1 and budget

③ For the application based on the item 2, Governor of Small and Medium Business Administration shall review the quality innovation project Implementation Plan, and in case the institution is judged to satisfy the requirements, Governor of Small and Medium Business Administration shall designate the Implementation Institution before 15 days from the date of project commencement and announce it.

④ Implementation Institution may establish the branch of Single PPM Quality Innovation Implementation(hereinafter referred to as "Implementation Branch") in order to implement Single PPM Quality Innovation project smoothly.

Article 4 (Composition of Single PPM Screening Committee)

① For efficient operation of screening and systematic management of Single PPM Quality Certification System, Implementation Institution shall have Single PPM Screening Committee (hereinafter referred to as "Screening Committee:").

② Screening Committee shall be comprised of the Director General in charge from Small and Medium Business Administration, relevant organization, industry and academic field for less than 9 persons who are appointed by Governor of Small and Medium Business Administration based on the recommendation of the head of the Implementation Institution and the Chairman of the Committee shall be the Director General in charge from Small and Medium Business Administration and Coordinator shall be the person nominated by the Chairman.

③ Screening Committee shall be convened by the Chairman and discuss on each of the following items and shall be decided by gaining a majority of the Committee members attended subject to the attendance of majority of the registered members.

1. Screening of Single PPM Quality Innovation project implementation plan
2. Screening of certification criteria for business type and item for which measuring of defect rate is difficult.
3. Screening of detailed screening item by sub-item of Single PPM Quality Certification criteria based on the provision of the Article 14-3-1 of the Decree
4. Screening of awarding superior corporation and men of merit for Single PPM quality innovation project
5. Other items which Governor of Small and Medium Business Administration acknowledges to be necessary for the operation of Single PPM Quality Innovation project that was entrusted to the Implementation Institution by Governor of Small and Medium Business Administration

Article 5 (Allowance) The members of Screening Committee who attended the screening shall be entitled to receive allowance within the scope of budget. Provided, the committee member who is a government official attends the Screening Committee in relation to his own work shall not be entitled to receive the allowance.

Article 6 (Establishment of Single PPM Quality Innovation Project Implementation Plan)

① The head of Implementation Institution shall establish Single PPM Quality Innovation Project Implementation Plan(hereinafter referred to as "Implementation Plan") for the following year in order to promote the quality innovation of the corporation and submit the Plan to Governor of Small and Medium Business Administration by the end of

November every year.

② The Implementation Plan of the item 1 shall include each of the following items:

1. Major implementation direction and detailed Implementation Plan for the project entrusted by Governor of Small and Medium Business Administration for the development of Single PPM Quality Innovation project pursuant to the provision of the Article 19 of the Decree
2. Budget funding and use plan necessary for the implementation of Single PPM Quality Innovation project
3. Matter related to post management screening for Single PPM Quality Certification
4. Matters related to the operation of Single PPM Quality Innovation project
5. Matters related to the guidance of Single PPM Quality Innovation participating corporation
6. Matters related to education and publicity for the distribution of Single PPM Quality Innovation Movement
7. Other matters necessary for quality enhancement of small and medium corporations

Article 7 (Subscription of Participating Corporations)

① Governor of Small and Medium Business Administration shall announce the subscription plan for the participating corporations targeting small and medium corporations based on this Procedure at the beginning of every year.

② The announcement shall include the information of application method, eligibility for application and supports given.

③ Application shall be submitted through Small and Medium Business Administration, Implementation Institution and Implementation Branch, and the applications received by the institutions other than Implementation Institution shall be handed over to the Implementation Institution.

④ The head of Implementation Institution shall review the Single PPM quality Innovation Implementation Plan of the applied corporation and select the participating corporation.

Article 8 (Supports to Participating Corporations)

① Small and Medium Business Administration and Implementation Institution may support all or a part of expenses required for the Single PPM Quality Innovation related guidance and education for the participating corporations selected based on the provision of the Article 7 after conducting the guidance and education.

② Small and Medium Business Administration and Implementation Institution may support all or a part of expenses required for the corporation which wants to get Single PPM Quality Certification. Provided, the corporation which received the support for all or a part of the expenses in the year concerned based on the provision of the item 1 shall be excluded from the object for the support.

Article 9 (Single PPM Quality Certification)

① Governor of Small and Medium Business Administration shall grant Quality Certification by categorizing as per [Separate Table #1] depending on the level of defect rate at the time of granting Single PPM Quality Certification pursuant to the provision of the Article 17-2 of the Act. Provided, in case it is acknowledged that the measuring of defect rate is difficult depending on the characteristics of product, the Certification may be granted pursuant to the criteria which were separately stipulated by the Screening Committee.

