Qualification Strategies and New Media for Quality Assurance in Manufacturing

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Qualification Strategies and New Media for Quality Assurance in Manufacturing

– the example of the automotive industry in Korea and Germany –

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FOREWORD

Structural transformation processes in Korea and Germany – as in other highly developed societies are characterized by technological developments and technical systems which are becoming increasingly complex.

Growing competitive pressure, globalization of markets, introduction of new information and communication technology in production, distribution and service and a more individualized customer behavior are leading to new qualitative challenges for initial and continuing training. Success and result oriented human resource development in companies can be characterized as one of the essential factors in ensuring competitiveness.

This development is seen particularly in the growing importance of information and communication technology (ICT) as tool for initial and continuing training and in the highly efficient company infrastructures connected with this processes.

This study compares the training strategies utilized by automotive industry in two countries, Korea and Germany. Despite different policy frameworks and institutional arrangements in the two countries, automotive companies in both countries have tried to maintain the high quality of the companies' products and services in the face of the growing challenges. Their strategies to guarantee high quality products vary depending on their corporate training strategies.

In this way the study did examine comparatively and on the basis of concrete examples the different existing approaches to facing and solving the problems connected with educational concepts and the use of new (digital) media, against the backdrop of the respective national and company-specific learning cultures.

This study has been a joint effort of researchers from two leading national research organizations in the field of vocational education and training in Korea and Germany.

We commend the researchers on this team for their hard work in completing this study.

Dr Jang Ho Kim
KRIVET

Mr Manfred Kremer
President, BIBB

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Executive Summary

This study examines the approaches utilized by automotive industry in Korea and Germany to keep their workers skills or to enhance their range of skills.

The study analyzes the national framework for education and training policies in the two countries and explores existing training strategies of automotive industry by examining quality assurance in manufacturing, target group specific initial and continuing in-company training and the use of new media in VET. Synergies were identified between the Korean and German education and training systems to assist each other improve their delivery of initial and continuing education and training to trainees and employees in the contexts of automotive industry.

Training strategies in automotive industry

The national framework for education and training in Korea and Germany is different reflecting the differences that exist in their structure of states, industrial structures, and cultural differences. The Korean education and training system is a centralized, state-led system while the German system is a decentralized, corporatist one. Initial education and training in Korea is provided in schools and public training institutions with little involvement of industry, which is contrasted to the fact that the role of social partners in initial training is pivotal in the German dual system.

Notwithstanding these differences, automotive companies in both countries have tried to maintain the high quality of the company's products and services in the face of increasingly rapid technological changes and the competitive pressures of globalization. Their strategies to guarantee a high quality products vary depending on their corporate cultures. While Korean companies have introduced various schemes to improve productivity and product quality, German companies made use of specific teaching and learning of their training contexts.

Initial education and training in both countries put emphasis on generic skills, knowledge of production process and fine tuning of relevance at the stage of initial education and training, even though initial training is provided mainly in schools in Korea while it is provided at workplace in Germany. Increasingly, both countries will need to pay greater attention to continuing training of employees as the proportion of young people in the working age population declines and existing jobs require new skills as work organizations change.

There has been increasing use of new media in education and training in automotive industry in recent years. Over the coming years, it is anticipated that the use of new media in education and training will continue to increase amongst Korean and German (potential) employees. As both economies transform into the knowledge-based economy, technological prerequisites, the availability of the necessary infrastructure, and the training of personnel qualified to implement and control specific knowledge management systems will become strategic resources.

Lessons from the Korean-German experiences

Although there are differences in the economic and enterprise structure and industry profiles of the Korean and German economies, both economies are currently facing challenge of a similar nature, particularly in the globalization of markets and technological advancement.

Therefore, the vocational education and training systems in both countries need to be responsive to the growing challenges. Both countries need to give more attention to continuing education and training of employees as the existing jobs require new skills as work organizations change.

1) Lessons from the Korean experience

Lifelong vocational education

Vocational education has been stigmatized as being "second class" education system chosen only by those who have failed to get admission to a college. Graduates of vocational high schools have had little chance to pursue college education. The reform in the mid-1990s was thus aimed to expand the scope of vocational education to establish a lifelong vocational education system.

Measures have been taken to facilitate transition not only from vocational high school to higher education, but also from work to higher education. To encourage vocational high school graduates to move into higher education, the government has introduced initiatives such as 'integrated high school program' and '2+2 linkage program'. Graduates of vocational high schools, moreover, are given admission to junior colleges and polytechnic universities in related fields of study. Meanwhile, to encourage workers to be transferred to higher education institutions, they are given preferential consideration when polytechnic universities screen candidates for admission.

The policies for promoting lifelong vocational education resulted in a dramatic increase in the rate of vocational high school graduates admitted to college education in the last decade. On the contrary, percentage of workers pursuing college education has remained minimal. This can be attributed to the fact that compensation systems of enterprises do not provide incentives for employees to continue their studies in institutions of higher education.

Case study findings indicate that government initiatives to open college education for those who are in the labor market are inadequate to promote lifelong vocational education. These policy initiatives need to be supported by corporate HR management, which encourages employees to participate in further education in colleges and universities.

Fostering continuing training–the Employment Insurance Scheme

Traditionally, continuing education and training of the employed in Korea has mainly been the responsibility of the enterprises. As large industrial conglomerates grew, workers were often given the opportunity to stay under one employer for a long time, often until their retirement. This work culture has meant that the larger employers were virtually assured of recouping the benefits of any investment made in the training of employees.

The Korean government has introduced the Employment Insurance Scheme (EIS) in 1995. Vocational training forms part of this scheme and the contribution rate for the vocational training component of the system ranges from 0.1 per cent to 0.7 per cent of the total wage depending on the size of the firm. The Vocational Competency Development Program (VCDP) under the EIS is an incentive scheme to foster voluntary training funded by the EIS fund.

Since the introduction of EIS in 1995, VCDP has expanded its scope of coverage and subsidies to include private vocational training. VCDP thus became the most important subsidy program to upgrade skills of employees.

Despite the incentives it provided, the scheme has had limited success in increasing the amount of training provided by small firms. Large firms have been the main beneficiaries of the training programs with 'windfall' gains accruing to large firms. Not all firms that contribute to the fund actually provide training for their workers.

Therefore, a scheme such as the EIS could be considered by German governments as a means of encouraging firms to provide higher–level training for their employees. The Korean experience suggests that, to be successful, a scheme of this type should be designed to include part-time and casual workers and older workers.

Developing e-learning infrastructure

There are increasing demands for affordable, accessible and timely education and training. With the rapid development of information and communication technology over the last two decades, e-learning has become extremely important.

The Korean government has made efforts to provide the information and communication technology infrastructure and funding required to promote and support e-learning in educational institutions and enterprises. The government had realized that availability of financial incentives was not enough to ensure that individuals and enterprises will engage in e-learning. There had to be the necessary infrastructure to provide a platform for e-learning delivery.

In Korea, policies and strategies adopted by the government have created the appropriate environment to enable the development of e-learning. The National Information Framework, represents an endeavor by the Ministry of Information and Communication to build ICT infrastructure. In addition, the Korean government has also supported ICT education for students at all levels of education. The Ministry of Education and Human Resources Development has legislated for the establishment of cyber-universities whose main purpose is to provide higher education programs via e-learning. The Ministry of Labor has provided financial support to encourage the uptake of e-learning in Korean enterprises. Due to the government policies and strategies, Korea has shown exceptionally rapid growth in terms of Internet access and Internet use. Its performance has placed it among the leading countries in this area.

The Korean experience provides an example of the role of the government in promoting e-learning by taking initiatives in developing e-learning infrastructure.

2) Lessons from the German experience

Quality assurance

In German companies 'quality' is understood as the 'quality of training and skills' while it is defined as the 'quality of products' in Korea. This approach is based on the belief that a high standard of initial training in the context of real work-processes should guarantee high-quality of the production process, and hence an end product which meets the highest standards. The final outcome should naturally fulfil the demands of the customers reliably and systematically.

To meet this standard, the companies made use of specific teaching and learning concepts in their training contexts (the 'process learning workshop' at DC Gaggenau, 'training islands' at Ford in Cologne, the assessment system (AiD) at DC Mannheim) to implement didactic approaches in a targeted way. These schemes for initial training include elements from quality management systems based on the international standards of ISO 9000 family and other quality awards.

Recently, many countries have tried to introduce schemes to enhance the quality of skills and training in enterprises by evaluating and certifying corporate training activities. The German examples show that the scheme for quality assurance should be examined in the broader context of total quality management system.

Involvement of social partners in initial vocational training

In Germany, vocational training takes place primarily in the so-called 'dual system'. For one or two days a week apprentices attend public vocational schools and they spend the rest of their work hours in their workplaces.

The term 'dual system' denotes a combination of two different training locations within the same training program. Vocational training follows general schooling and precedes actual working life. As a rule, vocational training programs span three years. The German training system, with its nationally standardized and rigorously enforced curriculum, is governed in a "corporatist" fashion, i.e., by employers associations and trade unions together under a state umbrella. There is not much in the system that individual employers can decide on their own. Chambers regulate, supervise, and sanction the firms whose training they are charged with guiding. The "corporatist governance" of enterprises is supported by state regulations. Adherence to training regimes is also enforced by work councils.

As a result, the German economy has an abundant supply of skills. The role of the social partners in initial vocational training in Germany has been highly regarded as a major source of providing the 'right skills' in response to industrial demands.

Germany's current VET system, involving organized social partners in developing training regulation and training curricula, would simply not be possible without strong corporatist institutions.

Use of new media in international education and training

Case study of DaimlerChrysler Mannheim illustrated an example of the use of new media in international education and training. The Mannheim Plant's "didactic database" made it much more efficient to bring the new Series 900 engine into production in Korea. In late 2003, Korean multipliers were trained in engine assembly in Mannheim using the PLS as a training medium. Afterwards they received individual instruction at the relevant work station or by working on a specially prepared training engine. These training multipliers returned to Korea and passed on their knowledge to their colleagues, communicating the training content using the database on assembly skills they had brought with them from Mannheim.

The DC Mannheim's experience indicates that using a new training medium for internationalization offers advantages in terms of cost and efficiency. It reduces the number of trainers required to transfer knowledge and skills, which substantially cuts travelling costs. Even after the departure of experts, the work-related expertise is left behind to be repeatedly accessed for training.

As the world becomes more globalized, enterprises including automotive companies are expected to have more collaborators and suppliers abroad in the future. The DC Mannheim's experience in VET internationalization was a prime example of how international cooperation in education and training can be promoted with the help of new media.

I. Introduction

1. Background

Structural transformation processes in the Federal Republic of Germany and the Republic of Korea – as in other highly developed societies – are characterized by technological developments and technical systems which are becoming increasingly complex.

Growing competitive pressure, globalization of markets, introduction of new information and communication technology in production, distribution and service and a changing (more individualized) customer behavior are leading to new qualitative challenges for initial and continuing training. Success and result oriented human resource development (HRD) in companies can be characterized as one of the essential factors in ensuring competitiveness.

This development is seen particularly in the growing importance of information and communication technology (ICT) and in the highly efficient company infrastructures connected with them.

Enterprises in the automotive industry (as well as their suppliers and retail networks) are playing an economically important and almost prototypical role within the overall output chain in both countries. At the same time they are making extensive use of new information and communications technologies. These are the main reasons why this industrial sector was chosen by both sides as the application example for the project. Another focal point will be those continuing training measures which serve quality assurance in manufacturing.

The questions for in-company initial and continuing training which result from this will be posed in connection with the respective degree of the use of new ICT in initial and continuing training as well as in the manufacturing process itself. In this regard the central challenge to in-company qualification strategies is beyond doubt either the media competence of the employees or strategies for imparting media competence as an important first step towards making profitable use of the potential of the new ICT in daily skilled work. Media competence includes analytical reasoning, interaction with technical systems and "informedness." Media competence should go hand in hand with social competence at all levels. It encompasses the ability to acquire critical information and to select specific – specialized – information (learning on demand) and communication within a team.

The second major challenge in handling the potentials of the new ICT lies in the uncontrollable flood of information available in particular through the internet medium. How can one provide important, technically sound information quickly (just in time) without wasting valuable time searching through various data pools (the "lost" in hyperspace" effect)? Competent use of the new ICTs in-company initial and continuing education and training processes plays a decisive strategic role in this context. The successful implementation of the new media is directly dependent on it.

2. Research objectives

This research examine comparatively and on the basis of concrete examples the different existing approaches to facing and solving the problems connected with educational concepts and the use of new media, against the backdrop of the respective national and company-specific learning cultures.

3. Analytical framework

The recent literature on industrial organization and skills formation provide the analytical framework of this research. The study examines the systems of vocational education and training, quality assurance in manufacturing and changing job requirements, target group specific training programs, and use of new media in education and training. The systems of vocational education and training are described based on analyses of education and training systems, funding systems, and training practices. The initial and continuing education and training programs are targeted on skilled workers and master craftsmen.

4. Data and methodology

Korea

The main references and research reports that are referred to in detail are:

- *The Statistical Yearbook of Education* published by the Ministry of Education and Human Resources Development (MOEHRD) and the Korea Educational Development Institute (KEDI). The report is based on a nation-wide annual survey conducted in April, 2004. The report identifies numbers of vocational schools and students by program and grade.
- *The Current Status of Vocational Training Programs* reports published by the Ministry of Labor. These reports identify vocational training practices by training providers, training programs and sources of funding. These reports are annual publications.

Major data sources are as follows:

Hyundai Automotive Company was selected as a case. Considering that the company has been the largest automotive company in Korea since its establishment in the 1960s, the company offers advantages as a leading enterprise in the automotive industry in Korea.

For empirical research, visits to the company (plants and training centers) were made. Data were obtained from managers and union officers on those occasions. These data sources included internal reports, annual education and training programs, and publications, such as journals and newsletters. In addition to collecting data, interviews with two different groups were conducted: (1) section managers and (2) shopfloor workers and trade union officers.

As initial education and training to foster skilled workers and technicians for the industry are provided in vocational high schools and junior colleges, Pusan Specialized High School, a vocational high school, and Ajou Motor College, a junior college were closely examined in case studies.

In addition, two external collaborators contributed to the research. Dr. Hyung Je Jo and Dr Sung Gug Jung provided papers on "Education and training programs at Hyundai Motor Company" and "Skills Formation in Engine Plants", which were respectively incorporated into "Quality assurance in manufacturing and changing job requirements" and "Target group-specific continuing in-company training" in this report.

Germany

The German contribution was to produce the present study, making reference to four case studies of initial vocational training in the German automotive industry[1]. Here, BIBB was able to draw on cooperative links with companies in the automotive industry going back many years. The case study examples are as described by the employees from each company. In addition, visits were made to all the companies, and a field observation was conducted over several days in one of the DaimlerChrysler AG companies in Gaggenau; this was summarized in a report. Therefore, as far as the German section is concerned, the present study has model character. At the same time, the main focus of this part of the study is on the initial training of skilled workers within the German 'dual system' of vocational training. This emphasis is justified for three reasons:

The dual system of initial vocational training is the most commonly used training route for middle grade employees. More than half of all young people in each age-cohort in Germany complete an initial vocational training program under the dual system.

In the automotive industry, those employed in production and assembly are characteristically qualified to skilled worker level. In the majority of cases, teams and sections are led by Meister (Master Craftsmen)[2], which is a standard upgrading training for skilled workers in Germany. University-trained engineering graduates tend only to be employed at the hierarchical level of entire departments and units, or in sections responsible for production support services. But even at this level, both in commercial and industrial-technical roles, there are many employees who hold a skilled worker qualification. Unskilled workers are only assigned to auxiliary processes which do not demand extensive occupational competence or responsibility.

Since in-company vocational education and training in the dual system is the main focus of work at the Federal Institute for Vocational Education and Training (BIBB), this was the area in which the authors were best equipped to contribute their expertise.

Various differences in slant will be noticed in the presentation of the case studies described, with the result that particular examples tend to accentuate particular aspects. While the case study at Ford in Cologne focuses strongly on enterprise-based training, the Audi example is geared towards the use of electronic media in initial and continuing vocational education and training.

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1 The two plants belonging to DaimlerChrysler AG, the Ford plant in Cologne, and AUDI in Neckarsulm. The case studies are included as Annexes 1-4.

2 The Master Craftsman qualification should not be confused with the Master's Degree which is an academic qualification awarded internationally

The two case studies from DaimlerChrysler place the enterprise-based system of initial and continuing vocational education and training within the context of corporate training needs and training strategies. DaimlerChrysler Mannheim puts an emphasis on international education and training within the company.

II. Korea

1. Education and training system

1) Administration of education and training

Vocational Education is provided under the formal education system and vocational training is provided as non-formal training in Korea. The Ministry of Education and Human Resources Development (MOEHRD) administers vocational education, and supervises and coordinates national policies concerned human resources development and the Ministry of Labor administers vocational training.

The Ministry of Education and Human Resources Development is the government body responsible for the formulation and implementation of policies related to academic activities, the sciences and public education. MOEHRD integrates and coordinates educational policies, publishes and approves textbooks, provides administrative and financial support for all levels of school system, supports local educational offices and national universities, operates the teacher training system and is responsible for overseeing lifelong education and developing human resources policies.

Non-formal vocational training is administered by the Ministry of Labor. Headed by the Minister and Vice Minister, the Ministry has two offices -Planning and Management Office and Employment Policy Office – and four bureaus – Labor Policy Bureau, Labor Standard Bureau, Industrial Safety & Health Bureau and Women Workers Bureau. In addition, eight professional officers are responsible for offices of specialized fields. In charge of vocational training in the Ministry of Labor is the Ability Development Office under which there are three divisions: Training Policy, Human Resource Development and Qualification Support.

Under the Ministry of Labor, HRD Korea (former Korea Manpower Agency) was established in 1982. HRD Korea is a public corporation responsible for vocational training. Its main functions are (i) vocational training, employment guidance, and follow-up service, (ii) development of vocational training materials, (iii) national qualification testing and registration, (iv) skill encouragement and competitions, (v) employment promotion, and (vi) promotion of private vocational training.

2) School education

Korea uses a school ‘ladder’ following a similar track of 6-3-3-4 system which maintains a single track of school levels in order to ensure that every citizen can receive elementary, secondary (middle and high), and tertiary education without discrimination and according to the ability of each student (Table 2.1).

Table 2.1: School system

	Schools	Duration (years)	School age
Kindergarten		2~3	3~5
Elementary education	Elementary schools	6	6~11
Secondary education	Middle schools	3	12~14
Secondary education	High schools	3	15~17
Tertiary education	Junior colleges	2~3	18~19/20
Tertiary education	Colleges	4~6	18~21/23

Source: The Ministry of Education and Human Resources Development(2005). *Education in Korea, 2005~2006.*

School enrollment rate is high at all levels of schools (Table 2.2). Today, almost all young people complete secondary school and the percentage that go on for higher education is among the highest in the world (As of 2004, about 81 percent of high school graduates advanced to university/college). The quality of secondary education is high as well, at least judging by international tests of academic performance comparison[3].

Table 2.2: School enrollment rate: student/school age population (2004)

Elementary school	97.7%
Middle school	91.9%
High school	90.9%
Tertiary	61.7%

Source: Korea Education Development Institute, *Statistical Yearbooks of Education.*

Elementary and middle school

In Korea, schooling usually begins at the age of six, when the children move from kindergarten into elementary school. Elementary and middle school education are compulsory and together last nine years. Upon completing their primary education, learners who wish to pursue secondary education are assigned, most often, to the middle school nearest their residence.

High schools

High school education aims at providing advanced general and specialized education building upon the achievements in the middle school. High schools are classified into academic, vocational, and other schools-e.g. foreign language, art & athletic, and science high schools.

Graduates of middle schools or those who have completed equivalent level of education may enter high schools. Admission into high schools used to be based on the applicant's score on the entrance exam, but admission processes began to vary in 1974 when high school leveling policy

[3] In the second test of OECD Program for International Student Assessment given to upper level secondary students in 2003, Korea ranked first out of 41 in problem-solving, second in reading, third in math and fourth in science. In 2001, Korea had ranked first in science. (Korea Herald, 8 December 2004).

was launched in selected regions. Students who seek vocational education can choose a school and submit an application, upon which they are admitted either through an entrance examination or based on middle school records. Meanwhile students who opt for general education are given the opportunity to select their schools but are assigned to a school in their residential district.

Students in academic high schools, where advanced general education is practiced, select a major in the second year (11th grade) from the areas of humanities and social sciences, natural sciences, and vocational education. Their choice is based on their own aptitude and interest, which, in turn, serve as links between their school courses to future careers. The majority of students opt to spend the first two years as preparation for university application. Students may transfer to the vocational track in the beginning of the third grade

Curriculum and textbooks

The Ministry of Education and Human Resources Development oversees the national school curriculum, as designated by Article 23 of the Elementary and Secondary School Education Law, in order to ensure equal educational opportunity for all and maintain the quality of education. The national curriculum and regional guidelines accord flexibility to individual schools in accordance with the particular characteristics and objectives of each school.

The national curriculum is revised on a regular basis to reflect the newly rising demands for education, emerging needs of the changing society, and new frontiers of academic disciplines.

Curriculum standards serve as guidelines for educational contents at each school level and for textbook development. The government has undergone seven curriculum revisions to meet national and social needs as well as to keep up with the challenges in consideration of various factors related to research and development.

The Seventh Curriculum which was introduced in 1997 consists of the Basic Common Curriculum and the Selected Curriculum at the high school level. The curriculum covers ten years from the first year of elementary school to the first year of high school, to provide the general public with basic education.

In the 11th and 12th years in high school, students are given the opportunity to choose their course track so that they may access education that facilitates their pursuit of future academic and/or career paths.

Teachers

Teachers are required to meet the specific qualification criteria for each category (which is defined in the Act on Elementary and Secondary Education) and be licensed by the Deputy Prime Minister and Minister of Education and Human Resources Development as stipulated by Presidential Decree.

Kindergarten teachers are trained in colleges, junior colleges, and the Korea National Open University. Teachers for elementary and secondary schools are trained in universities of education, colleges of education, or in department of education or other departments in general colleges/universities that are authorized to offer teacher’s certificate programs. Elementary school teachers are generalists and secondary teachers are subject specialists. All candidates

aspiring to become secondary school teachers must undergo the screening process conducted by city/provincial education offices.

Higher education

The higher educational institutions are divided into seven categories: colleges and universities; industrial universities[4], universities of education, colleges of education; junior colleges, broadcast and correspondence universities, polytechnic colleges and other institutions (including theological colleges and seminaries). Education period is from four to six years. The Ministry of Education and Human Resources Development has control over such matters as student enrollment quotas, qualifications of teaching staff, curriculum and degree requirements.

The government sets basic minimum requirements for universities regarding the admission process to promote the independence and responsibility of universities, normalize the public education system, and alleviate the burden of private tutoring costs. To expand the opportunity for higher education, receipt of donations from students, and high school classification system are prohibited. These measures are intended to contribute to normalizing public elementary and secondary education system and guaranteeing fairness in the student admission process. In terms of the types of data to be utilized and the weight given to such data universities may exercise independent authority in utilizing student records, the scholastic aptitude test (SAT) scores, essay writing, certificates and recommendation letters.

The scholastic aptitude test consists of five areas: language (Korean), mathematics, foreign language (English), social studies/ science/vocational training, and second foreign language/ Chinese characters. Students may choose the subjects to be tested on, based on the basic principles of the Seventh Curriculum, allowing students to take either part or all of the tests in the subjects available. High school graduates who wish to continue on to college must have a good grade from “the national SAT” which is held once a year[5].

Because of the system of university admission by competitive exam, Koreans believe it is feasible to line up and rank universities on a single scale. Entrance exams of one sort or another are generally regarded as a necessary evil and the most impartial method of regulating access to education above middle school. Because of the need to prepare for entrance examination, Korean high schools provide a sound grounding in mathematics, statistics, and basic science. Because of the high degree of standardization in high school curricula and the stringent requirements of the university entrance exams, there is but a small range of variation in background among students in these fields. Characteristically, schools in the Korean education system tend to be academic, or focused on what may be called general education.

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[4] Open university was renamed polytechnic university in accordance with the Higher Education Law which came into operation in March, 1998. However, open universities are often named in various ways depending on the mission and objectives of the university

[5] Admission to colleges is determined on the basis of the scholastic achievement test (SAT), school achievement and the main entrance examination, and the SAT is the most important of the three criteria.

3) Vocational education system

The largest element in Korea's system of vocational education and training is vocational education provided in schools. Initial training (pre-employment education and training) are provided at the senior secondary level vocational high schools and post-secondary level junior colleges and polytechnic colleges.

Vocational education at the secondary education

Vocational high schools

Vocational high schools aim to educate skilled workers equipped with sound occupational awareness and professional knowledge to enable them to cope with rapid changes in an information-centered industrial society. They provide technical-vocational education programs in the specialized fields of agriculture, technology, business and commerce, marine & fisheries, and home economics. Most vocational students are participating in programs in senior secondary schools of business/commerce and technology. These vocational high schools serve as training grounds for craftsmen in Korea.

There are various types of vocational high schools – high schools established for special purposes, that is to foster human resources capable of contributing to nation's key industries, specialized high schools to strategically foster specific skills-e.g. shoe-making, cuisine, and animation – the 2+1 system which consists of two years of school education and one year of on-the-job training, and integrated high schools which provide both general and vocational curricula to prepare students for both higher education and the job market.

Considering the aspiration of both parents and students for higher level of education, a special curriculum has been developed for integrated school tracts such as vocational high school education (11th and 12th grades) and two years of junior college education.

As of 2004, vocational schools comprised about 35 % of the total number of high schools. Student enrollment in vocational high school accounts for about 28.9 per cent of total high school enrollment, which has been declining since 1997. Among the graduates, more than 62 % advanced to higher education.

The curriculum for vocational high schools is composed of general and vocational subjects. Students are required to take 216 units in six semesters spanning three years[6]. Of the 216 units, students are required to take a minimum of 82 units of general subjects such as mathematics and science and minimum of 82 units of vocational subjects[7]. Of the 82 units allocated to vocational subjects, from 2 to 68 units should be allocated for field training. The field training program is operated in co-operation with individual industries.

[6] According to the Vocational Education and Training Promotion Act, the principal of vocational high school is given authority to offer maximum of 237 units, which is 10 percent higher than the required number of units.

[7] In general, the ratio of general subjects and vocational subjects offered in vocational high school is 50:50.

Vocational education at the post-secondary education

As the overall educational level of Koreans rose dramatically, the task of workforce development, which had belonged to the domain of high school level education, was transferred to junior colleges and other higher education institutions.

Junior colleges

Junior colleges, offering two- or three-year programs are the direct outgrowth of the increasing demand for technical manpower attendant to rapid industrialization. Their specialized courses are grouped into technology, agriculture, nursing, fishery, health, commerce and business, home economics, arts and athletics. For the effective achievement of the educational goals, junior colleges develop and provide practical curricula through on-site training via school–industry collaboration programs and vocational specialty training plans and job sheets.

High school graduates or equivalent may apply to junior colleges. Admission is determined on the basis of academic achievement, the SATs, and the main entrance examination score. Approximately 50 percent of the freshmen quota is reserved for graduates of vocational high schools in the same fields, craftsmen qualified by the National Certification System, and workers meeting specified industrial requirements.

Polytechnic colleges

Polytechnic colleges are publicly funded post-secondary vocational education and training institutions. They provide two-year programs to train multi-skilled craftsmen (technicians). Multi-skilled craftsman program is provided by 48 departments including automation system, car electronics, mechatronics, computer-applied molding, etc. The program focuses on training learners the skills industries need in the workplace. Graduates of multi-skilled craftsmen programs receive the industrial associate degree. As of 2004 there were 23 polytechnic colleges with a total enrollment of 13,603 students.

In addition, polytechnic colleges provide 1-2 year programs to train master craftsmen in the specialized area of engineering[8]. Master craftsman program[9] is provided as evening courses by six departments, including machine tool, electricity, car maintenance and molding, with a total enrollment of 233 students in 2004. Education and training expenses for the program are fully covered by the government.

Polytechnic universities

The polytechnic university provides employed youths and adults with an alternative approach to higher education. Since the establishment of Kyonggi Technical Open College (later it was renamed Seoul University of Technology) in 1982, 19 polytechnic universities with an enrollment of about 158,444 have been established in 2004.

The requirements for admission into a polytechnic university are the same as those for regular universities. However, priority in selection is given to persons with experience in industrial

[8] There are two courses (1-year course and 2-year course) in Master craftsmen program. Those who have more than three years of work experience can complete master craftsmen program within one year

[9] Master craftsmen in Korea usually possess theoretical knowledge, but lack practical skills. Their role is not well recognized as that of German Meisters

organizations, holders of national technical qualifications, and graduates from vocational high schools and vocational courses in academic high schools, according to the school regulations. There are no academic years in this curriculum. Over 50 percent of the admission quota is given the opportunity both to improve their business abilities and to be educated continuously by being offered classes at night.

Experimental and practical exercises are the center of the curriculum of a polytechnic university in order to make a positive emphasis on the practical aspects of education. To heighten adaptability to industrial sites, a polytechnic university employs staff with teacher's licenses at the industrial site as supplementary teachers.

Recent trends in vocational education

In the 1990s, the Korean economy was facing new challenges posed by the changing economic environment, including the globalization of trade and labor markets, the rapid advancement of new technologies and heightened competition. Despite the expansion of higher education in the past decade, the current level of education and training was unable to meet industrial demands. The government has recently introduced various measures to strengthen the vocational education and training system in order to prepare the necessary skilled manpower to meet the changing industrial demands while reducing the pressure on higher education. It is worthy to note that the government began to make efforts to transform the traditional supply-oriented systems into more demand-driven systems.

PCER[10] proposed the Second Educational Reform Program including the vocational education reform in 1996. The main objective of this vocational education reform was to establish a "Lifelong Vocational Education System" to realize a "Lifelong Learning Society." It would ultimately lead to the development of each individual according to his or her unique talents and interests as well as the nurturing of high-quality human resources demanded by the labor market.

Diversification of vocational education program

With the reform program vocational education at high schools has been designed to lead not only to the labor market but also further education in institutions of higher education. In this context, the establishment of specialized high schools and integrated high schools was proposed as a way of diversifying vocational education programs.

Specialized high school. This *scheme* was introduced to curb the existing trend in high schools focusing mostly on preparing students for higher education regardless of the individual wishes and plans of students for their life after high school. These *specialized high schools* offer job preparation courses to students who are not ready to pursue university education at this stage. Specialized high schools were introduced in 1998. As of 2004, there are 64 specialized high schools in animation, cooking, tourism, design and information and communications technology. This scheme has been evaluated as being successful, and the government plans to increase the number of specialized high school up to 200 by year 2010 (CEIN, 2005).

[10] Presidential Commission for Education Reform(PCER), a consultative body directly under the President, was established in February, 1994 and has announced educational reform suggestions in 48 areas. The Commission announced major educational reform plans on May 31, 1995, with supplementary educational reform plan on February 9, 1996 and August 20, 1996.

Integrated high school. This new program aim to integrate vocational and general education in high schools. Schools that wish to do so can integrate and operate the curricula of vocational and general high schools to enable students to choose from the wide selection of courses irrespective of their field of study. This is to enable students to satisfy prerequisites for further education while at the same time acquire work-related knowledge and skills in high school to enter the workforce upon graduation.

Schools that integrate and operate both tracks of curricula minimize the number of compulsory courses students must take and increase the number of elective courses. The pilot programs have been implemented in ten schools across the country. The government plans to promote this scheme more actively (CEIN, 2005).

2+2 linkage program. Some schools have combined the second and third years of vocational senior secondary schools with two year programs of vocational colleges -hence 2+2 – in order to expand the higher education opportunities for vocational high school students and to strengthen the capacity of junior colleges to provide quality vocational education.[11] Students who have completed vocational senior secondary school courses are given priority in the selection process or entry into colleges in related fields of study. As of 2004, 340 vocational high schools and 152 junior colleges participated in this linkage program.

The policies for diversifying vocational education, especially the integrated high school scheme and the 2+2 linkage program, have helped raise the number of vocational high school graduates pursuing college education. Nevertheless, inadequate curriculum, lack of investment in vocational education and problems related to instructors continue to be problems on account of which vocational education is assessed to be falling short of satisfying the needs of industries.

School-Industry collaboration programs

The government has taken measures to provide financial support to promote closer relationships between the school and the industry. At the high school level, the government has introduced *school enterprise* and *business incubator* programs in order to provide financial support to school-industry cooperation programs. At the higher education level, various programs have been introduced by several ministries (Table 2.3).

Table 2.3: Financial support programs to promote school-industry cooperation (2004~2005)

Education level	Major school-industry cooperation program	
4-year college	School enterprise, industrial techno park, strengthening of regional college, school-industry cooperation-centered college	Youth internship program, Youth job world
Junior college	School enterprise, business incubator, school-industry cooperation-centered junior college, customized training, industrial techno park, specialization of junior college	
Vocational H.S.	School enterprise, business incubator	

Source: Joo, Yong-Gook (2005). *Promoting School-Industry Linkage.*

[11] A pilot program to link the curricula of the vocational high school and the junior college were conducted in the period of 1997-1998. 16 vocational high schools and 4 junior colleges participated in the pilot program.

Current initiatives to promote school-industry collaboration at the higher education level are part of the broader strategies for achieving balanced regional development. These initiatives aim to establish regional colleges/universities as focal points of innovating the regional economy.

Despite government's supportive policies, school-industry collaboration at each level of education has borne limited results. The industry tends to be disinterested in agenda not related to immediate business benefits, which effectively limits the extent of their willingness to cooperate. Participation of industries in school-industry initiatives tends to be passive and formal. At present, there is no established council or board to link schools and industries.

4) Vocational training system

In Korea, the state has taken the initiative in the supply of skilled labor. Because of the lack of in-company training, employers depended heavily on outside sources to provide skilled labor, and in many cases the government was behind supporting the development of skilled labor.

There have long existed formal vocational schools, but these could not provide sufficient technical manpower for the rapidly industrializing country. To train workers to meet increasing industrial demands, the Korean government established several vocational training institutes in the periods of 1960s and 1970s.

With the introduction of compulsory training system `under the Basic Law for Vocational Training enacted. in 1976[12], when the government began to undertake a structural change towards the development of the heavy-chemicals industry, the training has expanded to private companies.

Vocational Competency Development Program

The Basic Law for Vocational Training including the compulsory training system, contributed to the early increase in in-company training, but it did not meet the training demands of private firms during the more recent environment of ongoing changes in the Korean economy. In addition, the law constrained enterprises from providing upgrade training to their employees.

The government enacted the Act on Promoting Workers' Vocational Training in 1997 to establish a system for Vocational Competency Development[13] and to encourage enterprises to provide further training for the employed on a voluntary basis. The act has been put into effect since January 1999. With the enforcement of the act, the Basic Law for Vocational Training was abolished.

According to the act, the Minister of Labor will provide financial support to employers who provide Vocational Competency Development Programs (VCDP). The Minister also supports employees who make an effort to develop their vocational competency by participating in the

[12] According to the Law, firms in certain industries with 300 or more employees (expanded to include companies with more than 150 as from 1991) are required to provide in-company skills training to a certain proportion of their employees. If the employer cannot meet this requirement, he or she may have this obligation waived by paying a training levy as determined by the Ministry of Labor.

[13] "The Act on Promoting Workers' Vocational Training" uses the term 'Vocational Competency Development' to differentiate it from 'vocational training' used in "The Basic Vocational Training Act".

vocational competency development training programs or any other programs specified in the Education Law, or by pursuing a certificate. Governmental agencies or local autonomies may provide training for the unemployed.

Vocational training in Korea can be divided into two kinds based on the type of training institutions, namely, public and private vocational training. Public training is undertaken by Human Resources Development Service of Korea (HRD Korea), the Korean Chamber of Commerce and Industry (KCCI), governmental agencies, local autonomies and the Korea Employment Promotion Agency for the Disabled (KEPAD)[14]. It aims to train semi-skilled and skilled workers in programs lasting from three months to two years.

Private vocational training is undertaken by Training Foundation, Women Workforce Development Center and Training Centers recognized by the Ministry of Labor. Private vocational training programs are divided into 'training for the unemployed', 'government commissioned training', 'training for the employed' and 'small and medium vocational training consortium' depending on the target trainee group. These programs consist mainly of institutional training. However, 'training for the employed' is often conducted through e-learning or correspondence training.

Government commissioned training aims to foster workers in trades selected by the government as a priority[15]. Vocational training is undertaken in 17 industrial sectors including traditional sectors such as agriculture/forestry, fishery, and mining and newly emerging sectors such as environment.

In 2003 there were 53 public vocational training institutes, and among them 44 institutes were under the jurisdiction of HRD Korea[16]. In addition, 4,155 private vocational training institutes participated in the Vocational Competency Development Program (VCDP).

Employment Insurance System (EIS)

In Korea, in-company training and training for the unemployed are financed through the Employment Insurance System (EIS). EIS was introduced in July 1995 as a comprehensive system intended to reduce the risk of unemployment, the risk of losing income as a result of unemployment and the risk of skill obsolescence.

In the early 1990s, the government developed a new economic strategy (New Economic Plan), aimed at transforming the economy from a growth-oriented economy with lifelong employment and low wages into an economy based on competition, flexible labor market and higher wages. The EIS was introduced to assist workers in an environment more conducive to layoffs.

The Employment Insurance System comprises three components: the Employment Security Program, Vocational Competency Development Program, and the Unemployment Benefit Program. Vocational training initiatives are supported through the Vocational Competency Development Program. The EIS is a levy-grant system in that employers and employees make

[14] HRD Korea, KCCI and KEPAD are concerned with trades that are commonly required by manufacturing industry (die-making and machine work), export–oriented trades (gem–cutting, dyeing and weaving etc.), and trades in advanced and new technology (CAM).

[15] Priority occupation is defined as (1) occupations in industries essential to the national economy in which there is shortage of labor; (2) occupations in the nation's strategic industries, such as the ICT industry and the automotive industry, in which there is labor shortage; and (3) other occupations announced by the Minister of Labor, in which it is necessary to foster human resources as industries' demand for labor force increases

[16] 44 institutes included 23 polytechnic colleges which were placed under the authority of Korea Foundation for Polytechnic Colleges in December 1998.

payments as a levy and get refund for expenses upon implementation of training. The size of the levy for VCDP varies according to the size of the company. Companies with less than 150 employees pay 0.1 percent of the overall wage bill and companies with more than 1,000 employees pay 0.7 percent. The reason for the differing levy amounts is the differences in the external efforts of in-company vocational training. Even though the Employment Insurance Fund is collected from employees and companies, the government has the responsibility for its management.

The VCDP under EIS is an incentive system to promote voluntary training by providing financial support to employers and employees from the EIS fund. There are three main categories of financial support available in the scheme. The first is the support for employers who conduct the Vocational Competency Development Programs, namely, subsidies for training costs (grants for in-plant training, paid leave for education and training, and loans for training facilities). The second category of support is for employees, in the form of training subsidies for insured employees and tuition loans. Finally, the unemployed are offered the opportunities to participate in various training activities regardless of their eligibility for unemployment benefits. Needless to say, re-employment in secure jobs through opportunities to acquire appropriate skills should be preferred to the passive protection of unemployment benefits.

Implementation of Vocational Competency Development Programs

Since the introduction of EIS in 1995, Vocational Competency Development Program has expanded its scope of coverage and the subsidy to include private vocational training (Table 2.4). Initially, the level of subsidy was not high, but has grown dramatically since 1998 when the Asian financial crisis resulted in mass unemployment in Korea. As of 2004, the number of workers participated in the training with the subsidy of the Vocational Competency Development Program reached 2,057,000, and training participation rate of the insured stood at 27.1 %. This demonstrates that VCDP has become the most important subsidy program to upgrade vocational competency of employees.

Table 2.4: Participation in VCDP

(unit: number of forms, thousand persons, %)

		1995	1997	2000	2002	2004
Firms	Insured	38,953	47,427	693,414	825,531	1,002,638
Firms	Subsidized	380	8,863	86,692	62,293	95,753
Firms	Participation rate	(1.0)	(18.7)	12.5	(7.5)	(9.6)
Workers	Insured	4,204	4,280	6,747	7,171	7,577
Workers	Subsidized	10	200	1,367	1,739	2,057
Workers	Participation rate	(0.2)	4.7	20.3	(24.3)	(27.1)

Source: Ministry of Labor (2004), The Current Status of VCDP (1995~2004).

The VCDP includes a provision to subsidize the training costs or provide loans for employees' self-directed training of workers, but the outcome of this program remains minimal. Majority of VCDP participants undertook in-company training (94.1 %), while only a small fraction

took paid leave for education and training (0.3 %), financing for college courses (1.6 %) and reemployment training of the unemployed (3.3 %).

Moreover, in-company training is concentrated in large firms. In 2003, the participation rate of firms with less than 150 workers in in-company vocational training was negligible, while it came close to 98 percent in the case of firms with over 1,000 workers. The high participation rate is explained by the fact that firms may claim support more than once over a given period of time. Other programs of training for the employed are also mostly pursued by large firms.

Vocational education and training reforms

Vocational Education Reforms

The Korean government, recognizing the demand for workers who can adapt quickly to the rapidly changing work environment, has worked on a plan for reforming the vocational education system to one which can train learners to fulfill those demands. In May 2005, the Presidential Committee on Education Innovation (CEIN)[17] disclosed a proposal[18] for reforming the vocational education system to better respond to the emergence of the knowledge-based society.

Vocational education system will be reformed in the following ways:

First, the vocational education system will be transformed from one that is designed to foster a large pool of workers with general skills to one which trains specialized professionals. The new vocational system would promote diversification of curriculum and program length.

Second, the provision of education will be decentralized. The MOEHRD had been the central organization that oversees vocational education, but with reform the mandates will be distributed among local autonomies, the industries, and the various government organizations who will be encouraged to participate.

Third, short-term training will be expanded beyond the scope of vocational education for full-time learners so that adults, including employed workers, can benefit from re-education.

Fourth, the reformed vocational education system will promote school-industry collaboration and linkage between education and training. The new system will thus maximize human and material exchange and utilization.

Proposal for transforming secondary-level vocational education includes expanding specialized high school system, raising core skills of students in vocational high schools, introducing the integrated high school system, and upgrading the competency of instructors.

Under this plan, several vocational high schools will be transformed to specialized high schools. This will mean an increase from 64 specialized high schools as of 2005 to 200 schools by 2010.

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[17] Presidential Committee on Education Innovation was established on July 31, 2003 with the aim of bringing innovation to the education sector and identifying tasks for vocational education policy.

[18] CEIN and MOEHRD plan to revise related laws, such as the Promoting Worker's Training Law, the Primary and Secondary Education Act, and the Higher Education Act as recommended in the proposal. The two education organs will also develop detailed plans for the implementation of the proposal.

The local governments, industries and ministries concerned will be supporting and participating in the specialization of vocational schools.

Meanwhile, vocational schools that do not intend to make the transformation into specialized high schools will be encouraged to move away from a focus on technical skills training towards promoting vocational education that enhances lifetime employability. In other words, their post-reform curricula will concentrate on building core (generic) skills, such as communication and problem-solving skills. Courses dealing with skills that are difficult to teach in school may be outsourced to other vocational training providers. Such training courses will be recognized as are regular classes in school.

Improving the vocational education system requires developing the capacity of instructors. If there is an excess of instructors for a particular subject while in another subject there is a shortage of instructors, then the surplus teachers will be advised to receive training to make up for the teacher shortage. Furthermore, recruitment of professionals as part-time instructors will be endorsed and the remuneration for their teaching services will be raised to a practical level. Finally, schools will be urged to adopt a system of appointing principals in which qualified candidates from both inside and outside the school are screened.

Plans for reform of the higher level vocational education include enlarging the role of colleges as the local continuing education centers, and establishing a system of support for junior vocational colleges on the local government initiative.

A local government-initiated assistance system will be established to foster junior colleges. Under the system, the local government will be urged to support the provision of vocational education by junior colleges. There will also be efforts to create an industrial technology education cluster in which local businesses and junior and 4-year colleges can collaborate. School-industry cooperation programs such as school-based enterprises, business incubators, technical assistance centers, student business venture clubs will be fostered. School-industry collaboration will be strengthened by appointing professors with special mandate to oversee contracts and collaborative projects with businesses.

Vocational training reform

The Act on Workers Vocational Training which was implemented in 1999 was amended twice. The first amendment was made in March 2001 and the second in December 2004. With the second amendment the act was renamed the Workers Vocational Competency Development Act.

The purpose of the new act is to secure the employment of workers, raise their social and economic status, and improve the productivity of enterprises, thus contributing to social and economic development by promoting and supporting workers' vocational competency development throughout their lives.

The major components of the act are as follows:

Transformation of government- and employer-centered training into a training scheme that involves both the labor and the management.

A new clause regarding the participation and cooperation of the labor and the management was inserted in Article 3. Basic principles of vocational competency development training.

The amendment seeks to provide workers the opportunity to receive vocational training suitable to their aptitudes and abilities by expanding their participation in vocational competency development projects.

The Minister of Labor, under the revised law, shall promote labor-management participation and cooperation, and consult employer groups as well as labor groups when drafting and implementing the basic plan for vocational competency development.

When supporting vocational training programs, the government shall place priority on vocational training that have been developed by the employer in close cooperation with workers based on consensus.