② Single PPM Quality Certification shall be granted separately for the factory or business division (hereinafter referred to as “Business place”) which manufactures the product concerned.

Article 10 (Criteria for Single PPM Quality Certification)

① Criteria for Single PPM Quality Certification (hereinafter referred to as “Criteria for Certification”) pursuant to the provision of the Article 17-2-3 of the Act and the Article 14-3 of the Decree shall be as per [Separate Table #1].

② Detailed screening item by screening item for the criteria for Certification in the [Separate Table # 1] shall be separately stipulated through the screening of Screening Committee.

③ The head of Implementation Institution shall inform Governor of Small and Medium Business Administration when he/she decided detailed screening items or changed them based on the provision of the item 2.

Article 11 (Eligibility for Application for Single PPM Quality Certification) The small and medium corporation which wants to get Single PPM Quality Certification based on the provision of the Article 9 (hereinafter referred to as “Applicant”) shall have the records for the implementation of Single PPM Quality Innovation activity for more than 6 months and the items eligible for application shall be the items which takes up more than 3% of total sales or total production quantity of the factory which manufactures the product concerned.

Article 12 (Application of Single PPM Quality Certification)

① The applicant based on the provision of the Article 11 shall apply the Certification to the head of Implementation Institution together with the require documents based on the Separate Form#1 of the Enforcement Rule of the Small and Medium Business Technology Innovation Promotion Act (hereinafter referred to as “Enforcement Rule”). Provided, the head of Implementation Institution may allow to submit the application at the Implementation Branch for the convenience of the applicants.

② When an application was received by a Implementation Branch based on the provision of the item 1, the application shall be passed to the head of Implementation Institution within 3 days from the date of receipt.

③ When inadequate item was found after the review of the application based on the provision of the item 1, the head of Implementation Institution may request the applicant to supplement stipulating the period of less than 14 days. Provided, applicant may request to extend the period due to the reason that he/she cannot supplement within the specified period specifying required extension period, and in this case the applicant’s extension request shall be limited to two times.

Article 13 (Site Screening)

① When the application received based on the Article 2-2 of the Rule turned out to be suitable, the head of Implementation Institution shall select 2 persons out of the members for Certification Screening and conduct site screening based on the site screening criteria in the [Separate Table #1]. Provided, however, the person who conducted quality guidance for the workplace applied for Single PPM Quality Certification in the same year shall not be selected for the member of Certification Screening for the workplace concerned.

② In case technical advice is required for site screening based on the provision of the item 1, the head of Implementation Institution may allow an expert related to the target item for screening to participate in the site screening.

③ When the site screening based on the provision of the item 1 is conducted, the head of Implementation Institution shall prepare Site Screening Plan and inform the applicant of the schedule for the site screening and the list of the members of the screening without delay.

④ The site screening based on the provision of the item 1 shall be within 2 days. Provided, however, when it is acknowledged to be necessary in view of the size of workplace or the characteristics of items, the period of site screening may be extended within minimum range in discussion with the applicant.

Article 14 (Submission of Site Screening Result)

① When the members of Certification Screening completed site screening, the member shall submit the result to the head of Implementation Institution in the form of Site Screening Report in the Separate Form #2 with the attachment of detailed contents of screening.

② The head of Implementation Institution shall review the Site Screening Report received based on the provision of the item 1 and request the Governor of Small and Medium Business Administration to grant the Certification in case it turned out to be suitable for the judgment criteria in the [Separate Table #1].

Article 15 (Member of Certification Screening) The member of Certification Screening shall be appointed by the Governor of Small and Medium Business Administration among the persons who are applicable to each of the items stipulated in the [Separate Table #2].

Article 16 (Partial Exemption of Site Screening) When a case is applicable to any of the following items, site screening may be partially exempted. Provided, however, the scope of exemption shall be decided by the Screening Committee:

1. In the case of the application by the workplace which obtained the Certification for Quality System based on ISO 9000 and ISO/TS 16949 specifications
2. In the case of the application by the factory which obtained the PMS Certification based on the Article 22-2 of the Industrial Development Act.
3. In the case of the application by the person who obtained the certification based on the provision of the Article 17 for the purpose of adding items or changing the grade of the Certification.

Article 17 (Issuance of Quality Certificate and Announcement)

① When the request for Single PPM Quality Certification was made based on the provision of the Article 14-2 of the Decree, the Governor of Small and Medium Business Administration shall review the request and make decision on the Certification. When the applicable criteria were met, the Governor of Small and Medium Business Administration shall issue Single PPM Quality Certificate (hereinafter referred to as "Quality Certificate") in the form of the Separate Form #3 based on the provision of the Article 14-5 and inform the head of Implementation Institution of the contents of the Certification.