Strengthening government support to the disadvantaged workers, i.e. workers in SMEs and non-regular workers

Preferential support may be provided for training programs organized by SMEs and those in which SME workers autonomously participate.

Preferential support may also be provided when non-standard workers, such as daily workers, hourly workers, and part-time workers autonomously engage in training programs.

Expanding participants in VCDP and coverage of programs

In the past employers were the main beneficiaries in VCDP. With the amendment labor-management groups and associations of those groups, and private training institutions are also eligible for financial assistance under VCDP.

VCDP now invites higher education institutions to participate in their capacity as private training providers.

The coverage of costs will be expanded to include not only training costs but also infrastructural costs that go into training materials development, research and HRD personnel training.

Vocational training for priority occupations

The amendment defines the criteria for selecting priority occupations for vocational training support. Priority occupations are occupations in key industries, such as ICT and automotive industries, in which there is workforce shortage. The amendment also defines who the target trainees will be.

5) National qualification system

There are mainly three types of national qualification system: degree system, vocational qualification system, and other recognition systems for lifelong learning. The degree system is about higher education, while the vocational qualification system is mainly related to National Technical Vocational Qualifications. The National Technical Vocational Qualifications system

in Korea is independent from rather than integrated with training courses. This is quite different from similar systems in France, Germany and Australia, where vocational training is linked with the qualification acquisition process. In other words, anyone who wants to acquire a vocational qualification can apply for a qualification examination no matter where he or she learned the skills, and upon passing the examination, a qualification is awarded. Other recognition systems for lifelong learning include the Credit Bank System, the Self-Study Degree Award System and the Education Account System.

The most sought after qualifications in Korea undoubtedly belong to the degree system. Korea adopted the College License System, under which colleges, licensed by the government are given the authority to grant degrees. Licensed colleges and graduate schools are also allowed to grant bachelor's degrees, master's degrees or doctor's degrees to students who have completed courses specified in the school regulations (Higher Education Act, Article 35). Universities and four-year colleges grant bachelor's degrees and two-year colleges give associate bachelor's degrees. Universities and four-year colleges offer programs that lead to master's or doctoral degrees.

For a long time, vocational qualifications have been recognized only as a means to supplement academic degrees. As for the Credit Bank System and the Self-Study Degree Award System, they also have played auxiliary roles, helping people without degrees to obtain one. All this serves to show how eagerly Koreans aspire to earning academic degrees. National qualifications are evaluated by identical standards nationwide and are thus equally recognized anywhere in Korea.

The development of Korea's unique national qualification system has been affected by historic and social conditions. First among them is a tradition of strong central governance. Korea, a relatively small nation in terms of territory, has a long history of strong central governments. The centralization of governance naturally created a favorable environment for nationally recognized qualifications. Second is the high social status enjoyed by scholars, which led to the aspirations for academic achievement. Scholars were the most respected class in traditional Korean society followed by lower classes of farmers, manufacturers, and merchants, in that order. Academic credentials, in particular in humanities studies, have thus been prized and recognized as indicators of an individual's abilities. In contrast, vocational qualifications were not as valued for they were considered supplementary indicators when the person could not receive more academic education. This tradition that looks down upon vocational training has served as an obstacle to fostering highly skilled human resources. More recently, however, there is a growing interest in vocational qualifications as Korean society begins to emphasize competency more than educational background (Dong-Im Lee and Sang-Jin Kim, 2004).

2. Quality assurance in manufacturing and changing job requirements

1) Understanding of quality

In Korea's automotive industry, the concepts 'quality' and 'quality assurance' are used differently depending on the corporate context. With regards to quality assurance in manufacturing, quality is widely understood as the quality of the company's products and services as they

face challenges posed by rapid technological advancement and globalization. As the quality of products is reflected in the quality of overall production process, corporate strategies to improve productivity and develop human resources need to be examined.

Businesses are most interested in maintaining competitiveness in the international market by upgrading quality of products and services. In order to meet ever changing demands of consumers by supplying quality products, Hyundai has introduced Total Quality Management (TQM) and other management innovation techniques.

2) Instruments for quality assurance

Automated manufacturing system requires a change in the workforce management strategy because of its complexity. Effective organization of human resources is crucial in this regard. To maintain the continuity of manufacturing process, which has been achieved by automation, it becomes necessary to monitor and modify the facilities on a continual basis. The root cause of defect can be traced only after analyzing the system's elements and the broader conditions surrounding them. Problems in production may have been caused by malfunctioning, defect in the machinery, or a non-programming factor such as shortage of a certain raw material. If one of the many prerequisites for the programmed operation is not met, it is reason enough to halt the entire production process. Preventing malfunctioning and searching out the cause when it occurs requires that the worker has the understanding, knowledge and experience relating to the process and the facility.

When introducing automation facility, the businesses are interested in raising the operation rate. On the highly mechanized workshop the key concern is to keep the system moving, preventing any defects and minimizing the non-operation time. Despite scientific management of manufacturing processes, gaps between optimization, modification and repair are evident, and these mechanical gaps need to be filled by human intervention (Schumann, 1994a). Many automakers, therefore, have in the 1980's and after reorganized work so that production workers will take up maintenance and quality control, which were traditionally the domain of indirect departments.

(1) Task integration at engine plants

Self-Inspection Scheme

Underlying the traditional Taylorism and Fordism is the belief that workers will become less concerned with quality issues as tasks become simpler and the work more stressful. In fact, the line workers in the conventional Fordist work organization are not accountable for the outcome. The Fordist philosophy presumes that it is easier to assume control over workers when the task is broken down into smaller and simpler bits. The Fordist management thus raised the intensity of labor while transferring quality control responsibilities to workers not in the assembly lines.

A challenge to this control philosophy was the Japanese system of production which attracted much attention in the early 1980's. The Japanese system, which relieved the tension caused by conflicting needs to control and supervise the production process on the one hand and to maximize trust and creativity in work on the other, proved quite efficient. It was in the 1980's

when Western automakers eagerly embarked on rationalizing quality control. The American manufacturers, especially, were facing problems, such as the assembly workers' indifference to quality and production, low quality that showed no signs of improving despite double and sometimes triple control by the management, and Japan Shock. Self-inspection became a major slogan touted by the management. At the time, it was natural that reorganization of work teams should primarily aim to raise labor intensity and to reduce quality control personnel rather than to humanize labor. Notably, the Fordist task unification strategy is characterized by 'extremely short cycles,' 'speedy movement of the conveyor belts,' and 'additional indirect labor,' and for this reason it was called the 'integrated Taylorism'. Ford Motor Company appealed to the assembly workers to gain their support for this strategy, and introduced it in its factories in 1981. However, the outcome in terms of competitiveness and quality improvement was meager. This proved that a conveyor belt-based integration and reform offered workers little in return, whether it is competitive advantage or better quality, and that Taylorist and/or Fordist production system cannot be meaningfully reformed by such efforts (Jung, Sung Gug, 2004).

Before going into how self-inspection system was established in Hyundai's engine plant, we will take a look at the quality control system. The quality control department is responsible for mainly improving the quality of engines, inspecting the production lines, testing the engine quality, and controlling the quality of engine parts produced by outsourcing, etc. In the workshop, quality is controlled by regular and routine inspection of problems occurring in the assembly and machining lines. These inspections are aimed at preventing defects and managing defects that could not be avoided. Regular inspections take place four times a day, twice in the daytime and twice in the evening. Inspectors focus on some 20 items which are frequently found defects and important quality issues. One round of inspection takes about two hours on average, though this often varies. The everyday routine inspections are usually focused on the machining lines, and it consists of cleanliness inspection, and those that are specially conducted in the precision assessment room where quality of connecting rods, cylinder blocs and heads, etc. are tested.

As a result of Hyundai's efforts to strengthen the quality assessment system, defect ratio at the engine plant has decreased substantially in the past few years.-Since five or six years ago the standard unit for measuring defects was changed from percentage (%) to PPM (1/1,000,000). Many view that integration of information technology has boosted innovation in engine quality control[19].

In the late 1980's, Hyundai Motors sought to merge tasks in the name of self-inspection. In the engine plants, the average worker operates inspection devices to check for quality. The expansion of self-inspection has dramatically reduced the number of quality control personnel. When the self-inspection system was first introduced, there was a tendency to depend largely on the quality control personnel. Nowadays, the system is better integrated into the production lines and inspection takes place as if it is a part of the machining process. Self-inspection

[19] An employee in the engine quality control department at Hyundai said the following: "In the past, information was delivered slowly. Whether it concerned a problem in the plant or a complaint from a customer, it would take a long time before the person in charge of dealing with the problem found about it. Information technology has changed all that. If a problem occurs today, the person responsible for dealing with it is notified today. So problems can be solved quickly and without being known outside. We run a 24-hour global monitoring office. If a problem occurs abroad it is addressed right away. The relevant firm or the assembly line is investigated, and that is as far as information about the problem can travel. Inside Korea, daily reports are sent in from repair centers to the main system in the headquarter. [If problems occur] the production line or the outsourced firm is investigated. Computerization has greatly improved now and it is much faster today. Data has been accumulated in the past ten years, and they can be analyzed to look for any visible trend. Information technology is contributing much to raising quality.

time is included in the standard work hours, and one can easily find the average worker using inspection devices to test for quality. Self-inspection in the engine plant is conducted according to the work method and time cycle specified in the standard task guidelines. Check sheets are filled out so that major machining processes and x-R are monitored and the results are recorded. If the inspection results do not satisfy the specified standards, the machines are checked for the person on the post to take care of. If the problem is beyond the worker's capacity to solve, it is reported to his or senior, who will give instructions for the worker to follow. Records are kept every two hours (Jung, Sung Gug, 2004).

Self-Maintenance Scheme

Self-maintenance system in the engine plant is quite advanced. Because the engine plant is furnished with costly facilities, it is the more necessary to keep the machines running efficiently, maintained and upgraded than any other shop.

In the engine plant, self-maintenance is pursued as a part of Total Productive Maintenance (TPM)[20]. TPM is made up of seven phases. The first is the cleaning phase. At this level, the workers keep machines clean so as to make it easy to detect possible defects before they result in big problems. The next step is to fix the identified defect and try to come up with solutions. Actions that may be taken in this phase include solving problems found, putting a cover over the problem spot, keeping machines clean, managing the supply and use of neat cutting oil, improving the condition of nozzles, and preventing leaks. Many workers feel that the second phase is perhaps the most important in the entire TPM system. In phase three, facilities are cared for using lubricating oil and other means of maintenance. Tightening nuts and leaving eye marks to check the conditions of oil tanks are common practices in phase three. TPM 4 is the phase for total check conducted in four parts: lubricating machine parts, oil pressure and air pressure check, drive machine, and electric machine. The maintenance team takes care of electric machines and assembly workers take care of the rest. TPM 5 is the phase in which all of the above are checked autonomously. Finally, TPM 6 is the phase that guarantees the quality of product. It is made up of four steps from 6-1 to 6-4, which are respectively, assessment, maintenance of basic quality requirements, eradication of common defects, management and improvement of conditions to achieve zero defect. TPM 7 is the final phase where self-maintenance takes place. This phase is aimed at making the equipment more reliable, maintainable, and operational by having the workers improve the machines themselves. The seven steps in self-maintenance is shown in Table 2.5.

The TPM movement transferred much of the tasks carried out by engine maintenance team to the general assembly worker. Limit switches (LS) and proximity switches used to be operated by the maintenance team, but have now been transferred to the assembly workers. In the engine production plant, TPM activities are usually carried out individually. When the ban (an assembly unit) carries out TPM they usually take advantage of time after regular work hours, of days they are working overtime, or Sundays. TPM also takes place when the equipment goes out of order. The *jojang* (team leader) is the leader of TPM. Even in the engine factory, however, the division of labor between the maintenance team and the assembly workers doing TPM is clear. The electronic equipment maintenance team performs all the programming while the ordinary assembly worker does simple operations. The machining workers, for example, adjust

[20] Total Productive Maintenance (TPM): Japanese maintenance system adapted from the American preventive maintenance concept. The Japanese TPM is a combination of productive maintenance and worker's autonomous maintenance.

dimensions, modify the program or change coordinates when precision is lacking, or change programs to work on a different frame[21].

Table 2.5: Seven steps in self-maintenance

Step		Maintenance activity
1	Initial cleaning	- Clean the equipment, removing dust and other contaminants, beginning from its mainframe - Dismantle unnecessary facilities - Make a list of defects, sources of contamination, doubts and questions, etc.-
2	Set up strategies to keep equipments clean	- Identify sources of contamination and come up with ways to reduce contamination - Develop ways to prevent arsenic acid contamination - Identify parts difficult to clean and come up with ways to clean them more efficiently and in less time--
3	Maintenance	- Set standards for cleaning and refueling equipment in a short amount of time - Tidying up and putting in order various tools, handtools, measuring instruments, pallettes, etc.
4	Total inspection	Perform the following for each functional part - Train workers methods of inspection - Conduct total inspection - Improve inspection methods and facilities - Set guidelines to conduct inspection on a regular basis
5	Self-inspection	- Make standards for self-maintenance and check sheet to abide by the standards - Implement and modify the first four steps of self-maintenance - Guarantee quality with the goal of achieving zero defect
6	Quality guarantee	- Prevent defective parts from being circulated outside the plant - Guarantee quality with the goal of achieving zero defect
7	Self-maintenance	- Maintain and improve the current TPM level.

Source: Jung, Sung Gug(2004).

TPM in the engine plant was most vigorously implemented in 1996 when it was comprised of six phases[22]. Since the Asian financial crisis under which the Korean economy suffered, many of Hyundai's workers in charge of TPM retired or moved on to another job, causing the TPM organization to collapse. Today, TPM efforts remain limited.

Certain statistics, such as the ratio of preventive maintenance and after-defect maintenance, show that TPM is not stably integrated into the machining process at Hyundai plants. In Japan, maintenance personnel repair only 20 ~ 30% of defects. The assembly lines, as a rule, fix defects, and send to maintenance specialists only those that they could not repair. Maintenance specialists carry out preventive maintenance and improvement. They use their expertise when it is called for while minor defects are taken care of by the assembly workers. Such division of labor keeps the assembly lines more efficient as well as stable.

[21] Motor Company B, unlike Hyundai, authorizes only the *jojang* to change machining programs for the following reason: "When a problem arises we need to fix it. But if we leave it to the average assembly line worker to fix it things start to go in the wrong direction. That's why we never let the average worker touch the programming. Programming is not like a single machine. If someone messes with it, it gets harder to maintain it."

[22] Hyundai Motor Company won the Facility Maintenance Award in 1994, In 1996, it was awarded the TPM Award by JKM of Japan.

However, the ratio between preventive and after-defect maintenance is about 2 : 8, after-defect maintenance accounting for substantially more[23]. In the automated work setting, it is impossible to manage the complex machining process and facilities with a fixed set of parameters. The automated machines are very sensitive to environmental conditions.

External factors such as temperature is constantly changing, and under such variable circumstances the properties of the materials and the various standard levels that the parts must meet need to be adjusted accordingly. The machining process is itself fluid and without external adjustments to accommodate changes it would become very unstable. External adjustments are made to maintain a certain level of quality. The quality standards for the automobile industry is continually being elevated, and certain changes in the philosophy of quality guarantee has shifted the responsibility for quality to the production part. Another objective of modifying parameters is to minimize facility and machining process breakdowns (Jung, Sung Gug, 2004). Considering the latest trends toward integrating CNC into facilities, making facilities more multifunctional and complex, and toward networking of processes, greater demands are made on the operators of these facilities in terms of the capacity to troubleshoot and to manage the automated equipments. Hyundai Motors, in this respect, is facing some serious problems.

The difficulty of establishing TPM is mainly due to the limited troubleshooting capacity of workers in the assembly lines. This limitation, in turn, comes form the fact that troubleshooting capacity is not one of the key criteria in performance assessment. Moreover, Hyundai Motors does not have the kind of incentive system found in Japanese motor companies. At Toyota, for example, 20 workers from the machine work sector are promoted to assistant manager status each year. In fact, 1/3 of all assistant managers had been supervisors in the assembly lines. Production workers and administrative and managerial workers are part of the same rank system, as are the highly educated, who have completed college education and the less educated, who have finished high school education or less. Promotion is competency-based. On the contrary, Hyundai's production workers have little opportunity for promotion. The production workers and administrative and managerial workers belong to-different rank systems. Wage is primarily seniority-based, and individual skills and competency are not adequately reflected.

There are a small number of workers who are quite capable of troubleshooting. Unfortunately, their capacity is limited in that they lack methodological skills and the ability to deal with abstract ideas and theories. Few have expert knowledge of oil pressure, air pressure and electricity needed for troubleshooting. These workers seem to have the kind of knowledge acquired through actual experience but not supported by a sound understanding of theories. As information and communications technology is integrated into machining to a greater extent, this change is shifting the skills demands from skills based on experience to analytical skills and knowledge, and from skills dealing with concrete objects to those dealing with abstract concepts. Apparently, workers at the Hyundai factory do not quite meet the shifting skills demands[24]. Judging from the current situation, it is likely that only a few workers can identify themselves

[23] The Maintenance Officer of firm A asserted that the high factory operation rate must be taken into consideration as the plant operates on 2 shifts a day.

[24] A middle manager in the production technology department of Automaker B said: "I majored in mechanics. Nowadays we need to have more abstract and theoretical knowledge than before to understand a system. When we installed NC systems and machining centers in the new XK factory, experts from Japan came and complained that our workers do not understand the things that are being taught to them. In the past, it used to be easy to understand because it was all machines. Things are different now that we have numerically-controlled programming and equipments that are linked to electronic systems. Many workers confess that they simply can't understand."

as troubleshooters and have the will to further develop their capacity to solve problems (Jung, Sung Gug, 2004).

Workplace Innovation Program

Hyundai Motors strives to raise productivity and product quality by promoting competition between task teams. Past initiatives such as QC (quality control), suggestions, and TPM (total preventive maintenance) that were borrowed from Japanese companies fell into mannerism and bore limited result. These failed attempts are now replaced by Workplace Innovation Project (WIP), aimed at making the shops more efficient. Although WIP is not a training program in itself, it makes up for the lack of OJT and thus merits analysis. WIP began in 1997 but full-fledged implementation came three years later with the creation of the plant innovation team under direct jurisdiction of the vice chief supervisor. Under WIP, Ulsan Plant awards outstanding teams, departments and divisions from 950 teams, 240 departments and 86 divisions operating in 15 factories.

Table 2.6 shows the WIP criteria for evaluating the plant staff. Basic Supervision considers 4 basic categories (i.e. work environment, morale, safety control, conservation of resources) and 6 awareness categories (i.e. exemplary behavior of managers, shop environment improvement, open management, harmony in the shop, raising potential of workers, and ensuring product quality). In essence, basic supervision is an effort to evaluate how effectively conditions in the workplace are controlled for efficient production. Operational Supervision is made up of general monitoring (i.e. contribution to production, innovative suggestions, accidents, contribution to quality improvement, immediate improvement) and monitoring by department head (i.e. quality improvement, cost reduction, productivity, 3R5M's) and innovative organizational management. The WIP criteria are used for assessing whether elements of Japanese-style production such as QC and suggestions are managed effectively to improve quality and productivity and reduce cost.

The plant innovation team makes their evaluation using the above criteria, and awards top 15 % (or 141 teams) of the teams each quarter. Selected teams are given prize money amounting from 1.2 to 1.6 million won. In addition to the quarterly evaluation, there is an annual event where good practices are presented, and 60 teams are awarded with 300,000 won. The prize money is awarded to the team as a whole and is usually not divided among individual workers. Most often, the money is used for team activities to enhance team work and harmony among its members.

Rather than pursue intensive and substantial OJT, Hyundai Motors concentrates on WIP efforts to amend workplace behavior, promoting industry (through Basic Supervision), and to promote Japanese methods of production such as QC and suggestions (through Operational Supervision). According to documents provided by Hyundai Motors, the overall evaluation score for Ulsan Plant when WIP was first launched in 1997 was about 50 points. As time went on, the score, though somewhat fluctuating, gradually rose to 76.4 points at the end of 2003 (Hyundai Motors, 2003).

Table 2.6: Guidelines for evaluating workplace management

Categories		Items	Score
Basic Supervision (50)	Work environment (14)	Inside the plant/ Manufacturing process	4/4
Basic Supervision (50)	Work environment (14)	Warehouse management	3
Basic Supervision (50)	Work environment (14)	Outside the plant/ Office and auxiliary facilities	1.5/1.5
Basic Supervision (50)	Morale (16)	Punctuality	8
Basic Supervision (50)	Morale (16)	Behavior at work/ Observance of non-smoking rules	8
Basic Supervision (50)	Safety control (10)	Industrial accident record	4.25
Basic Supervision (50)	Safety control (10)	Safety check	5.75
Basic Supervision (50)	Conservation of resources (10)	Record of energy conservation	4
Basic Supervision (50)	Conservation of resources (10)	Energy check	6
Operational Supervision (50)	Monitoring by dept. head	Performance of each team: quality, cost, productivity, 3 Rights and 5 Musts (3R5M)	Norm-referenced evaluation
Operational Supervision (50)	General Monitoring (21)	Contribution to production (Diligence)	10
Operational Supervision (50)	General Monitoring (21)	Innovative suggestions	3
Operational Supervision (50)	General Monitoring (21)	Accidents	Deduction
Operational Supervision (50)	General Monitoring (21)	Contribution to quality improvement/ Immediate improvement	5/3
Operational Supervision (50)	Organization of production staff (29)	Management of teams (guidelines, actual management, development of team members)	5
Operational Supervision (50)	Organization of production staff (29)	Management of departments (policy, staff organization management)	12
Operational Supervision (50)	Organization of production staff (29)	Management of divisions (policy, staff organization management)	12
Total(90%)			100
Themes	Innovation in awareness	Innovation in managers‘ awareness Achievement of 6 major goals	5
Themes	Improvement Measures	Improvement in the criticized areas	5

Source: Hyundai Motors(2003). Internal document.

Although WIP has shown some positive outcomes, it has its limits as an initiative focused mostly on workers' morale when there is no systematic OJT to complement it. QC and suggestions included in WIP are both commendable approaches but workers who have not received adequate training in their tasks can only contribute so much through these channels. Moreover, the prize money of some 1.2 ~ 1.5 million won awarded to good practice teams made of 15 ~ 20 people each is not enough to effectively motivate individuals to work competitively for better performance. In Ulsan Plant, the annual budget as of 2003 for WIP awards is estimate 770 million won, which is relatively small amount as a monetary incentive for workers.

The Workplace Innovation Project is accompanied neither by systematic OJT nor economic incentive, and it has so far failed to promote voluntary participation by workers at the bottom of the plant's organizational pyramid. Leaders of teams and departments are the only people who are taking active part in this initiative, and the staff are reluctant to join in. Meanwhile, the labor union sees this as a tool that the management is using to exercise control over workers. The union is very much opposed to the idea of pushing teams to compete against each other and evaluating their performance through such process (Interview, 2003).

Name-based Quality Assurance Scheme

Name-based quality assurance is a system that keeps track of the names of the people responsible for each step of the manufacturing process so that when a defect or problem occurs it is clear who should be held accountable. The system motivates employees to take responsibility for their own jobs, and thus avoids mistakes they might make.

The purpose of name-based quality assurance is to achieve quality in manufacturing by training employees to be more conscious of their work responsibilities and quality of their output. The name-based quality assurance system is a 4-step procedure (Table 2.7).

Step 1: Accurately identify major deficiencies in the manufacturing process.

Step 2: Prevent recurrence by giving clear feedback to the person accountable for the deficiency.

Step 3: Keep track of monthly deficiency occurrence.

Step 4: Fundamentally address sources of deficiencies and train employees to raise their competency.

Table 2.7: Four-step procedure of the Name-based quality assurance scheme

Step	Concrete action	Checking point
Identification of deficiency	Identify major defects in quality	* Guidelines for filing major deficiencies (Approval) * Collection and documentation of data on deficiencies
Feedback	Tell the person the nature of the deficiency (the person responsible for the particular manufacturing process that was found to have gone wrong)	* Feedback on performance * Agility and accuracy * Common ground * Names of workers responsible for each job
Keeping track	Keep track of deficiencies that occur	* Deficiency graph * Notices on activity bulletin
Prevention of recurrence (Participation, cooperation, joint improvement)	Improve the quality of actual product (Fundamentally eliminate major deficiencies)	* Dissemination and linkage of good practices in quality enhancement * Dissemination, method, impact * Standardization, Follow-up
Prevention of recurrence (Participation, cooperation, joint improvement)	Improve the way employees work (Observe work standards)	* Quality training, training plan, outcome * Giving a sense of responsibility, one-to-one meetings, training. * Work standards, level of QC work * Measuring devices, facilities and equipments

Source: Hyundai Motor Co., Internal document.

Quality Keeper Scheme

Quality Keeper System is an initiative to organize and to foster output self-monitoring around quality keepers, ultimately with an aim to raise quality and productivity.

Quality keepers are workers specially appointed to perform tasks required for achieving a certain level of quality. Each keeper monitors the work of one ban (an assembly unit) checking the group's output against assembly standards. When a defect is found, the keeper either orders it to be mended within the group, or sends it to another group in earlier or later stage of the assembly to have it corrected.

These quality keepers carry out various tasks: i) checking and documenting the quality of the output at their assigned manufacturing process, ii) correcting defects and/or sending it to either the previous group that had worked on it or the next group that will be working on it, and iii) ordering for the solution of problems occurring at a particular step in the assembly line and reporting progress on problem solving.

As a rule, there is one quality keeper for each ban. A quality keeper should be: i) the person who best understands the assembly process he is assigned to; ii) a person whose skill level, measured against work standards, is fairly high; and iii) a person who has the capacity to improve quality. Quality keepers are appointed by the production team manager upon recommendation by *banjang*, the leader of the ban.

The keepers monitor items that belong to one of two categories, the *must check items* and *general check items*.

1) *Must check items* include security work, which has risks of injury and fire hazards, and work related to the performance of key functions.

2) General check items include :
   - General issues which frequently occur in the process of mending defects,
   - quality issues often arising in inspection and distribution stages, and
   - other major quality issues resulting from doing jobs

Quality keeping activities are various.

1) Quality keepers check through all the quality keeping items and record their assessment in their log every thirty minutes.

2) Quality keepers correct defects that they are capable of correcting within the set time limit. Defects beyond their capacity to fix are noted in the quality inspection table, and reported if necessary to the *jojang* or the *banjfang,* who hold leadership positions in the assembly lines, so that they are corrected later in the assembly process.

3) When a defect is too serious that it must be corrected before passing the work to the next person in the assembly line, and when it cannot be repaired by the quality keeper within the time limit, quality keepers report them to *banjang or jojang* before taking further measures.

4) Quality keepers provide feedback to workers in earlier or later stage in the assembly process about defects found. When major reliability problems or repetitive defects are found, quality keepers order the person responsible to amend them and report to the *jojang* and *banjang*, who will investigate into the cause and come up with timely responses.

5) *Banjang* checks up on quality keeping process every two hours to sign the quality keeping log and to give feedback to those who had caused the problem. At the same time, the *banjang* will come up with and implement measures to avoid the recurrence of the problem. The *banjang* will also report major defects and counter-measures to the production kwajang.

Quality circle

Quality circle (QC) is defined as a small group of 6-12 employees doing similar work who voluntarily meet together on a regular basis to identify improvements in their respective work areas using proven techniques for analyzing and solving work related problems. Ultimately the purpose is to achieve and sustain excellence that can lead to enhancement of employees and the organization as a whole. It is a way of capturing the creative and innovative power that lies within the workforce.

The automaker in March 1975 established Total Quality Control (TQC) team to implement quality control across the enterprise. Quality Control circles were introduced as part of the overall TQC initiative[25]. QC circles are intended to encourage workers to develop their capacities and to use QC techniques to consistently improve the overall quality of company's management.

[25] Quality Control circles were introduced in Korea in 1968 by Korean Productivity Center. In 1975, QC circles registration was institutionalized. To foster quality control efforts in enterprises the government has since 1995 organized a nationwide QC circle competition annually, awarding prizes to good practice circles.

QC circles in the production sector are jo-based. According to the company statistics, QC circle organization reached 94.8 % in the past 5 years. During the same period QC circles had identified on average 2,708 problems for consideration and completed quality control activities on 2,570 of them, or 94.9 %. However, a source in the company confided that participation in QC circle activities and worker suggestion were high initially when they were first introduced, but as time passes participation is dwindling and this is perceived as added burden on the *jojang* and *banjang*.

QC circle activities are organized in the following order :

1) Identification of the problem
2) Planning for action
3) Survey of present conditions
4) Analysis of cause(s)
5) Target setting
6) Coming up with a solution
7) Implementation of the solution
8) Evaluation of the effectiveness of solution
9) Standardization
10) Follow-up

Hyundai has instituted various reward schemes to foster QC circle activities. Selected QC circles are provided with financial support for QC activities, and good practice circles are annually awarded the outstanding team award and outstanding business division award. Individuals who are recognized for their excellent QC efforts are awarded the outstanding implementer's award with a cash prize and a chance to receive training inside Korea.

3) Organizational concepts and qualification requirements

(1) Flexible automation in automotive industry

Microelectronics technology is introduced for purposes of improving work environment, enhancing quality, reducing workforce requirements[26] and thereby reducing costs, and raising productivity, etc. In this research the focus was on the flexibility enhancement aspect of microelectronics technology.

General-purpose machines are operated manually to produce a variety of forms and parts. While these machines can be used for a wider number of tasks, they have their disadvantages. The work process, for example, proceeds at a slower pace, and the output is less stable in terms of quality. Moreover, the use of these machines requires training of skilled workers, which entail time and financial cost. Single-purpose machines are different in that they operate according to the given commands to produce parts of specific form and size. With these machines, greater the number of units produced lead to greater production efficiency and less marginal manufacturing cost. Disadvantages, however, are large facility investment and limited adaptability to changes

[26] In Korean this is called saeng-in-hwa, which is the reduction of the number of workers required by automating the manufacturing process. This is an effort more progressive than saeng-lyok-hwa, the reduction of human effort through automation. It is also referred to as so-in-hwa.

in the model being produced. Because these machines are made specially for producing parts of a specified form and size, they are not fit for making a wide variety of parts.

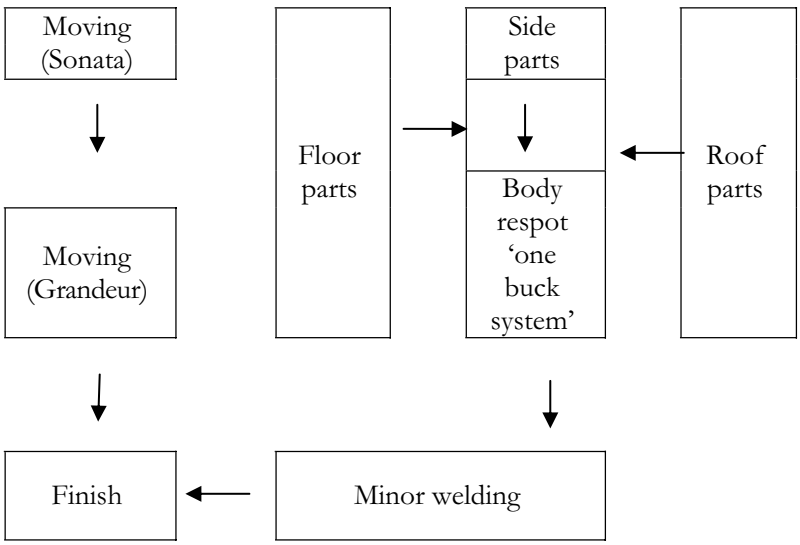
Microelectronics machines overcome the limitations of the general and special purpose machines, because they operate automatically as programmed. These machines can be made to perform different tasks by changing the programming. This allows them to operate automatically but with a wider application than the single-purpose machines.

Hyundai Motors has pursued flexible automation since the 1990's. The Plant No. 2 completed in 1991 adopted the flexible body line (FBL) system, which can alternately assemble the bodies of Sonata, Scoop and Grandeur. FBL was created by integrating the one buck system, based on the Toyota model, and the distributed information control system.

The illustration below (Figure 2.1) shows Hyundai's FBL, which is quite similar to other body assembly lines. For example, the floor, side and roof parts are welded in the subassembly lines to form the basic frame. This frame proceeds to the body build line followed by the body respot and finally to the body complete line where doors, hood, and the rear deck lid are fastened to a complete body.

The distinct feature in the FBL is the one buck system. When floor and roof parts of a particular car model are brought to the line on carts, they are joined to the steel sides that have been supplied to the main buck. Sixteen robots simultaneously weld and seal to complete the body. During this process the 4-sided main buck rotates to supply the sides of different models. This economizes space because the main buck, which is equipped with the different jigs for the models being produced, turns in its place to provide the right parts. Each side of the main buck is fitted with the jig for the models Sonata, Marcia, Grandeur, and Dynasty. To assemble a different model one has only to turn the main buck to access the right jig for that model.

Figure 2.1: FBL Production Process (Hyundai Motor Plant 2)



Source: Jo, Hyung Je (2005).

Another advantage of the one buck system is cost reduction in model change. When replacing an old model with a new model there is no need to change the entire production facility. Only

the jig for the outgoing model needs to be supplanted for the incoming model. This significantly cuts the cost of launching a new model.

For the body respot and body complete lines Hyundai has installed the Windmill Jig System, a proprietary system invented during FBL development. The windmill jig, like the one buck system, rotates like the windmill to assemble different models. As it does not require carts it can save a lot of space.

(2) Changes in work organization and skills requirements

Table 2.8 shows the worker organization of flexible body lines at Plant No. 2, not including the single-model assembly lines for exclusively producing Sonata. There are 6 assembly teams and 1 reserve team, which are responsible for the actual manufacturing of cars and 3 teams responsible for technical management. A team is made up of 3 sub-teams, which comprise 7~10 workers, making each team about 30 people. The assembly line workers are divided into jo (group) A and jo B, which alternately take on day and night shifts. The total number of workers including the reserve personnel is 189 and 199 respectively for jo A and jo B.

Table 2.8: Production organization and the number of workers at FBL (Hyundai Motor Plant 2)

Production Department	No. of persons		Technical Management Department	No. of persons	
Production Department	Jo A	Jo B	Technical Management Department	Jo A	Jo B
B/F	28	29	Keepers	38	36
B/S	23	27	Improvers	26	16
B/B	28	30	Jig Maintenance	30	
B/M(Sonata)	37	37			
B/M(Grandeur)	20	20	*Independent dept.	No. of persons	
B/C	39	40	Maintenance	20	
Reserve team	14	16	Quality Control	20	
Total	189	199			

Note: The asterisk * indicates that B/M(Sonata) team, reserve team, improvement team, keeper team and jig maintenance team are not separate from the Sonata-only production line in Plant No. 2.

Source: Jo, Hyung Je, Can there be a Korean production method, P. 31.

Workers are categorized by their tasks, such as welding, moving parts assembly, and grinding.

1) Welding : Despite advanced automation robots cannot completely replace human labor. Workers perform manually what the robots are unable to do. Welders, for example, check the specifications of the steel plate displayed on screen, then place the steel plate on the line, and press a button to begin welding. Welding takes place in the main line, which moves on a conveyor belt, and the sub-line. The task itself is pretty similar on either line. Since most

steel parts are assembled by welding, it accounts for the largest part of tasks performed on FBL engaging roughly 50 % of the assembly workers.

2) Assembly of moving parts : Manual work is involved in assembling doors, hood, and rear deck lid to the car body. The impact tool is used to firmly fix the components by fastening bolts and sealing. About 20 % of the assembly workers are assigned to the moving parts assembly.

3) Grinding : After assembling the parts there may be small pieces and chips of steel that have stuck to the surface or slight deformities created during the welding process. The surface must be grinded to achieve evenness. Grinding is critical to the quality of the finished car and so it demands higher level of skills than other tasks. About 30 % of the assembly workers are engaged in grinding.

In addition to assembly workers, there are others who belong to the FBL performing various support functions. The keepers, for example, make quick emergency repair when equipment and facilities are out of order. There are also the improvers who support and enhance production and raise productivity. Finally, there is the jig maintenance team who are in charge of the repair and maintenance of jigs. Outside of the FBL are the maintenance team (20 people), who take care of the machines in general, and the quality control team (20 people), responsible for quality inspection and management. These teams are operated independently from the FBL.

Flexible automation requires a different set of qualities and competencies in workers than do single-model assembly lines. FBL operators must be capable of keeping automated machines in order, and be able to perform basic programming when machines exhibit minor problems. Although such maintenance and repair skills are also important in the conventional single-model assembly lines, they are far more critical to the productivity and product quality of FBL, which produces different models. Line operators can acquire these skills as they take care of the machines and learn about how they work, which will take minimum 3 years (Jo, Hyung Je, 2005). Although there are maintenance personnel who are exclusively responsible for keeping the machines intact and functional, they alone cannot bear the full responsibility for maintenance. The ability of line operators to keep machines in good condition is indispensable.

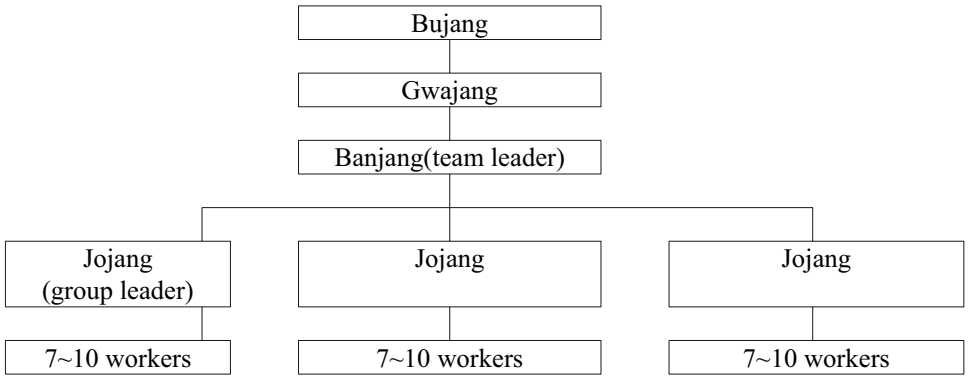
Training programs must be reinforced to foster the skills of workers and their active participation in production. Training can help workers to understand the overall manufacturing process and to respond to changes as well as irregularities.

The FBL system is no exception to the typical bipolarization of labor force. Line operators, for example, take on the simpler tasks while intensity of their work increases. Operators often joke that they are the ‘button men’, whose only job is to press the button in keeping with the robots’ work pace. On the contrary, the maintenance and the QC personnel perform tasks that demand sophisticated skills. These people are recruited through a different process and are assigned to teams that are independent of the assembly lines. This, in fact, is a legacy of the Fordist assembly process, characterized by the separation of ideas and implementation.

Hyundai's plant management structure has four tiers, the highest being the department (*bu*), under which is the division (*gwa*), which is divided into teams (*ban*) made up of smaller groups (*jo*). A jo consists of 7 to 8 workers under the supervision of the *jojang* or the group leader. 2 to 3 *jo's* make up a ban (Figure 2.2). The *banjang* or the team leader oversees the *jojang's* and other members of the ban. The *jojang* is assigned to many managerial roles regarding labor

affairs, production, quality and work performance. Thus *jojang* plays a role as a supervisor. Because about 10% of the workers are absent on any given day, the group leaders often join his subordinates in the actual production. A *gwa* is made up of four ban's, and four *gwa's* make up one *bu.*

Figure 2.2: Work organization at production section



It should be noted that the rank system applied to the production worker is distinct from that applied to administrative workers. Whereas administrative workers range from the *sawon* at the bottom to higher positions of *daeri, gwajang* and *chajang*. the production workers range from *ghisa, juim, ghijang* and *ghisungbo* (Figure 2.3). The jikguep, or rank, is different from the person's *jikchaek* in that the one is defined primarily by seniority while the other is defined more by the task assigned. It is the seniority-based *jikguep* that determines wage and other benefits.

Figure 2.3: Rank system *(Jikgeup)* by section

Administration	Sales	Production
		Ghisungbo
Excecutive		Ghijang
Bujang	Bujang	Juim
Chajang	Chajang	Ghisa
Gwajang	Gwajang	Banjang
Daeri	Juim	Jojang
Sawon	Sawon	Worker

The shop supervisor at Hyundai plants does not enjoy the same status and authority as do the German *meisters*. The lower status of Hyundai supervisors reflects their lack of expertise. The skills required of these supervisors are company specific, and their authority is not based on the certificates that are widely recognized in the industry but on their rank in the corporate hierarchy. The authority is not a result of investment in training as it is in the case of German *meisters*. This difference negatively affects the relationship between the supervisors and the workers under them. The workers do not readily accept the supervisor's authority, which leads the company to give supervisors various forms of power to control his subordinates as a way

of strengthening their authority, albeit artificially. For this reason, the shop supervisors are better integrated into the corporate structure and are more ready to uphold the rules set up by the company, while their position is dependent on the company. Moreover, their authority is limited in the face of workers who have better skills. In a shop environment where conflicts arise frequently, the supervisors are mainly charged with the management of the workforce as opposed to more technical duties. Therefore, promotion to the supervisor's position is more significantly affected by factors like labor relations than by the candidate's skills and expertise. At Hyundai where the supervisor's main role is to control workers, the ratio of supervisors to the total number of plant workers is greater than in the German automobile plants.

In many ways, shop supervisors in Korean factories are closer to the typical supervisor in the mass production plant. The shop supervisor is in a marginal position caught between the management and the labor, and the managers often use the shop supervisors as scapegoats or buffers in a labor conflict. Supervisors have only a limited influence on decision-making in the shop, and due to low wage and continuing decline in their standing in the corporate structure, they are not very committed to implementing decisions made by the management. To urge the disinterested supervisors, the managers continually pressure and check for their compliance. Such an unstable system further weakens the motivation in the supervisors to take responsibility for their work. Another disincentive is the gap between the supervisors and the managers in their social status and the level of education received. Separate promotion systems are in place for the factory workers and the office workers. For factory workers, promotion opportunities are slim, and their promotion to a position of greater responsibility does not entail promotion in rank. Such an organizational structure breeds a supervisor-worker relationship based on conflict, and obstructs skills formation (Jung, Sung Gug, 2004).

3. Target group specific initial education and in-company continuing education and training

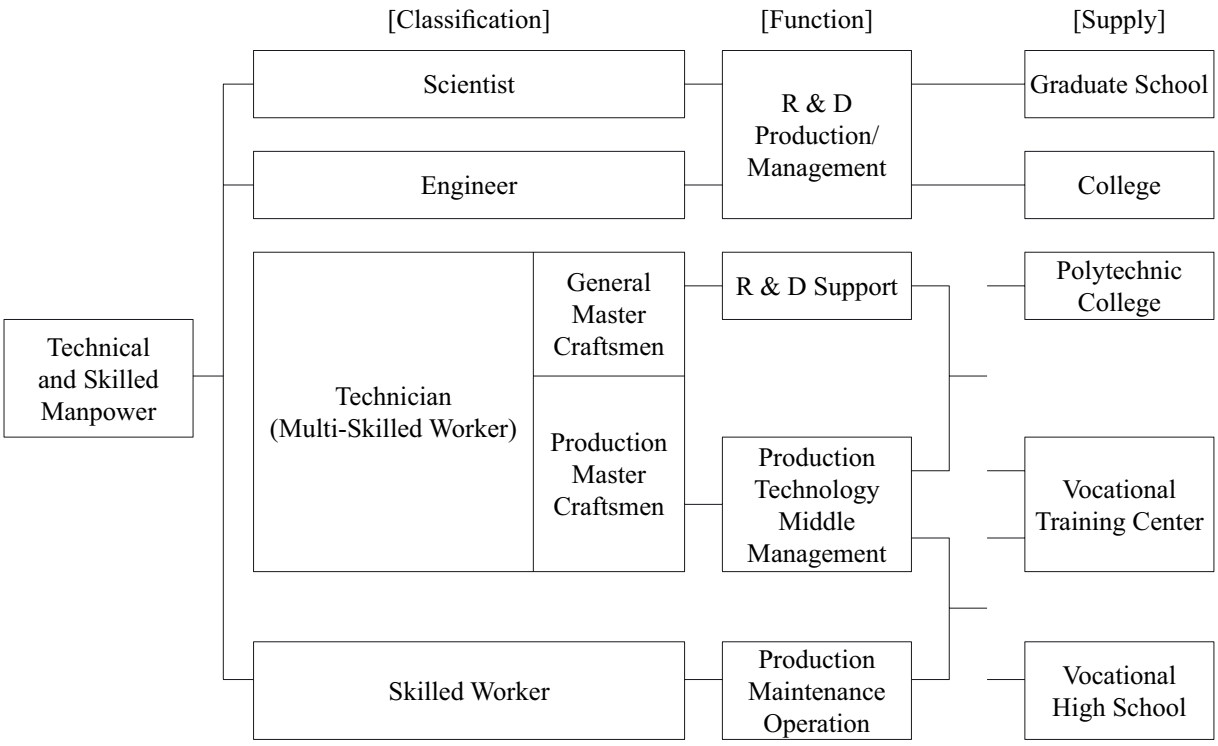
Initial education and training for all levels of skilled manpower are provided mainly under the formal education systems in Korea. The supply system of technical and skilled manpower under the Ministry of Labor is shown in Figure 2.4.