② When the Governor of Small and Medium Business Administration granted Certification based on the provision of the item 1, the Governor of Small and Medium Business Administration shall announce it.

Article 18 (Marking)

① The person who obtained the Certification based on the provision of the Article 17(hereinafter referred to as “Certified Corporation”) may use the certification mark in the [Separate Table #3] for their product, packing and advertisement.

② The certified corporation may post the sign board in the [Separate Table #3] on the gate of the workplace.

Article 19 (Support to Single PPM Certified Corporation)

① The Governor of Small and Medium Business Administration may render the support in each of the following items to the certified corporations:

1. Single PPM Quality Innovation guidance and education with all or a part of the cost required
2. Granting of additional points at the time of evaluation for financial support of Small and Medium Business Promotion & Industrial Infrastructure Fund
3. Preferential treatment at the time of evaluation for the designation of military service corporation
4. Preferential treatment at the time of allocating foreign industrial technical trainees
5. Preferential treatment at the time of evaluation for the selection of the company to support for small and medium business technology innovation development project
6. Preferential treatment in the case of participation in the consulting business with coupon system to get guidance
7. Preferential treatment at the time of implementation of other small and medium corporation support policy

② The Governor of Small and Medium Business Administration may request public institution, organization and Mother Corporations for each of the following items to support the certified corporations:

1. Granting of additional points at the time of credit guarantee from Credit Guarantee Fund or Technology Credit Guarantee Fund
2. Granting of additional points at the time of selection of overseas market exploration group
3. Preferential treatment for each of the following items from Mother Corporation to the certified corporation:

a. Shortening of fund settlement period
b. Exemption of delivery inspection
c. Preferential allocation of order quantity
d. Preferential provision of technology and information data

Article 20 (Post Management)

① The head of Implementation Institution may conduct the screening for post management regularly every year within the expiry using each of the following items to see if the certified corporation is maintaining the certification criteria based on the provision of the Article 10. Provided, however, the screening may be conducted occasionally as necessary.

1. In the following year after the date of Certification (the 1st year), post management shall be performed based on the Defect Rate and Quality Management System Maintenance Status for Single PPM Quality Certified Corporation (verified by Mother Corporation) based on the [Separate Form #4] which was submitted. Provided, however, in case there is no Mother Corporation to deliver, the delivery defect rate of Mother Corporation shall be substituted by average defect rate for external claims received/handled.
2. In the 2nd year, the post management shall be conducted in the form of site screening.
3. In the 3rd year, renewal screening shall be conducted but the screening shall be pursuant to the provision of the Article 13, 14 and 16.

② When there is an objection raised by consumer related or relevant organization on the defect rate of the certified corporation or it is acknowledged to be necessary to verify the level of defect rate for some reason, the head of Implementation Institution may conduct special screening on the maintenance of certification criteria based on the provision of the Article 10.

③ The head of Implementation Institution may cause Mother Corporation of the certified corporation to conduct post management based on the provision of the item 1 or 2.

④ The screening of post management may be waived for the corporation which received award based on the provision of the Article 25 only for once.

Article 21 (Cancellation of Single PPM Quality Certification)

① In order to maintain and manage the level of the certified quality of the certified corporation, the head of Implementation Institution may request Governor of Small and Medium Business Administration to take appropriate measures in case each of the following reasons were occurred:

1. Improvement may be requested where applicable to each of the following case:
   a. In case Defect Rate and Quality Management System Maintenance Status pursuant to the provision of the Article 20-1 (Verified by Mother Corporation) was not submitted within the stipulated time limit or the average score of Post Management screening does not reach to the Certification level.
   b. In case notification based on the provision of the Article 22 was not done or the false notification was prepared and submitted
   c. In case mark was indicated differently from that in the Article 18 or marking was done for the item which was not certified.
2. Certification may be cancelled where applicable to each of the following case:
   a. In case the Certification received turned out to be false or fraudulent one.
   b. In case the production of the certified item was acknowledged to be impossible due to bouncing check, closure of business or other reason
   c. In case request for improvement was received based on the provision of the item 1 but rectification was not made without justifiable reason

② The head of Implementation Institution shall give an opportunity to make statement to the party who is subject to taking measure based on the provision of the item 1 or the party's agent in the case of request for the measure.

③ When Governor of Small and Medium Business Administration received the request for taking measure based on the provision of the item 1, Governor of Small and Medium Business Administration shall review and take measure as appropriate and make announcement at the time of cancellation of the Certification.

Article 22 (Notification)

① Certified corporation shall inform the head of Implementation Institution of the reason within 30 days from the date of the occurrence of the reason when each of the following reasons were occurred:

1. Change of Representative
2. Moving of Business Place

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