1) Initial education and training at schools and training institutes

In Korean, initial education and training is provided in schools under the formal education system and in public training institutes managed by the Ministry of Labor. As vocational high schools and junior colleges are major sources for supplying skilled workers and technicians, one vocational high school and one junior college are selected as case studies to present initial education and training for automotive industry.

Initial education and training for unskilled and semi-skilled workers for automotive industry are provided at technical high schools and vocational training centers. Technical high schools provide programs in areas such as mechanics, metals, molding, piping & welding, electrical engineering, electronic engineering, computer graphics, civil engineering, communications, aircraft maintenance, chemical engineering, and environment.

Figure 2.4: Skilled manpower supply system



Source: Ministry of Labor (2004). The current status of vocational training programs, p. 3.

Public vocational training institutes provide eight programs including machinery, Metal materials, electric engineering, electronic engineering, information & communication, design, architecture and services. They offer training courses in 51 occupations including CNC lathing, metal coating, electric system control, industrial electronics, electronic communication, computer industrial design, steel concrete, etc.

Initial education and training for technician (multi-skilled workers) for automotive industry are provided at technical junior colleges and polytechnic colleges. Technical junior colleges provide programs in technical engineering, machine design system, information mechatronics, automotive engineering, electrical information engineering, communication engineering, materials engineering, computing & information system, and digital & information system, etc.

Polytechnic colleges offer programs in ten areas, including technical engineering, metal& material, electricity, electronics, information & communication, textile, design, architecture, environment, and aircraft. The training programs include mechatronics, computers, applied metallurgy, electricity, electronics, information communication facility, textile system, industrial design, architecture remodeling, environment chemistry, and aircraft machinery.

Case studies were carried out to examine initial vocational education to train skilled workers and technicians for automotive industry. Pusan Automobile High School and Ajou Motor College were selected as the targets of the case studies.

Case 1 : Pusan Automobile High School

Pusan Automobile High School (PAHS) was founded in 1999 by Busan Metropolitan City Office of Education, which restructured a vocational school to establish a specialized high school focusing on automobile engineering. This was done to train and supply a skilled workforce to the automobile industry nearby, including Hyundai Motors and Renault Samsung Motors.

Students are recruited without any distinction as to their specialization, but in their second year they are given a choice to choose one of three majors: Electronic Machinery (automobile parts processing), Automobiles (automobile inspection and repair), and Automatic Control (maintenance and repair of plant automation facilities)[27].

Students must earn 216 credits during their 3-year program. General subjects account for 48 % of the curriculum while specialization subjects make up 52 %, which shows a distinct focus on professional education. Students must complete core courses in their freshmen year. In their second year, they choose their major and take courses specific to their specialization (theory and practicum). The third year is for the advanced specialization program, which offers students OJT and opportunities for earning qualifications. For the sake of efficiency, practice sessions are held in groups of 40 when they do not require a lot of facilities and active participation from the students, and in smaller groups of 15 ~ 20 when students must all actively try out and practice the skills. Table 2.9 shows all the core courses and specialization courses for each major.

Pusan Automobile High School has as its mission the development of skilled human resources for the automotive and related industries. In an effort to achieve this goal, PAHS focuses on the following objectives in their educational delivery:

- to strengthen basic education
- to foster extracurricular activities of skills development clubs (clubs whose activities are focused on their school major)
- to develop a capacity to use high-tech equipment and facilities
- to help each student earn at least one qualification
- to strengthen computer education
- to provide opportunities for OJT
- to consolidate linkage with industries

[27] Each year Pusan Automobile High School can recruit 6 classes, or 240 students. The entire school is organized into 3 departments and 6 classes in each grade (totaling 18). The total number of students is 720. Drop-out rate is very low, and most students do complete the program. Half of the graduates pursued higher education in colleges choosing automobile-related majors. The rest found employment in the automobile industry.

Table 2.9: Curriculum of Pusan Automobile High School by program

Major Objective		Courses	
Major Objective		Year 1 (Core requirements)	Year 2 (Specialization courses)
Electronic Machinery	Develop skills to make automobile parts	1. Computer science basics 2. Basic drawing practicum 3. Basic machining practicum Lathing, milling, welding 4. Basic electronic engineering practicum electric engineering electronic engineering 5. Engine maintenance practicum engine maintenance chassis maintenance	1. Machine design 2. Mechanical materials 3. Lathing practicum 4. Milling practicum 5. CAD practicum 6. Numerical control practicum
Automatic Control	Develop skills to install, operate, maintain, and repair automated production facilities,	1. Computer science basics 2. Basic drawing practicum 3. Basic machining practicum lathing milling welding 4. Basic electronic engineering practicum electric engineering electronic engineering 5. Engine maintenance practicum engine maintenance chassis maintenance	1. Industrial electronics 2. PLC practicum 3. Hydraulic and pneumatic control practicum 4. CAD practicum 5. Automatic control practicum
Automobile Engineering	Develop skills to inspect and repair automobiles	1. Computer science basics 2. Basic drawing practicum 3. Basic machining practicum lathing Milling welding 4. Basic electronic engineering practicum electric engineering electronic engineering 5. Engine maintenance Practicum engine maintenance chassis maintenance	1. Automobile structure 2. Engine maintenance practicum 3. Chassis maintenance practicum 4. Electrical engineering practicum 5. Sheet metal painting practicum

Source: PAHS internal documents (2005).

Practical skills training

Students in their second and third years are given opportunities to acquire the skills related to their specialization by practice. The school is furnished with state-of-art facilities and equipment. Students are divided into groups of fifteen for each skills training session, which is adjusted to the learners' competency (See Table 2.10).

Skills training is designed to help students earn various qualifications for skills used in the automotive industry. PAHS has close ties with companies in the industry, which the school uses

to its advantage to run the school-based enterprise or to provide customized training. These efforts are intended to help students learn skills relevant to the workplace.

To respond to the automation of processes, such as logistical automation in car assembly and automation of parts processing, PAHS has installed the FMS system for Automatic Control majors. The FMS system is used to help students become familiar with equipments for automating processing and logistics, as well as understand the relationship between the different parts of the FMS system, such as control and command process. Students also get hands on practice on operating an FMS system.

Table 2.10: Skills training rooms in PAHS

(Unit: 1,000 Won)

Department	Skills training rooms	Number of equipments
Automobile Engineering	Engine maintenance, Chassis maintenance, Inspection room, Lab, Electrical engineering, General maintenance and Sheet metal painting	292 types 687 units
Electronic Machinery	Lathing, Milling, Machine assembly, Welding, Numerical control, CAD/CAM, Precision measurement	113types 687 units
Automatic Control	Electrical engineering basics, Electronic engineering basics, Hydraulic and pneumatic control, Automation, PLC, PMS, automatic control	143types 983units

Source: PAHS internal documents (2005).

PAHS emphasizes workplace training as a way of developing the skills and the adaptability relevant to the real work environment. Third-year students are given the opportunity in their second semester to be trained in a company in the automotive or related industry. Most students (about 80 %) are assigned to automobile manufacturers or other companies related to the automotive industry situated in close vicinity. In some cases, students are sent to distant regions to receive workplace training. Workplace training is generally three months or longer and the length of the program is converted to credits. Students are graded based primarily on the evaluation of the companies, which account for 75 % of the grade. The remaining 25 % is based on the written report students submit about their experience of the workplace training.

To strengthen the relevance of education to the actual work environment, PAHS collaborates with companies through many channels. PAHS has signed agreements with the region's automotive and related industries to give students a chance to be trained in the workplace to learn about the latest technology and skills applicable in a real setting. PAHS also has the permission from Hyundai and Kia Motors to use their offline satellite broadcasting programs in the education of students. The satellite programs were originally intended to expose employees to the current technologies, and they are also transmitted to PAHS for students to practice broadcast auto mechanics and automotive technologies real time.

As part of an effort to reflect rapidly shifting trends of industry demands for labor, PAHS involves the businesses in the development and administration of curriculum. For example, the 12-member PAHS Steering Committee, which is the body that makes the final decisions on curriculum, must include 4 business representatives as a rule. The committee members from

the industry exercise significant power in decision-making on school matters, and influence the educational programs, the skills training and the pursuit of school development. .

Companies that have signed MOUs for school-industry collaboration award students scholarship, donate materials and equipments for skills training, and give PAHS students the opportunity for workplace training before others. These companies in close consultation with the school administration, offer new technology training for school instructors, and request lectures on automotive industry and customized training. In this way, the industries communicate their concrete demands for skills training that industries need and PAHS is making the utmost effort to respond to that demand.

Case 2 : Ajou Motor College

Ajou Motor College (AMC), a 2-year junior college, was founded by Daewoo Group, which used to be one of the largest conglomerates in Korea. It was Daewoo's intention to have AMC provide customized training, focused on skills and competencies relevant to the real work setting so that the graduates from this school could be put to work right away without OJT. AMC has a long-term master plan, which is aimed at establishing the school as a leading educational institution focusing on the automotive industry. According to this plan, AMC has endeavored to specialize its programs with a focus on the automobile production technology. All the departments that were set up soon after the school's foundation (e.g. Machinery, Automobile Technology, Electrical Engineering, Electronic Engineering, and Computing and Information Systems) were planned with a distinct focus on the automotive industry (refer to AMC official website at http://motor.ac.kr/new/index.htm).

In order to train intermediate level technicians who have high level of theoretical knowledge and practical skills specialized in automobile production technology, the college has reorganized curricula related to automobile production technology, and introduced UK's NVQ system

The college has plans to make sizeable investment in facilities and equipment to create an environment that can contribute more effectively to the competitiveness of AMC's education and research (plans to invest 3 billion KRW in the next 5 years). It also has plan to invest in capacity building of faculty members.

AMC's programs belong to one of two tracks, which are Automobile Engineering track and Automotive Leisure and Culture track. Under these two tracks are 13 departments, which together recruited 560 students under the instruction of 35 professors. As much as 70 % of the tenured professors have work experiences in the industries of minimum 3 years. To train skilled experts, AMC has secured a faculty that has both field experience and research capacity while continually upgrading and expanding research facilities.

Curriculum of AMC

AMC's programs are run on a major course system basis, in which curricula are specialized and segmented, for the following reasons: to teach the skills the automotive industry demands in workers, to do research on tomorrow's technology and thereby deliver education that contributes to the future automotive industry, and to establish an education system in which skills and technologies in the workshops can be flexibly reflected in the curriculum.

Under the Automobile Engineering track are: Motor Design, Machine Design/CAD Program, Digital Metallic Pattern Design, Motor Control & Diagnosis Technology, Automotive Tuning & Control, Motor Digital Tuning, Car Electronics, Car Manager, Car Telematics, etc.

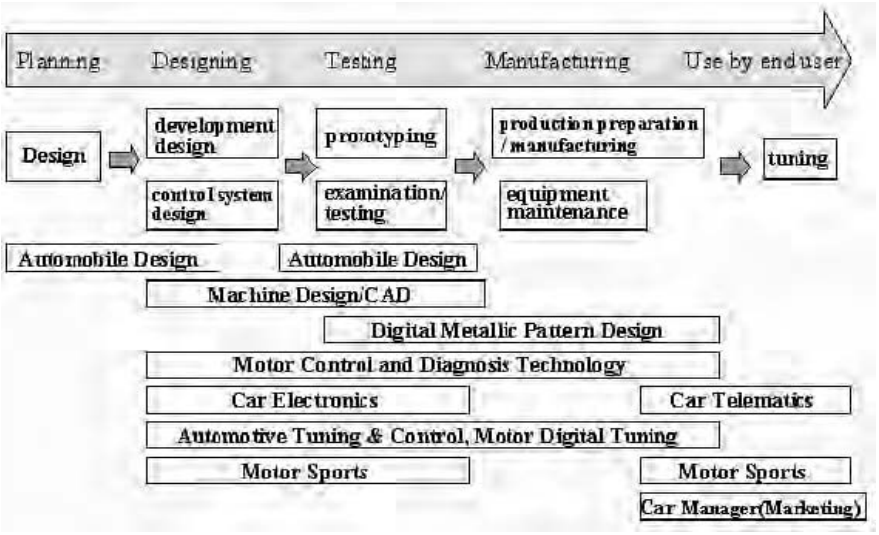
To foster the overall automotive industry, AMC has under the Automotive Culture & Leisure track the following departments: Motor Sports, Tourism-Leisure Sports, Cooking Art, etc.

AMC takes advantage of its partnership with industries to identify the skills used in the actual workplace. Then, it analyzes the jobs that require these skills and reflect this in their curriculum development and management. In identifying the workplace skills in the automotive industry, it also becomes clear what equipments and machines are needed. These equipments and machines are categorized by developmental stage of technology, mid- and long-term purchase plans are made, and finally the plans are carried out to maximize efficiency of practices and experiments.

The most important principle in making these purchases is to always choose the ones with most up-to-date specifications and which are more advanced and sophisticated than those found in the workshops. The facilities are not used not only in education and research but may foster school-industry cooperation.

AMC boasts a full line-up of state-of-art mission critical machinery that is essential in the conceptualizing, designing, prototyping, and manufacturing (Figure 2.5). AMC also runs an entrepreneur incubator center using relevant equipments and has established an industrial and technological education complex within itself. The system created by AMC is one in which education, production, research are promoted by school-industry collaboration.

Figure 2.5: Specializing in automobile production technology program



Source: Internal documents (2005).

In designing and delivering curriculum, AMC's primary goal is to make education demand-oriented and focused on learning by doing. AMC has organized the school into two distinct tracks under which are provided major courses. The school recognizes that today's rapidly shifting world demands education based on real work experience and a deeper and more

intensive specialization in one's area. Some of the efforts AMC has made to respond this environment include: fully furnished skills training rooms for all departments, introduction of project courses in which students can make what they want, and submission of students' works to AMC's own graduating class exhibition or major competitions held outside the school, e.g. Korea Machinery Fair (KOMAF). By displaying the works at such competitive events AMC actively promotes the outcome of education focusing on real experience.

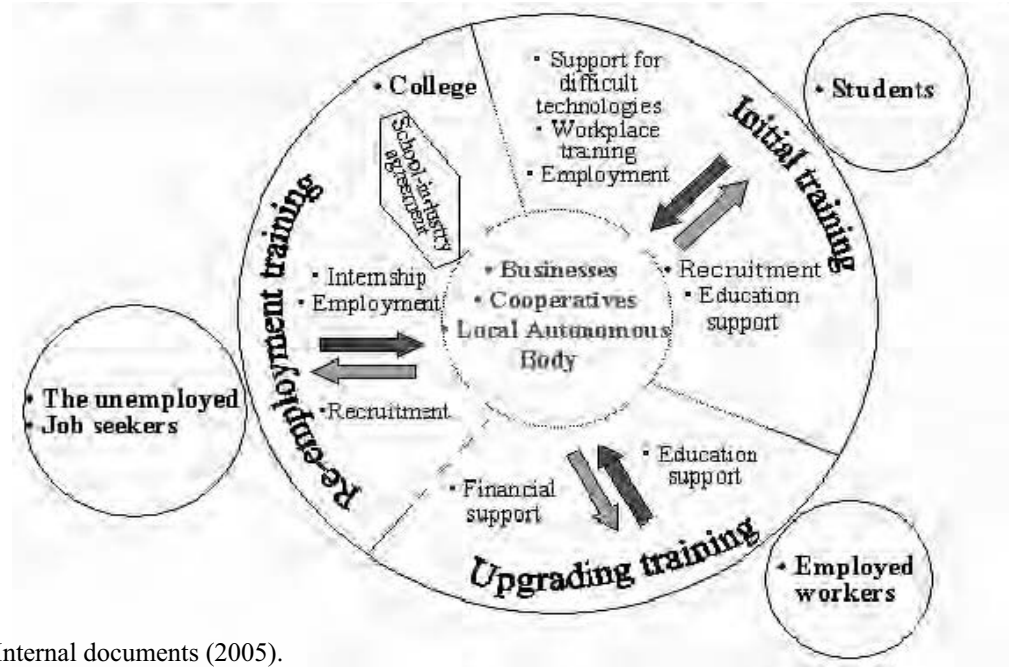
School-industry collaboration of AMC

AMC was established by Daewoo Group, and as such it has focused on establishing a training system that effectively reflects the needs of the industry. In 1995, it created a customized training model, based on recruitment of students by educational track, i.e. Automobile Engineering track and Automotive Culture & Leisure track, and the major course system.

AMC's educational model was chosen by the MOEHRD in 1996 as a pilot college program. In the following year, the MOEHRD sought to encourage dissemination of the model nationwide by subsidizing customized training initiatives. As of 2004, AMC signed MOU on customized training with 49 companies including Daewoo Motor Sales, offering 19 courses to 642 learners.

The distinct feature of AMC's customized training system is the made-to-order approach in education (Figure 2.6). The customized training system with a focus on workplace tasks was first conceived to strengthen the competitiveness of SMEs. The businesses and the college have entered into mutual agreements on customized training to strengthen competitiveness, especially of the SMEs. Under the agreement (1) AMC creates courses SMEs need, such as those that are designed with a focus on workplace skills, and (2) the industries and the college jointly deliver training for the jobs that are needed in the real setting.

Figure 2.6: Customized Training Model of Ajou Motor College



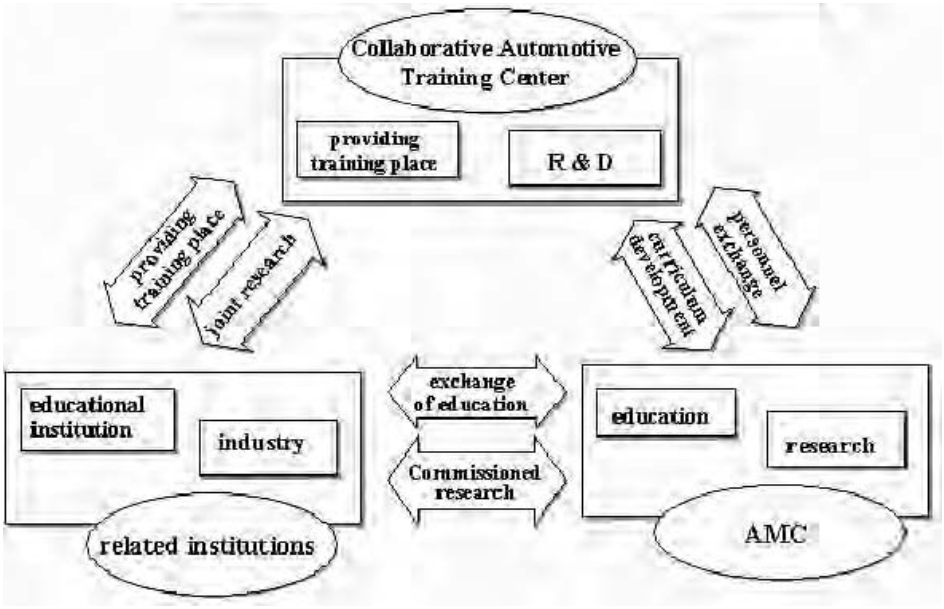
Source: Internal documents (2005).

School-Industry Technology and Education Compound was established to enable an effective system for school-industry collaboration. Businesses involved in the automotive industry one way or another and students who will some day become a part of them are working together in the Compound, where education, development and mass production are possible using the latest machines and devices.

Through these efforts AMC has: (1) provided effective customized training, (2) provided workplace-centered education, (3) trained students to be able to start right away without OJT, (4) relieved the unemployment as well as lack of competent people, and (5) strengthened global competitiveness of industries.

AMC established a collaborative training and research center to promote school-industry cooperation in 1999. AMC plays a major role as the center of education and research on automotive technology by securing high-priced facilities and equipment, making them accessible to other education institutions and industries, and promoting collaborative training and research among those organizations (Figure 2.7). For practice and education relevant to the automotive sector, AMC has developed a modularized curriculum. AMC's efforts have prevented redundant investment in expensive equipments, promoted sharing of human resources in managing programs. In program development, AMC has contributed to collaboration and standardization of curriculum.

Figure 2.7: Collaborative Automotive Training Center



Source: Internal documents (2005).

2) In-company continuing education and training

The automobile manufacturer Hyundai provides workers with different types of training, such as management training (target group specific training), on-the-job training, training for new recruits, foreign language training, special training and cyber education. Training courses are delivered at the HRD Institute, which mostly carries out training for managers, and training

centers established in each production plant to deliver institutional training for working-level staff. In addition to these, there are Plant Innovation Centers in each factory, which have been set up to offer various quality management programs and non-formal training.

(1) Target group specific training

Target group specific training is organized into six program areas, namely management, R&D training, production, sales, maintenance and repair, and quality. Target group specific training is offered to engineers and technicians in the production sector, who are further segmented into groups by the number of years they have served in the company ranging from the newcomers, workers in their second year, the third year, and so forth to those who have worked for 15 years and above. Workers are also categorized by their rank, for example into groups of *jojang*, *banjang*, and technicians/Grade 4. Training content is systematically planned and differentiated for each group.

A notable characteristic of target group specific training is that it emphasizes corporate ethics training. Each production worker must receive special training for corporate ethics for a set number of hours per year. The management believes that the majority of production workers have acquired sufficient level of work-related knowledge and skills through years of experience. The challenge is, therefore, motivating these skilled workers to be more willing and illustrious in the workplace, and to do so the management sees it necessary to bring about a change in the workers' attitude towards work through corporate ethics training.

Both *jojang* and *banjang* are given leadership training, and the former are obliged to complete TWI-A program and the latter an introductory course on workplace management. Professional skills training is provided to skilled workers, who have been in service for 15 years or more and the *jojang* and *banjang*. For managers (engineer grade 4) new entrants 4 grade manager training course is given the opportunity to participate. In engineers training course, creativity development course, professional skills training, interpersonal skills training course are included.

(2) Professional skills training

Professional skills training began in 1999 as a combination of a morale program and skills training targeting workers who are candidates for promotion. According to Table 2.11, professional skills training is offered to those who have worked for 15 years or more and are qualified to become an Engineer. This system obliges a worker who has reached a certain number of years in employment to participate in mandatory professional skills training and upon its completion to climb up the ladder. Candidates for the position of Engineer (Grade 4) as well as those waiting to become Assistant Managers (Technical Assistant Manager, Grade 3) or Managers (Manager Grade 3) all receive professional skills training in the same manner.

Each participant in the training is evaluated according to Table 2.11 and the results are considered in deciding his/her promotion. Grades received from the training and from performance evaluation are added and promotion candidates in the top 15% based on this total score are promoted. Trainees can apply for a retest when he is unsatisfied with the grade received from the training program.

Table 2.11: Scoring guideline for promotion

Job Classification	Score Distribution	
Administration and Technology (Staff level)	Training outcome	5 points
	Work performance	10 points
	Automobile Structure	5 points
	Total	20 points
Administration and Technology (Assistant Manager level)	Training outcome	5 points
	Work performance	10 points
	Paper assignment	5 points
	Total	20 points
Plant worker	Training outcome	5 points
	Work performance	10 points
	Attitude	5 points
	Total	20 points

Source: Jo, Hyung Je (2004) .

In the early 1990's when the introduction of Skill-based Pay System based on skill qualification was indefinitely postponed, Hyundai Motors launched instead the Skill-based Promotion Program. The Skill-based Promotion Program separated the role of Team Leader from its position in a bid to expand promotion to the Engineer position (Table 2.12).

Table 2.12: Skills-based promotion system at Hyundai Motors

Position	Qualification to be considered for promotion to Engineer
Team Leader	Must have served as Team Leader for more than 1 year in the last 4 years
Group Leader	Must have served as Group Leader for more than 2 years during the last 4 years; and must have worked more than 10 years
Group Member	Must be a worker who gets paid by the hour; and must have worked more than 15 years
Group Member	Must be working outside the plant (e.g. Headquarters, Mabook, Namyang, Research Center); and Must have worked more than 5 years

Source: Jo, Hyung Je (2004).

The professional skills training in actuality was not carried out in a way that links promotion to skill formation as was originally intended. The agreement signed by Hyundai Motors and the labor union sheds light on why this came to be so. According to the 1999 document, workers who had been employed for 19 years or more were to be given the right to apply for promotion test. 70% of those who apply were to be promoted to a higher position. This was done as a way of adding elements of SQS so as to facilitate promotion of workers who are qualified and waiting for their step up the ladder. At present, however, such personnel management crunch has been reduced substantially and candidates for the Engineer position are automatically raised one level. The labor union welcomes this non-competitive promotion scheme and now demands similar measure for those who have worked for a smaller number of years. Expanding the

promotion opportunity for plant workers in this way does not involve competition, and so the labor union has little reason to oppose it (Interview, 2003).

Skill-based Promotion Program, in sum, was introduced in the late 1990's to award and recognize employees who have improved their skills through training programs. However, elimination of competition from the promotion process has made it difficult to keep skills-based promotion program achieve its intended goal. It is now a mere tool of controlling personnel management crunch by promoting workers. Because with time everyone gets promoted, the evaluation of training performance has little positive influence on the learners. So the workers who first protested against evaluation of training outcomes eventually saw little reason to do so, and since then the labor and the management have continued on with this training program without much conflict.

According to Table 2.13, more than 21,000 plant workers completed professional skills training from 1999 to 2003. Considering that there are 23,592 union members (including those in the assistant manager level), and that plant workers on average have worked nearly 15 years, we may expect that soon most workers will be receiving this training. However, the table shows that the program, which was originally 4 to 5 days long, has shrunk in duration. The content of the training is also scheduled to change from being task-focused to morale-focused. It is said that the newly appointed chief supervisor of the plant puts morale before task-related training.

Table 2.13: Participation in professional skills training at Plant A

Year	Number of Target Learners	Number of Participants	Program Length
1999	8,524	7,863	4-5 days
2000	3,832	3,648	4-5 days
2001	4,115	3,993	4-5 days
2002	3,073	2,985	4-5 days
2003	3,144	2,792	3 days
2004	1,172	-	2 days

Source: Hyundai Motors(2003). Internal document.

Hyundai Motors has only partly adopted elements of SQS. This is evident in the way professional skills training for promotion candidates are provided in the form of Off-JT. The company had good intentions when it sought to enhance the skills of its employees by reflecting training outcomes in the promotion process. However, it is impossible to train people the intellectual skills that are needed in a flexibly automated work environment through short-term Off-JT without systematic OJT to complement it. Moreover, promoting workers based on the length of their service to the company with little regard to evaluation results naturally fails to motivate workers. The recent changes in the training program – i.e. shortened length of skills training and replacement of professional skills training with morale workshops – lead one to doubt the commitment of Hyundai Motors to encourage skill formation among its workers.

(3) Job skills training

Job skills training for production workers is divided into four areas: automobile manufacturing, plant automation, automobile engineering, and IT (Table 2.14). Most of the training is provided not only to the employees of the company but those of partner firms.

According to the training plan for 2004, the number of participants for each of the four areas was: Automobile Manufacturing (1,915), Plant Automation (2,153), Automobile Engineering (2,690), and IT (1,699).

The courses are 3~5 days long (or 22~40 hrs), and class sizes range from 9 to 30 per session. Each program was offered several times during the year to make it easier for workers to participate when each feels the need for the training.

Table 2.14: Job skills training program

Program	Course	Course
Automobile Manufacturing	* CATIA * Quality management basics * Precision measurement * Machining center * CNC lathe	* Press die * Reading drawings * Laser beam machining * Press material welding * Improving quality of automobile body welding * Special welding
Plant Automation	* Pneumatic system maintenance * Pneumatic/electric control * Hydraulic control * Electrical and electronic engineering * Inverter control * Digital control * PLC	* GP programming * GOT programming * MELSEC-NET * SIEMENS-PLC * Robot technology * YASKAWA Robot Technology * Plant Automation
Automobile Engineering	* Automobile structure * Electronic engine control * Electronic chassis control * Automatic transmission	* Automobile powertrain application * Car chassis * Car master repair intermediate level
IT	* Computer data processing application * Information utilization * Power point * MS word	* Excel * Visual Basic * Excel VBA

Source: Hyundai Motor Co. Ulsan Education Team (2004). 2004 Technical Education Programs (in Korean).

(4) Approaches to multifunctional task fulfillment (multi-skills)

Types of skills formation

Large corporations in Korea are more reliant on their own vocational training programs, and OJT especially, for human resource development than on public vocational training. This is quite similar to the situation in Japan where the State plays only a marginal role in the skills

formation in the businesses. The education system and the employment system are not structured on the basis of professional job categories. Job categories, which refer to a specified set of skills qualifications and domain of work responsibilities, cannot be found in either the training system or the employment system. Unlike Western shops, job tasks are not clearly categorized and consequently there is no performance-based wage system. Skills are valuable to the industry but they do not have exchange value in the labor market. Skills formation is focused on the social context of the particular task rather than on the professional expertise. The corporate culture substitutes for diversity of cultures in specific job categories, while instead of standardization of labor and training there is firm's organization and skills structure. Career is more important than learning. The worker's identity based on job categories is obliterated by loyalty to the company. The relationship among role, career and wage varies greatly from company to company. Even within the same company, this relationship is neither clearly nor consistently defined. The primary goal of education and training is not the integration of knowledge and competency but the acquisition of multiple skills specific to a situation (Jung, Sung Gug, 2004).

On-the-job training is the most vigorously pursued form of skills formation among many that take place in the automotive companies. Because much vocational training is provided in the workshop, OJT is primarily focused on satisfying the demands of the enterprise. OJT is a form of vocational training that takes place as the worker participates in the production process. For this reason, OJT is carried out in a natural work environment in a relatively unorganized and unofficial manner and is not open to the public. The production process varies between industries, enterprises and even within the same team in a shop. Because OJT is conducted in stages in keeping with the level of training required in a particular part of shop, it varies according to the special features of each step in the process and the particular job task. OJT cannot be readily formalized and organized because job tasks and technology is constantly evolving. There is no set content to be covered in OJT and no formal textbook exists to serve as learning material. Learning content and knowledge are not closed, and they are dependent on the personal and social contexts. With the exception of a special segment of Off-JT, there is practically no dividing line between labor and skills formation (Jung, Sung Gug, 2004).

Job rotation

In the case of Japan, skills formation through OJT is largely dependent upon the tasks that the individual has taken on in the course of his/her career. Assigning workers to a job category is effected by promoting or transferring a person, or giving the worker a certain post in the shop. The most efficient method of skills formation in such a setting is OJT, and flexible job assignment makes an OJT-focused skills formation possible. Skills formation through OJT is dependent on the worker's career, which is decided by job rotation, promotion and transfer. The job rotation, in principle, is a transfer to a closely related job category or to a post in the nearby segment in the shop. Under the system, performing the current job serves as training for the next job, and in this way the economic efficiency of training investment is guaranteed (Jung, Sung Gug, 2004). At Hyundai, however, job rotation is not systematic and the promotion opportunities for assembly workers are very limited. Job rotation cycle in the engine plant varies depending on the features of the particular manufacturing line, but on average it is about six months[28].

[28] In some machine work, job rotation occurs every three months, Automaker B also rotates jobs once in three months, but not for the same reason as Hyundai, which was to systematically foster multi-skilled workers. In Automaker B, the 3-month cycle was adopted because after three months workers begin to lose their familiarity with the tasks they performed earlier (Jung, Sung Gug, 2004).

The company adopted job rotation as a policy primarily because the workers demanded it, not because it is the company policy to develop multi-skilled workers[29].

Training multi-skilled workers

'Multi-skilling' is needed to effectively respond to the following: demand for greater functionality due to sophistication of facilities, consumer demand for higher quality, increased volatility of demand, increased prevalence of musculoskeletal disorders, need for greater flexibility in filling up vacancy.

Multi-skilling should be pursued, keeping in mind to:

- standardize and streamline the work process to allow each worker to perform different tasks;
- train the leaders, i.e. *jojang and banjang*, before others;
- standardize work (provide work guidelines or manuals as necessary);
- provide adequate incentives to skilled workers who are multi-functional; and
- progress gradually and systematically according to the skill level of workers.

Multi-skilling table (a table that shows the level of multi-skilling of each production worker) can be used as a tool to manage multi-skilling. Multi-skilling table is used to record the degree of multi-functionality of individual workers as well as the entire workshop. It is a tool that makes it easy to set targets for education and training, and to assess the progress made by individuals and at different stages of the manufacturing process.

Informal learning

In many of the Korean factories informal learning is one of the major channels of skills formation, and the Hyundai automobile plant is like the others in this respect. Many forms of informal learning take place, but two types are particularly of significance in the Hyundai case, OJT conducted by superiors and learning by doing.

Like other domestic conglomerates Hyundai hires those people who have graduated from vocational or general high schools with good grades. These recruits participate in a short-term training program organized by the vocational training center. This short-term training is designed to help the newly-employed to become an accepted member in the workplace.-The aim is not to teach professional skills. After the initial training, the newcomers are assigned to various steps in the production process, and only then real skills training takes place in the form of OJT.

The newly recruited worker in the engine plant first follows his supervisor, who will point out for him the areas requiring special attention to safety and explain about the facility layout, the product, and the quality check-up process. Then, the newcomer will move on to the next phase in training, which will usually be conducted by his/her senior. There is no standardized form of training for machine work so the newcomer must follow her senior around watching and learning how experienced workers solve and prevent problems. The senior worker will teach the newcomer by repeating the steps, and this demonstration-oriented training will go on for

[29] Awareness of muscular and skeletal problems caused by work has led the workers to demand job rotation to reduce fatigue that results from repeated use of certain parts of the body. This is one of the key reasons for adopting job rotation.

about a month. Having carefully watched his senior for a number of weeks, the newcomer is now ready to do some learning by doing. He is assigned to perform tasks under careful scrutiny of his superior who will check his output. After a month of this closely supervised learning by doing, the new worker is finally given his first assignment in the machining process where he will mature into a skilled machine worker[30]. (Jung, Sung Gug, 2004)

Learning station

Another important method of learning at Hyundai factory is training in the Learning station (Lernstatt). Each department in the plant has a room attached to it for training in quality, safety, company policy, TPM, etc. Safety training takes place twice a month while other training programs are conducted irregularly when there is time to fit them in. Quality training program tends to be more frequent than others. Quality training includes solving problems that occur, preventing the same problems from happening again, and raising the worker's quality awareness (Jung, Sung Gug, 2004).

Training provided by equipment makers

Training provided by the maker of an equipment is an important part of OJT. When a new equipment is introduced to the workshop, the maintenance personnel and the workers in the segment of the assembly line that will use the equipment are given training. Controller makers like FANUC Korea Corporation and Siemens are either asked to send training experts to the shop or to open training courses for workers to attend[31]. The tables below show the composition of two training programs designed by FANUC Korea Corporation. One is an introduction to CNC and the other a job upgrading training in CNC (Table 2.15 & Table 2.16). These examples give us a view of what kind of training machine workers and maintenance workers in the factories receive.

Table 2.15: Introduction to CNC conducted by FANUC Korea Corporation

Day 1	Morning Afternoon	Watch a video clip, overview of CNC Composition of CNC and equipments
Day 2	Morning Afternoon	Understanding the functions and terminologies
Day 3	Morning Afternoon	Code and milling programs Coordinate system
Day 4	Morning Afternoon	Correction Fixed cycles
Day 5	Morning Afternoon	Lathe programs Summary and assessment, awarding of certificates

Source: http://www.fkc.co.kr, The official website for FANUC Korea Corporation.

[30] It takes about three years for a new recruit to become a skilled machine worker, meaning that he or she can be trusted to perform a task assigned in the workplace. An interviewee went so far as to say that it takes ten years for a worker to receive compliments for excellent performance.

[31] Sending workers to training conducted by companies that made the controllers or the equipment will cost 400,000 to 500,000 Korean won (about $350 to $440) per person for a week's training. To save this training cost Automaker B has set up its own plan for special skills training. This plan is a useful document that shows the content of training designed for machine workers. Please see the Appendix for details.

Table 2.16: Retraining in CNC conducted by FANUC Korea Corporation

Day 1	Morning Afternoon	Watch a video clip, overview of CNC Understanding capabilities of each unit, methods of operation
Day 2	Morning Afternoon	Coupling CNC, interface Checking the power source and voltage
Day 3	Morning Afternoon	Servo composition, operating principles, servo tuning Exercise in servo-related breakdowns
Day 4	Morning Afternoon	Servo tuning Spindle composition and tracking
Day 5	Morning Afternoon	Repair and maintenance,(audiovisual learning material) Summary and assessment, awarding of certificates

Source: http://www.fkc.co.kr. The official website for FANUC Korea Corporation.

Training of suppliers (a training consortium at Hyundai Training Centre)

In November, 2003, Hyundai established a training centre for its suppliers. The consortium's training courses were financed through the Employment Insurance System and have all been approved by the Ministry of Labor. Hyundai Motor, the Ministry of Labor and 10 suppliers are represented on the consortium's management board. The Training Centre develops its provision in close cooperation with Hyundai Motor and its suppliers, and ensures a high level of technical and educational input, which the suppliers, most of them small companies, are unable to achieve with their own in-company training. Since the consortium began to provide training in January 2004, 1,946 people (106 in initial training and 1,840 in advanced training courses) have participated in courses lasting between two days and three months[32].

SME Training Consortia in Korea

The Korean government finances training grants to enterprises from the employment insurance fund (EIF), under the Vocational Competency Development Program (VCDP). The EIF is funded through a payroll tax on enterprises. The VCDP provides subsidies to firms that a) conduct in-plant training; b) assign workers on paid education or training leave; and c) provide training courses outside the company organization. It also supports employees engaging in education and training – including training for older workers – and provides tuition loans. One of the main drawbacks of the VCDP is that the major beneficiaries are large firms, while small and micro enterprises are benefiting much less from it (although they also pay smaller contributions)[33].

In response to the low take-up of training grants by smaller enterprises, the Korean government is supporting training consortia, involving large enterprises (including multinationals) that organize training for SMEs. The initiative provides an interesting and innovative example of how to tackle low training participation among SMEs.

In this system, training institutions of large enterprises pool resources to create a job training centre to cater to suppliers, distributors and subcontractors. This collaboration benefits all partners by increasing efficiency and quality of training delivery, streamlining the training programs of partner enterprises, encouraging employees of partner enterprises to participate

[32] The duration of training varies depending on the training courses. Courses in initial training are span from one month up to three months, and courses in advanced training from two days to two weeks.

[33] OECD (2005). Promoting Adult Learning, pre-publication draft March 2005.

in training activities, and ultimately achieving higher product quality. Moreover, training consortia organized by multinational enterprises or technologically advanced domestic firms may facilitate technology spill-over. The VCDP supports this by providing subsidies to the consortia as well as to partner enterprises using the training facilities.

Reform efforts in education and training at Hyundai

Hyundai Motor has not completely neglected reform efforts to enhance workers' skills to accommodate flexible automation.- Each time Hyundai met with a management crisis, voices called for innovating education and training.- This is a natural response since such crisis could be a good opportunity for bringing fresh changes to business management.- In the history of Hyundai Motors there were two such attempts to amend education and training.- One was carried out in the early 1990's and was titled 'Skill-based Pay System.'- The other was 'Training Road Map', which was launched amidst foreign exchange crisis in Korea in the late 1990's.-

Skill-based Pay System based on Skill Qualification

It was the labor movement in the late 1980's that occasioned Hyundai Motor to consider adopting the Skill-based Pay System (SPS) as a way of reorganizing the staff. From the long-term perspective, it was the huge success of the model Excel that necessitated enhancing product quality through promoting worker skills. In the short-term, however, the management wanted to effectively respond to the organized pressure of the labor as labor movement became more vigorous.

The labor union protested Hyundai's human resources management policy, which included discrimination against high school graduates as opposed to college graduates and limitation of promotion opportunity for plant workers as opposed to office workers.- This led in 1990 to draft an official document signed by both the company and the labor to start a long-term HRM reform designed for the new millennium. A staff reorganization committee was formed with 5 representatives each from the labor and the employer sides. This committee launched a research project on HRM reform.

Figure 2.8: Blueprint for Skill-based Pay System (Tentative)

Position	term
Manager	
Assistant manager	5
Engineer	5
Team leader	2
Group leader	2
Production worker	3

Current → New

Rank		Term	Title	Note
1	A B	5	Bujang Chajang	
2	A B	3 2	Gwajang Gwajang	
3	A B	2 2	Daeri Daeri	
4	A B	2 2	Sawon Sawon	New entrants (coll. Graduate)
5	A B	3 2	Sawon Sawon	New entrants (H.S. diploma)

Source: Jo, Hyung Je (2004).

The management listed four reform guidelines: (1) present a vision for lifelong employment, (2) provide equal opportunity and judge by competency and performance, (3) develop competency of individual workers and use human resources efficiently, and (4) pursue fairness and equity in personnel management. In sum, the employer focused on giving out incentives based on the worker's competency and performance. The management felt that existing promotion and compensation system had been run without clear standards and adequate assessment of individual workers. In this way, the workers were led to feel that it made no difference whether or not they worked hard, which in turn hurt worker morale and motivation. Hyundai Motor tried to solve these problems by launching a Skill-based pay system. SPS was designed to promote workers solely based on their capacity to perform and compensate them accordingly. Academic credentials or current position in the company did not matter. In other words, SPS was designed to separate the actual tasks performed from the position each worker held in the organization. SPS as shown in Figure 2.8 tried to unite the office workers and factory workers in a single system of staff organization, thereby satisfying the factory workers' desire for promotion. The assessment of individuals in SPS was also intended to foster competition within.

What would have happened to the existing skill formation system if SPS were to be introduced- Under SPS, promotion and wage level of workers would have been determined individually by their competency, and that competency will have been judged based on concrete data such as performance assessments, reports, tests, records of education and training received, and the number of years the person has worked. Therefore, SPS would have contributed to making skill formation more systematic. All criteria for the assessment of competency found in the SPS blueprint, except the length of the worker's employment at Hyundai, relate to his/her technical expertise and skills. This can motivate workers to constantly develop themselves to reach a higher position in the organization or to earn greater monetary compensation. Table 2.17 shows that under SPS, factory workers can climb higher to become a group leader, then a team leader then ultimately to the engineer position depending upon their level of skill. In this system, each worker learns the professional knowledge of not only their own task but of others belonging to their skill level.

Table 2.17: Skill-based pay system at Hyundai

Grade	Years	Qualification	Level of Skills
1	7	Qualification necessary to become an Engineer	Expertise in the entire manufacturing process pertaining to the particular job classification
2	5	Qualification necessary to become a Team Leader	Expertise in one‘s own task + some expertise in manufacturing process related to one‘s own
3	3	Qualification necessary to become a Group Leader	Expertise in one‘s own task + basic knowledge of manufacturing process related to one‘s own

Source: Jo, Hyung Je (2004).

The Skill-based Pay System devised by Hyundai Motor was an innovative scheme which systematically links skill formation of workers with education and training and promotion. Unfortunately, opposition from the labor union prevented this plan from being implemented.

The labor union was concerned that competition between individuals may weaken the workers' collective initiative or protest against the management. In other words, they feared that when individual worker is evaluated by standards the employer has unilaterally imposed, the solidarity of the union may be shaken to the detriment of its existence. For this reason, the labor union still opposes the implementation of SPS.

Training Road Map

The second occasion for Hyundai to change its education and training came with the foreign exchange crisis in the late 1990's. The new training program which incorporated evaluation was essentially in line with SQS which was developed in the early 1990's. The Training Road Map (TRM) aimed to train experts in automobile technology by fostering self-development efforts. As shown in Figure 2.9, TRM is made up of OJT and Off-JT. TRM's Off-JT is focused on teaching basic knowledge and skills while OJT on developing competencies needed in the shop. Workers are encouraged to acquire skills as they mutually exchange knowledge, technology and workplace experience.

Figure 2.9: Training Road Map

<table>
<tr><td colspan="3">OJT</td><td>systemizing
experience
→
←
use of knowledge
and skills</td><td colspan="3">Off-JT</td></tr>
<tr><td>Developing
New tasks</td><td>↘↖</td><td>Application</td><td>Training
Road Map</td><td>Goal setting</td><td>↙↗</td><td>Goal
Systemizing</td></tr>
<tr><td colspan="3"></td><td>Self Development</td><td colspan="3">-</td></tr>
</table>

Source: Jo, Hyung Je (2004).

At the core of TRM is OJT. In the TRM the term 'standard OJT' was adopted to distinguish TRM's OJT from the usual training taking place in the shop. Standard OJT was an attempt to standardize and systemize the existing OJT. In other words, the common expertise of predecessors in the form of tacit knowledge was to be transformed into formal knowledge and handed down to the successors. TRM recognized that to foster a pool of automobile technology experts it is necessary to train not only the newcomers but the experienced employees as well. The TRM sought to identify and train leader potentials among the workers so that they can in the future provide systematic OJT. Standard OJT system allows individuals to set their own learning goal and efficiently aids them to develop their competency while performing their tasks. When a worker completes the standard OJT program he may be given credits based on the evaluation of his OJT performance, which will later affect his promotion. The standard OJT in TRM was designed to strengthen the workers' capacity to solve problems in the shop and to boost their morale.

TRM does not disregard the necessity of Off-JT. Different professional skills training was to be offered for workers belonging to each job classification to help them acquire knowledge and skills that are needed in the workplace as well as systemize their work experiences. The

training was to be task-specific to help each worker, assigned to one of 147 tasks that belong to 19 job categories, such as pressing, body part, painting, accessories and engine. The learner's achievements were to be graded and reflected in the promotion screening process.

Hyundai set up a team in 1998 to pursue the TRM initiative. It was planned so that the team would, in 1999, invigorate the OJT system and then in 2000 to expand this throughout the entire organization. Hyundai hoped that implementation of TRM would be smooth and that this would contribute on the one hand to enhancing the firm's competitiveness, and on the other to resolving labor conflicts through better communication (Jo, Hyung Je 2004).

Hyundai in the late 1990's actively pursued a new training program. This was in large part because the company could not lay off unnecessary labor despite the fall of plant operation rate, because of the stout opposition from the labor union. Instead, Hyundai pursued a vigorous training initiative to enhance the skills of excess labor. This was not merely wishful thinking. The training program would teach workers to take care of quality control themselves, allowing the company to save on the budget for hiring quality control specialists. It was expected that if successful this would result in as much reduction in labor cost as would a massive layoff. What is more, the tacit knowledge, through TRM, would be turned into formal knowledge so that even if a large number of employees are laid off or if they take an early retirement, their expertise could be systematically passed down on to others (Jo, Hyung Je, 2004).

However, change of top management in 1999 and gradual recovery from a management crisis prevented this program from being carried out as originally planned. As economy in general started to recover, the sense of crisis itself diminished. Besides, the new top management did not, as had their predecessors, hold reform of education and training as a top priority.

While it is true that the central element of TRM, namely OJT, was not implemented, some parts of the program went on as planned. Professional skills training, an Off-JT, was launched as preparations for it were complete before the change of upper management and because it was easier to implemented than OJT. This program has continued on to this day since 1999.

In the 1990's, Hyundai Motors attempted a reform of its employee training two times. Flexible automation requires formation of the necessary skills, which in turn necessitated a linkage of OJT and Off-JT. However, opposition from the labor unions and replacement of upper management hindered the full implementation of the reform plans. Bringing changes to training to promote skill formation remains a major task to be completed in the new millennium.

4. Use of new media in education and training

Korea is well known as a country which has achieved a rapid development in ICT sector. The role of government initiatives in Korea has been crucial to this development to the promotion of e-learning in particular. The government has set up specific plans to turn the country into an information society in a short period.

It would be appropriate to review key initiatives of the Korean government to boost the development and uptake of ICT in Korea and special policies taken by the Ministry of Education and Human Resource Development (MOEHRD) and Ministry of Labor to promote e-learning.

1) National strategies to advance ICT in Korea

There is general agreement that government policies were the main fuel to rapid development of ICT and fast penetration of this new technology into public and private sectors. In Korea, the influence of the government on private sectors remains strong. For instance, private companies have been quick to accept and implement the basic guidelines for ICT established by the Ministry of Information and Communication. In addition to providing a supportive environment for the effective development of ICT, the Korean government has intervened more directly as well. For the last 15 years, there have been at least six major government programs aimed at improving the state of ICT in Korea. Among these programs, the most outstanding is the National Informatization Framework (NIF) established in 1996. This program set out the roadmap for Korea's future information technology development (Misko et al. 2004).

The Korean government has adopted a three-pronged approach to intervention. First, it has created the right environment for the development of ICT mainly by establishing pro-market policies of liberalization and privatization of the ICT industry. Second, it has intervened at the non-market end of the supply chain through the funding of the public internet backbone, which is, the Korean Information Infrastructure. Third, it has intervened at the non-market end of the demand chain, by providing information technology training for about ten million Koreans, including homemakers and those who are employed in government agencies, in the army, and in school. These policy efforts by the government were aimed at turning Korea into an 'information society'.

To note again, the success of Korea's ICT sector is in large part due to the policy directions that the government has adopted. Among the major policy initiatives are efforts to promote universal access. With Cyber Korea 21 launched in 1999, the government declared war against the digital divide. The 2002 Act on Closing the Digital Divide includes the establishment of the Korea Agency for Digital Opportunity and Promotion (KADO) as well as the Digital Divide Committee. As part of this digital divide project, 500,000 primary and secondary school students from low-income families participated in extra-curriculum computer courses during 2000 and 2001. In addition, 50,000 low-income students with good grades received a free personal computer with a free five-year internet subscription (Misko et al. 2004).

Outcomes of ICT initiatives

The outcomes of government initiatives to promote ICT in Korea can be clearly observed at different school levels and in different sectors. Every primary and secondary school in Korea has access to the internet. By 2001, all were equipped with a Local Area Network (LAN), at least one computer lab and access to the government network, PUBNET. The student to PC ratio was 5.8 to 1 and about 67 percent of all schools have a network connection with a speed of at least 2 Mbps in 2003 (KRIIS, 2004). Every student begins computer education from primary school by taking compulsory ICT courses of one hour per week. Middle schools provide three hours of optional ICT training a week and high schools provide two hours per week.

As in other countries, the higher education sector is a pioneer in computer networking in Korea. All public and some private universities are connected to the Korean Education Network (KREN), which can also be accessed by other educational institutions as high schools. In addition, there are online universities, also called cyber universities, which were first established in March

2000. Among the nine cyber universities that opened up in 2000, four offered purely online courses, while the others provided offline courses as well.

Special initiatives to promote e-learning

The fast development of e-learning in Korea is in part due the rapid development of ICT supported and funded by government policies pertaining to ICT in general. The government has given special attention to e-learning setting up distinct e-learning policies that have contributed to the speedy dissemination and growth of education using electronic mediums. In addition, both MOEHRD and MOL sharing the mandate of HRD have contributed their part in fostering e-learning.

In 1996, the PCER made a recommendation to the government to introduce cyber universities in Korea. Accordingly, the Ministry of Education and Human Resources Development in Korea opened up possibilities for the establishment of cyber universities on a trial basis. These 'cyber universities', were renamed 'distant universities' in line with a new MOEHRD law on establishing online universities.

In 2000, MOEHRD amended the Lifelong Education Law to include a new clause to legally approve the establishment of online universities according to set standards. It is worth noting that the article related to establishment of online universities is not part of the Higher Education Law which governs the establishment and operation of higher education institutions. Instead it is part of the Lifelong Education Law which mostly governs the establishment of diverse lifelong educational institutions such as lifelong learning centers affiliated with universities. This is to facilitate the establishment of online universities, because the standards are less strict for educational institutions classified as lifelong learning institutions than those for higher education institutions. Once established, the online universities have played an important role in providing the adult population with opportunities to obtain a degree in higher education while working or remaining at home (Misko et al. 2004).

Another important government initiative aimed at promoting e-learning has been introduced by the Ministry of Labor in the form of internet correspondence training courses (ICTC). This has contributed to the expansion of e-learning in corporate training. The internet correspondence training courses are a part of the VCDP which is supported by Employment Insurance Fund. Under this scheme, companies that provide e-learning to their employees (either by providing training directly or by commissioning their training to other institutions), receive a financial incentive for providing such programs to their employees. As the amount of money companies receive is considerable, it can effectively serve as an incentive for them to expand e-learning. The implementation of this incentive along with the development of ICT infrastructure in Korea has increased the number of existing workers receiving e-learning instructions to meet the company training requirements.

2) Growth of e-learning infrastructure in Korea

While having a good infrastructure is not enough to guarantee successful development of e-learning, it certainly provides an important basis for such a development. Having the right hardware and software infrastructure for e-learning is indeed crucial.

There are a number of preconditions for e-learning to take place. First, people should have access to computers or the internet. The number of people who have access to computers or internet largely determines the number of people who can take advantage of e-learning. It is also important that people can not only access the computer and the internet but that they have the knowledge and skills to use them, in other words, they must have ICT literacy. Dissemination of computers and internet, and the ability to use them constitute important conditions for e-learning.

Rapid growth in access to the internet

In 2002, there were almost 26.5 million (26,480,000) personal computers (PCs) owned by individuals in Korea. Given the size of the Korean population, this indicates that 56% of the total population in Korea has a PC. This can be compared with the situation in 1995, when the number was about 5.346 million. This indicates that the number of individuals owning a PC has quadrupled in only seven years. The rapid increase in the number of PCs owned by individuals shows how fast e-learning infrastructure and ICT in general have expanded in Korea.

The high degree of diffusion of ICT in Korea is also witnessed by the number of people who have a subscription to a digital subscriber line (DSL), which is the major means of access to the internet. This figure has reached over 11.6 million in 2004. This indicates that almost 80% of all households in Korea have direct access to the internet. (Misko et al. 2004).

Altogether, the speed of growth in the number of people who have PCs or access to internet in Korea is worthy of attention. This period of rapid expansion of ICT infrastructure also helps to explain the rapid development in e-learning in Korea during the same period.

E-learning in corporate training

With a gradual upward trend in the number of internet users, e-learning in the vocational sector is also growing. This trend is particularly visible in large corporations, where both in-house programs and outsourced programs, supplied by e-learning companies, operate side by side. Corporate training divisions use blended learning approaches for target employees. By combining e-learning with traditional methods they seek to maximize learning outcomes. In addition, they focus on designing a customized educational system that will contribute to the company's competitiveness, while meeting the needs and demands of individual learners.

In the corporate sector, companies tend to form alliances to better represent their interests. In addition to the Korea Alliance of Cyber Education, the Korea Federation of E-learning was founded in June 2003. The federation is primarily comprised of businesses specializing in e-learning, corporate training and education centers, and corporate departments in charge of e-learning. Its objective was to expand the base for e-learning and increase the competitiveness of e-learning-related businesses.

Currently, the Ministry of Labor provides policy and financial support for the enhancement of employees' vocational competency. In 1999, the Ministry of Labor added web-based training (known as internet-based training) to the 'Act on Promoting Worker's Vocational Training' as a new form of vocational training and education.-The ministry has been subsidizing part of the training expenses to the employers who, in compliance with the Employment Insurance Act, have their employees take web-based training courses. Moreover, in August 2001, the ministry

announced a plan to promote internet-based training, which is now being implemented. The Korea Research Institute for Vocational Education and Training (KRIVET), through its centre for e-learning, advises the Ministry of Labor regarding internet communications training, and promotes research and related projects for vocational and lifelong education. In 1998, the internet-based Training Project was implemented in seven companies, with 67 courses and 7,187 participants. In September 2000, there were 18 companies operating these training programs and a total of 206 courses offered, (Yi Su-gyeong et al. 1999).

Through full utilization of the Ministry of Labor's internet-based training, there have been positive results in terms of the cost-effectiveness of education. However, there have also been criticisms that the employment insurance reimbursement criteria has led to homogenization of internet-based training content (Digital Times, 10 July 2001) and that training subsidies have mostly been allocated to large corporations. In response to these criticisms, the Ministry of Labor is making greater efforts in quality management and necessary revisions of relevant laws and regulations.

Within the area of corporate e-learning, there is much discussion addressing current critical issues and future development. There is a growing demand to expand blended learning to maximize teaching outcomes and to conduct more measurable and specific studies on the effects of e-learning. From 2003, research in such areas is expected to be in full swing, led primarily by e-learning companies and large corporations. Along with the concerns about inefficient information-sharing and resources due to a lack of consistent standards, there has also been a growing debate, since 2002, about the standardization of e-learning, which will be the top priority for future expansion and marketability of e-learning. Similarly, high-quality customized content, improvements of the internet-based training system, and the fostering of e-learning professionals have all been receiving much attention.

3) E-learning at Hyundai

Hyundai provides various training programs targeting executives and staff in varying positions and responsibilities to enhance their vocational competency. Hyundai has relied mostly on institutional training, which has a number of drawbacks, including high cost. Another practical issue is that it requires employees to leave their work to take classes, hindering work flow. Because it creates vacuums in the workplace, institutional training is an unsuitable form of training for courses conducted over a lengthy period of time. Latest attempts to solve these problems include the use of media to deliver training more efficiently. For employees dispatched to a branch office abroad or in another part of the country, video conferencing, satellite broadcasting, and web-based training (WBT) are used to engage them in learning. Costly methods, such as video conferencing and satellite broadcasting, are employed for subjects that are especially important or for programs targeting upper managers. For staff or assembly line workers, training is often delivered in the form of CD-ROMs, computer-based training or WBT. These are the more widely used forms of e-learning and merit close examination.

(1) Introduction of e-learning

Globalization and rapid technological advances, especially in information technology, have increased competition between businesses. To raise productivity to survive in such a highly

competitive environment, businesses now opt for a flexible production system, which requires employees to continuously upgrade their knowledge and skills. Hyundai chose e-learning to support the lifelong learning of workers to meet this necessity.

The launch of e-learning initiative by Hyundai was facilitated by Korea's excellent ICT infrastructure (offering high-speed Internet access at 100mbps) which was described in detail above. Moreover, personal computers are widely accessible in the home and the workplace, and there are countless Internet cafes in business across the country. These conditions create a favorable environment for expanding e-learning access, and Hyundai has taken full advantage of it to promote learning among employees.

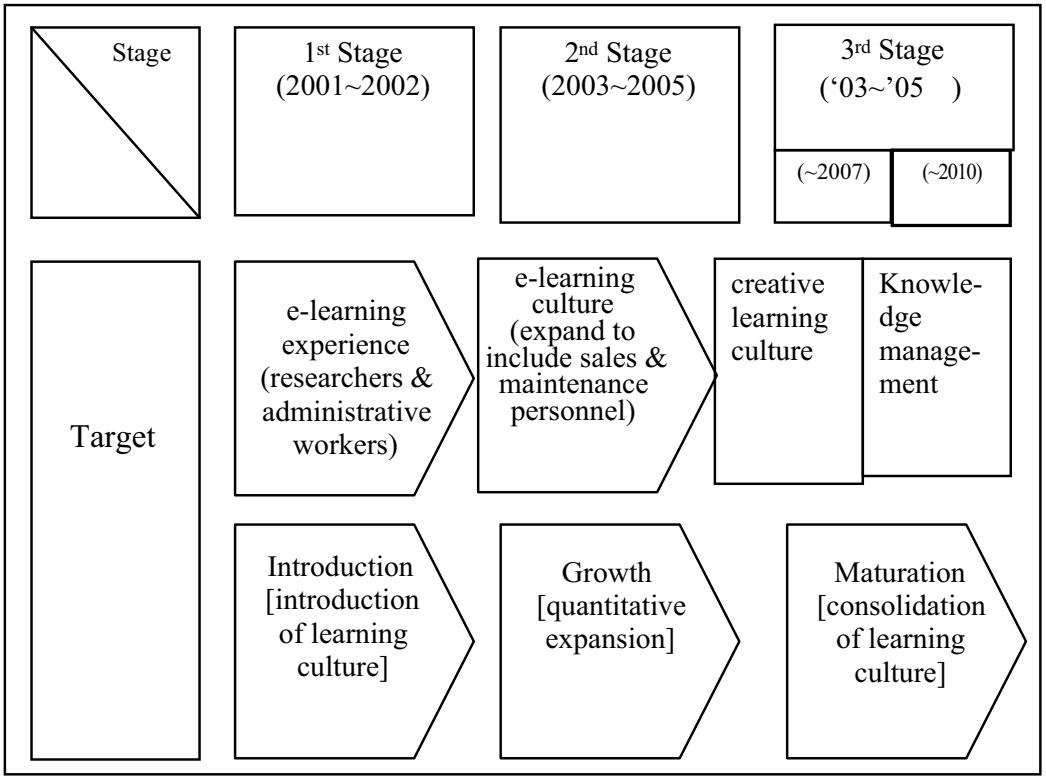
Ministry of Labor has contributed to e-learning in enterprises through its many policies. After the Korean government legislated financial aid for Internet-assisted training, many businesses sought to implement e-learning in the hopes of gaining various benefits.

Hyundai began to provide e-learning programs in July 2000, which have developed both in size and quality during the past couple of years. The progressive trend in e-learning is expected to continue well into the future.

The mid- to long-term plan for e-learning developed by Hyundai Learning Center is made up of the following three stages:

First stage (introduction: 2001~2002): Create the right digital learning environment for executives and foster an e-learning culture. Provide e-learning to employees in research or administrative work.

Figure 2.10: Hyundai's e-learning plan (internal document, 2005)

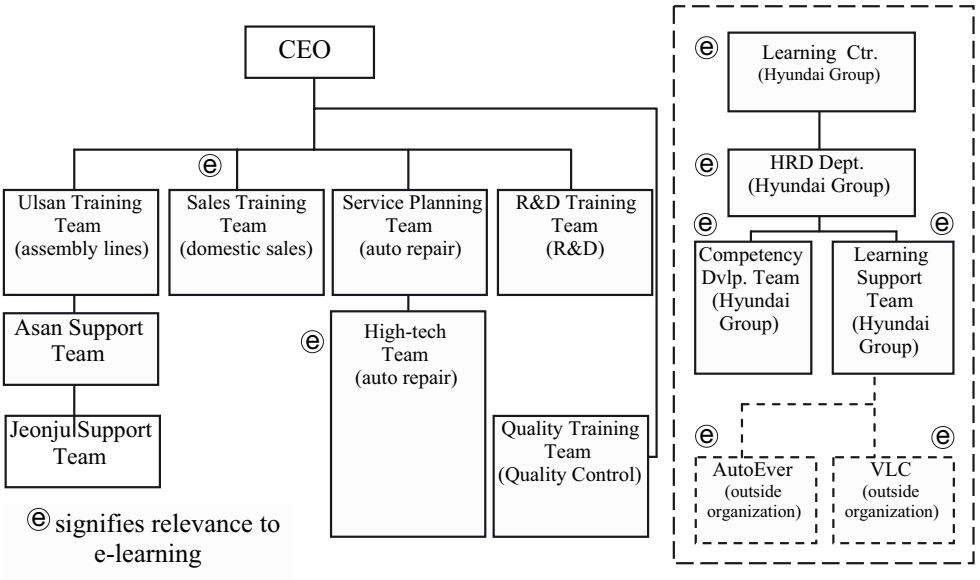


- Second stage (growth: 2003~2005): Achieve quantitative growth in e-learning services, and extend e-learning opportunities to all employees including those in sales and repair line of work.
- Third stage (maturation: 2006~2010): Foster a more creative culture of learning building on the existing e-learning environment. Strengthen the link between e-learning and knowledge management to consolidate an enterprise-wide training system.
- As of June 2005, Hyundai is nearing the end of the second growth stage. Presently, the focus is in achieving quantitative growth to establish an e-learning culture.

(2) E-learning organization

Hyundai's e-learning organization has as its focal point the Learning Center founded in November 2003. The Learning Center sets the educational vision and long-term strategies for Hyundai Motor Co. Training, in accordance with the vision and strategies, is provided by the training department in each business segment headquarter. Training is designed in accordance with company values, and the content is relevant to the learner's work. Figure 2.11 shows the organization of e-learning at Hyundai.

Figure 2.11: Organization of training and e-learning provision at Hyundai Motors



- E-learning providers in Hyundai Learning Center (HLC)

  Competency Development Team: plans education and training for the entire Hyundai Group (both online and offline training), improves education system, manages training budget, etc.

  Learning Support Team: [delivers and supervises e-learning for Hyundai Group as a whole], delivers offline job training customized for different ranks, manages the training center, etc.

- Other e-learning providers

Sales Training Team provides e-learning exclusively for sales personnel while High-tech Team trains only the auto repair personnel. Beginning in 2004, the Production Training Team will take full charge of e-learning dealing with product assembly.

- AutoEver Systems and VLC, which are outside organizations, support e-learning and system management.

(3) E-learning provision

Hyundai Motor's e-learning program (Table 2.18) is divided into three course areas: general administration skills, specialized skills, and foreign languages. As of 2004, a total of 142 training courses were provided. Most courses are developed by training institutions outside Hyundai but customized to the company's distinct needs. Hyundai Motor develops its own training courses only when there is special need to do so.

Table 2.18: E-learning programs at Hyundai

Program Area	Subject	No. of Courses	Program Area	Subject	No. of Courses
General administration skills (72)	Business management /CS	22	Specialized skills (36)	Business management	8
	Leadership	17		E-business	6
	Marketing/Sales	6		Finance/ Accounting	7
	Financial management	6		Leadership	1
	Qualifications	4		Online MBA	14
	e-Biz / Purchase/Production	4	Foreign languages (34)	English	19
	Globalization/ Liberal Studies	4		Chinese	7
	IT	9		Japanese	8

Enterprise-wide e-learning at Hyundai is coordinated by the Learning Support Team of HLC. Training specifically for sales personnel and auto repair are respectively conducted by Sales Training Team and High-tech Team. In 2003, two courses were offered across the enterprise with participation from 31,183 workers. For sales employees, 7 courses were delivered online, which together trained 5,660 people. Meanwhile, 408 auto repair personnel participated in 5 courses specially designed for them. Tables 2.19, 2.20, 2.21 show the exact figures.

Table 2.19: Training courses and participation (2003)

Course Title	Number of times course has been offered	Class hours	Enrollment	Completion
Product liability law	20	20	17,717	15,761
Antitrust law	20	20	17,717	15,422
Total	40		35,434	31,183

Table 2.20: Training for sales personnel and participation

Course Title	Number of times course has been offered	Class hours	Enrollment	Completion
CRP MAP	4	20	234	228
Effective use of laptop PCs	7	20	2,656	2,388
Industrial relations	3	20	692	673
People skills for better interpersonal relationships	6	20	717	630
Working in the branch office	5	20	243	239
Using information and human networking	4	20	337	309
CS for professional auto dealers	2	20	1,200	1,193
Total	31		6,079	5,660

Table 2.21: Training for auto repair personnel and participation

Course Title	Number of times course has been offered	Class hours	Enrollment	Completion
How to read circuits	3	20	176	154
Basic electric and electronic engineering	1	20	51	43
Engine mechatronics	3	20	137	104
Diesel engine	1	20	60	55
Introduction to A/T	1	20	60	52
Total	9		484	408

E-learning courses in Korean companies like Hyundai are often eligible for cost reimbursement from employment insurance under Ministry of Labor's e-training promotion initiative[34]. The majority of training courses delivered by Hyundai in 2003 was supported by the MOL with 14 courses qualifying for reimbursement. Only 5 courses were not assisted by the MOL (Table 2.22).

Table 2.22: Training courses and financial support from employment insurance

	Number of courses	Number of participants	
	Number of courses	Enrollment	Completion
Supported by employment insurance	14	41,997	37,251
Not supported by employment insurance	5	532	412

- Courses assisted by employment insurance accounts for 73.7 % of the total number of courses and 98.7 % of the number of participants.
- E-training programs designated by the MOL can have their training expenditure reimbursed by employment insurance.

Investment in e-learning in 2003 accounted for only 3.8 % of total investment in training, while the number of participants in e-learning comprised 15 % of all trainees. This shows that e-learning is substantially more cost-efficient than institutional training. Table 2.23 compares institutional training and e-training in terms of funds invested and the number of participants.

Table 2.23: Comparison of institutional training and e-learning (2003)

Training expenditure				Number of participants				Yearly total wage
Institutional training	E-training	Others	Total	Institutional training	E-training	Others	Total	Yearly total wage
25,084	986	-	26,070	263,628	46,870	-	310,498	2,367,495

* Training expenditure, the number of participants, and yearly total wage were calculated based on relevant figures for all of the 52,000 executives and staff as well as workers in the workshops.

At the end of year 2003, Hyundai made a progressive move to open 100 online training courses (mostly general administration and foreign language courses) to employees so that they can make their own choice about what to learn. In an effort to improve labor relations the company has expanded access to e-learning services to the family of the employed. E-learning services for

[34] To receive government assistance for e-training courses, companies providing e-training must meet requirements on learning contents and their quantity, instructors, learner management, evaluation and certification criteria, system, personnel and facilities, etc. The application process is as follows: 1) official registration as a training institution 2) application for e-training support 3) submission of request for screening 4) screening by authorities 5) screening results notification 6) report on course delivery/completion and confirmation of training expenditure.

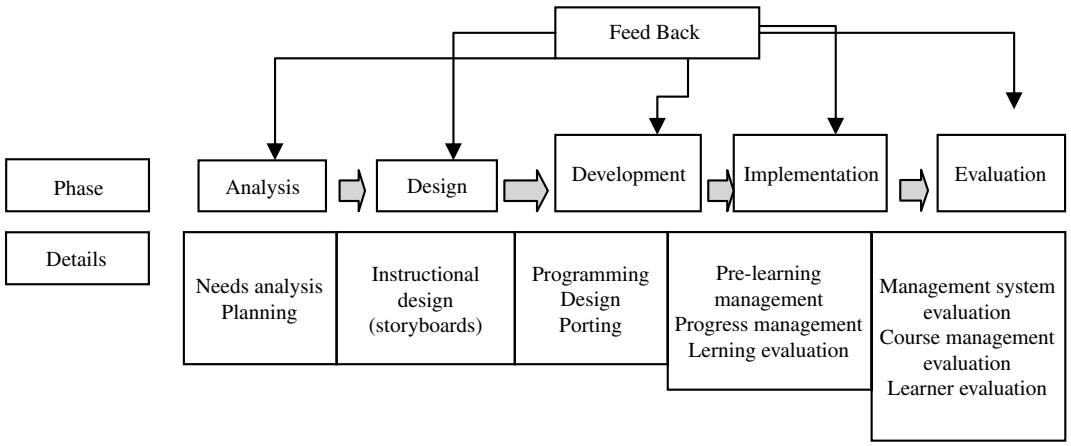
family members include courses designed for full-time homemakers and educational programs designed to help children understand the economy. Hyundai also has plans for improving educational access to assembly line workers. Currently, foreign language and liberal education programs are offered as options for workers who sign up for them. In the future, however, these courses will be included as part of mandatory job training.

(4) E-learning development at Hyundai

E-learning course development

At Hyundai Motor, e-learning courses are developed through a five-step process: analysis, design, development, implementation, and evaluation. The diagram below shows the detailed process (Figure 2.12).

Figure 2.12: E-learning course development[35]



- Analysis is the phase in which the course developer considers the need for a new curriculum. If the decision is 'yes', then planning may begin. All analyses necessary for course design, such as analyses of learner needs, corporate environment, objectives, etc. are carried out at this stage. Communication with SME must actively take place during this phase. The comprehensive analysis allows the instructional designer to create a more complete and sophisticated set of storyboards.
- In the design phase, the instructional designer creates storyboards illustrating his ideas about what to include in the course.
- Developing phase is made up of programming, design and porting. In real life, design and programming are considered from the initial planning stage.
- Implementation is the phase in which the course is actually provided and engages learner participation. As the course proceeds errors in course development can be identified, which will help upgrade the quality of the program in the future.

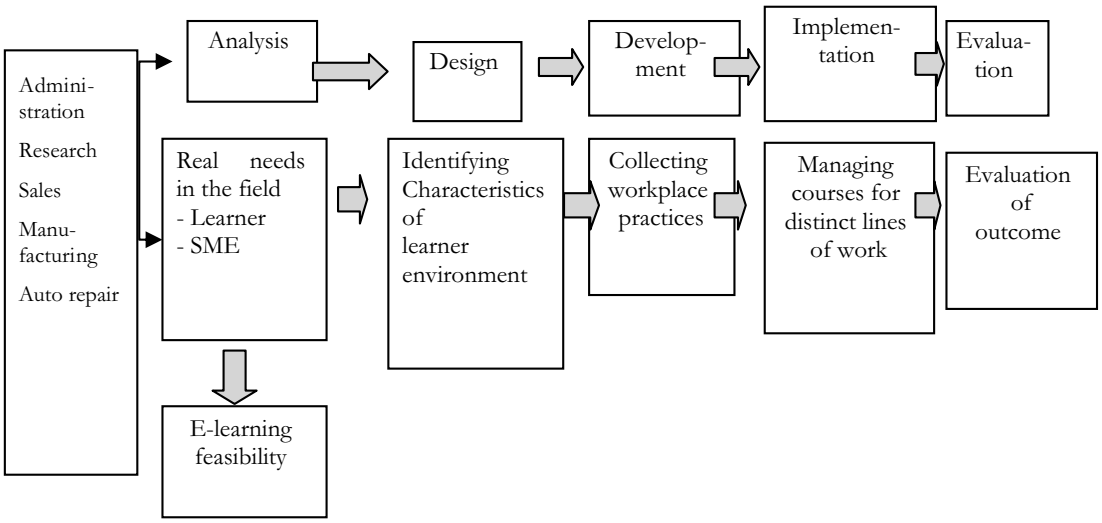
[35] Each phase in e-learning course development should be understood as elements of a system that are organically linked to each other. Although Figure 2.12 marks the relationship between the phases with one-sided arrows, in reality the phases interact, affecting and being affected by one another.

- At the evaluation phase, three things are assessed: course management system, course management, and learner's achievement. Evaluation results are reflected in the development phase. According to Figure 2.12, evaluation seems to occur only once at the end of the whole course development process. In actuality, evaluation takes place at the end of each phase resulting in an exchange of feedback as the process moves on.

Considerations for introducing e-learning courses

Hyundai independently develops its training programs only when there is a special training need or demand from the management to do so. Most courses Hyundai creates on its own deal with skills and tasks relevant to the actual workplace, and the aim is to teach what may be used as problem-solving tools in the field. When the course subject is not directly relevant to real work or when there is a variety of existing e-learning contents on the subject, or when the course is of the most basic level, the e-learning course is adopted through the following process.

Figure 2.13: Course development process in detail

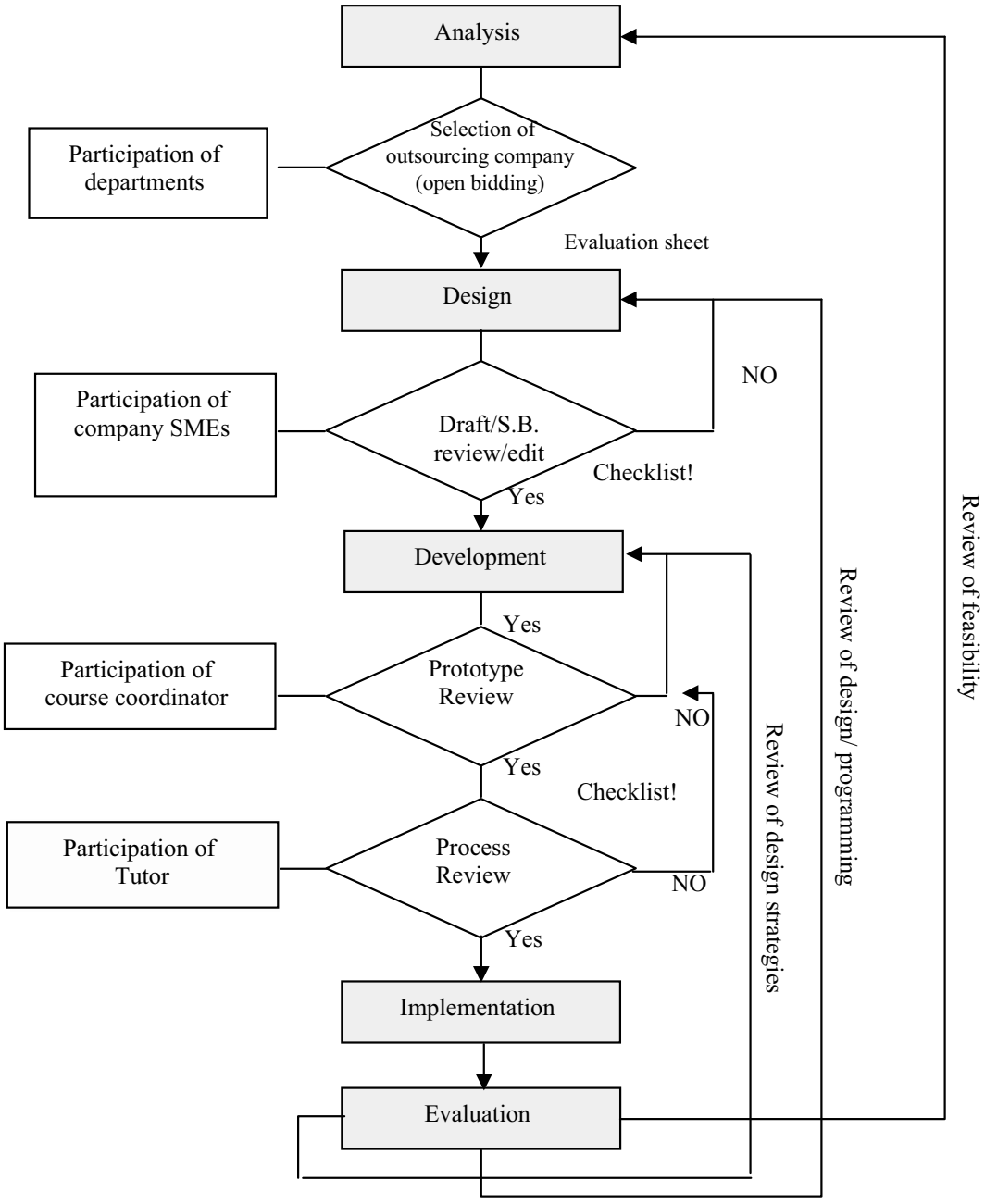


As in conventional courses conducted face-to-face in classrooms, introducing corporate e-learning programs must be preceded by clear identification of purpose, scope and subject. It must also be decided, based on a thorough assessment of existing resources and capacity, whether the company will independently manage its courses or rely on outsourcing. The decision should be made after considering the course subject, existing resources, expert pool, cost of management, work efficiency, course management know-how, and outside training providers.

E-learning quality control

To provide quality e-learning services, Hyundai engages experts in each phase of instructional development to analyze and offer feedback. Such quality control effort aims to review three elements: feasibility, design and programming, and design strategies. Moreover, Hyundai Motor outsources institutions of varying specializations to efficiently harness expertise. Figure 2.14 illustrates e-learning quality control process.

Figure 2.14: E-learning quality control process

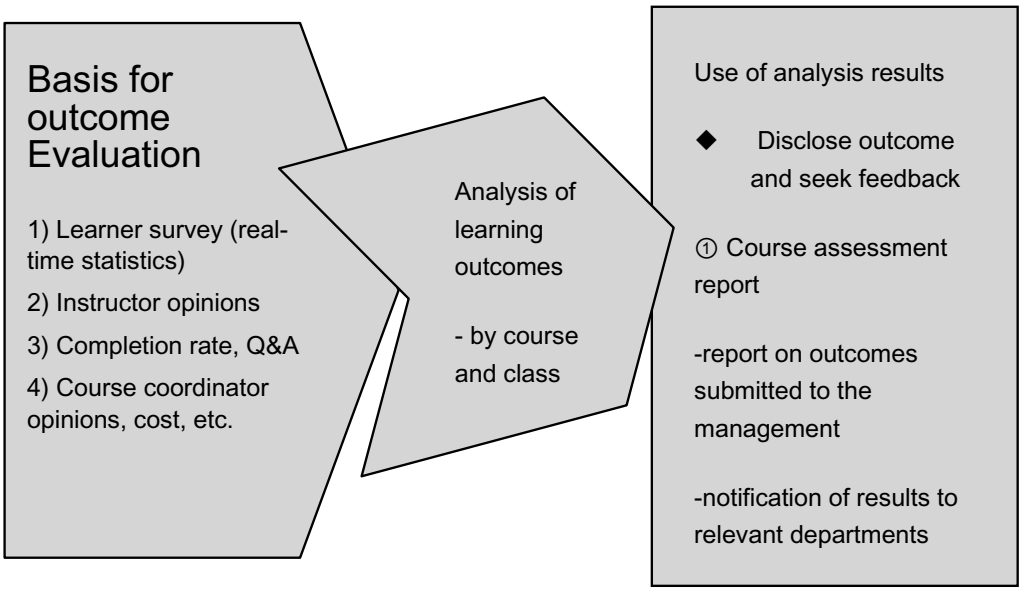


E-learning evaluation process

At Hyundai Motor, all e-learning courses are evaluated based on learner and instructor surveys and analyses of learning outcomes. Figure 2.15 shows the data used for evaluation.

- Training outcome report to be submitted to the management and the relevant department.
- Reports on individual learning achievements
- Data to consult in course development and improvement
- Data that can support continued course provision

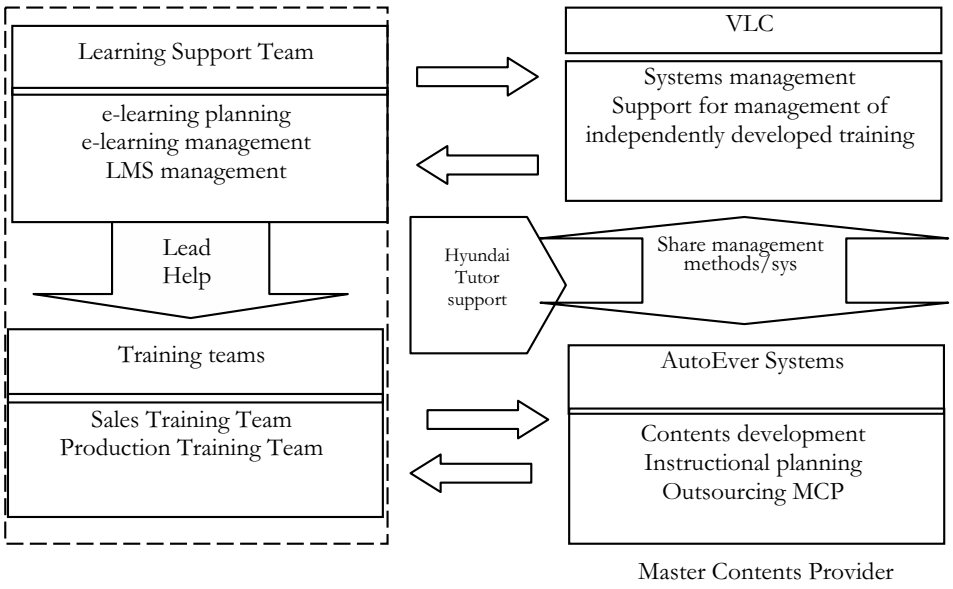
Figure 2.15: E-learning evaluation process at Hyundai Motors



(5) Harnessing e-learning expertise

As Figure 2.16 illustrates, Hyundai actively collaborates with outside organizations with expertise in educational IT system development/management. Learning Support Team, for example, works closely with VLC, and each department exchanges feedback with AutoEver Systems. Hyundai Motors articulates demands on course management and/or system and makes requests on new curriculum development. Outsourcing organizations respond by endeavoring to fulfill those requests. Hyundai dispatches tutors, who are inside experts, to assist outsourcing organizations to develop training courses and system and to manage programs effectively. In sum, Hyundai effectively augments expertise of its e-learning organization by outsourcing expertise.

Figure 2.16: Professional organization for e-learning quality control



In order to secure the necessary e-learning professionals, Hyundai Motors has established candidate screening criteria and guidelines for fostering e-learning experts and performance management.

- Screening criteria

  Learning coordinator: Appointed according to company HR rules. No separate criteria exist.

  Instructor (Tutor): Should have at least a Master degree in a relevant discipline. Should have more than 5 years of relevant working experience (at least three years at the center). Vocational training instructor's license holder or who has similar qualifications (as specified in the Promoting Worker's Training Law).

  Employment process:
  1) Open recruitment process based on the set criteria
  2) Screening of candidates by subject and final selection
  3) Initial Training
  4) Prior learning and preparation for course delivery
  5) Course delivery and instruction

- Fostering e-learning experts and performance management

  Support career and expertise development through seminars, meetings, and training programs.

  Performance management and compensation:
  1) Keep track of performance through regular reporting
  2) Reward based on performance

  Compensate e-learning tutors: Motivate inside instructors and reward them for performance

(6) Future of e-learning at Hyundai and tasks

The foremost task for e-learning at Hyundai is to diversify the programs. Currently, Hyundai offers e-learning courses in a limited number of areas, such as foreign language and computer education. To employ e-learning as a means of training diverse work skills, wider selection of e-learning programs need to be developed and made accessible anytime and anywhere to employees.

It should also be noted that e-learning at present has a limited target learner group, primarily workers in administration and management. Assembly line workers and sales personnel are not given as much learning opportunities. This is partly because sales and assembly line workers are constantly working outside their offices, which make it difficult for them to participate in training during work hours. More importantly, however, there is a lack of e-learning contents that could interest assembly line and sales workers to participate. To engage these workers in successful e-learning, a greater variety of programs aimed at skills and self-fulfillment needs to be developed.

As a multinational company, Hyundai Motor should also consider developing training programs in foreign languages to embrace workers in international branch offices whose mother tongue is not Korean.

The second task for e-learning at Hyundai is to innovate its delivery to realize mobile learning and/or ubiquitous learning. E-learning, by and large, is mediated by fixed-line Internet accessed through laptops and desktop PCs, and this naturally limits e-learning to take place in classrooms or other places with Internet and computer access. In the future, mobile learning delivered via wireless Internet should be promoted so that workers are not confined to a classroom environment. Learning should take place anywhere, whether it is in the office, the workshop, or the employee lounge. Furthermore, an intelligent learning system should be introduced to enable just-in-time learning or ubiquitous learning.

Thirdly, autonomy in e-learning should be promoted. Up to now, e-learning program at Hyundai has served as a supplementary to institutional training, and it was attractive because of financial support provided by the government. As Korea moves on to a knowledge economy, the importance of knowledge is steadily growing. Major corporations thus strive to accumulate and organize knowledge systematically on the one hand, and endeavor to raise the competency, skills and problem-solving capability of their employees. This means that work and learning are gradually converging. The organizational reform of businesses demands a new paradigm in education and training. The new paradigm will be a break from the conventional institutional training, composed mostly of uniform lectures. It will emphasize autonomous learning, which encourages the learner to identify his/her own needs and problems and resolve them on one's own. Therefore, the optimal learning paradigm for the future is on-demand learning, delivering the content learners want at their own convenient time via diverse mediums.

Fostering on-demand learning leads to the next task, which is to establish a cyber training system capable of meeting the needs of individual learners. This requires the development of various computer courseware and the introduction of Learning Content Management System (LCMS). When the conditions for ideal e-learning are met, it will contribute to efficient problem-solving in the workplace and promote productivity. The individual may also use e-learning opportunities to develop his or her career. A prerequisite for realizing this potential is fostering and utilizing competent e-learning experts.

Another important task in today's globalized world is international cooperation in courseware development and exchange. Expanding e-learning demands the development of various programs, but one company alone cannot meet these demands. Limitations can be overcome by collaborating with foreign companies to jointly develop courseware. However, standards must be developed first to serve as a guideline on what learning content to create, how the course development will proceed and how the final product will be mutually shared.

III. Germany

1. Education System[36]

1) Common Education System

In 2002, the number of people aged 29 or less was 26,761,235 (32,5 % of the population), and here were 8,962,815 young people in full-time compulsory education.

Administrative control and extent of public-sector funded education

In 2003, 94 % of the pupils attended public sector schools, and the remaining 6 % attended privately maintained schools.

In the Federal Republic of Germany, responsibility for the education system is conditioned by the federal structure of the State. According to the Basic Law (*Grundgesetz*), educational legislation and administration are primarily the responsibility of the *Länder* (in a system comprising the Land Ministries of Education, Cultural affairs and Science, the regional authorities (*Bezirksregierung /Oberschulamt*) and the lower-level school supervisory authorities *(Schulamt*)). This particularly applies to the school system, higher education and the adult education/continuing education sector. The responsibilities of the Federal Government in education are defined in the Basic Law (*Grundgesetz*). Among these responsibilities are the legislation concerning the general framework for higher education, and the financial assistance for individual training, including promotion of younger academic staff. The Basic Law also provides for particular forms of cooperation between the Federation and the *Länder*, such as that which occurs in the sector of educational planning and the promotion of research. School supervisory authorities in each *Land* are responsible for inspection and exercise academic, legal and staff supervision within the school system. Each school has a teachers' council responsible for educational matters, and a school council (comprising teachers, parents and pupils), which decides on school regulations or disciplinary rules. The relative powers of these councils vary between the *Länder*.

As regards initial training in the *duales System* (the Dual System of vocational training in both the workplace and at school), which is experienced by two-thirds of all young people, the training in the workplace is financed by firms, and the school element by the *Länder*. The workplace activity follows nationally coordinated rules for training, while there are curricula for the school-based work which are adapted to these rules and established by the *Länder*.

Vocational training in the workplace is supervised by public-law corporations (such as chambers of industry and commerce, chambers of craftsmanship, etc.)

Pre-primary education

In most *Länder*, responsibility for pre-school education lies with the social ministries. From three to six children can attend *Kindergärten* which are mainly run by non-public bodies (primarily

[36] from http://www.eurydice.org/Documents/ProcesLearingWorkshop/struct2/frameset_EN.html.

churches and welfare associations) and to which parents are also required to contribute, despite the allocation of major public subsidies and reliance on other funds.

2003	Age 3	Age 4	Age 5
Pre-compulsory education	58.9%	83.8%	89.8%

Compulsory full-time education

(a) Phases

Grundschule (primary education)	6-10 years of age (6-12, Berlin & Brandenburg)
Lower secondary education - Orientierungsstufe ('orientation' phase within the different school types or as a separate organizational unit) - Gymnasium /Realschule/ Hauptschule/Gesamtschule/ Types of schools offering several courses of education such as the Mittelschule	10-12 years of age 10/12-15/16 years of age
Upper secondary education (see section 5)	15/16-18/19 years of age

Full-time education is compulsory from between the ages of 6 and 15 or 16 (depending on the Land), and part-time education is compulsory until the age of 18 for those who do not attend a full-time school.

(b) Admission criteria

Generally, children are admitted to *Grundschule* from the age of 6. At primary level, children undergoing compulsory schooling enter a local primary school, which is the same for all of them. Transition from primary school to one of the school types at secondary level is subject to different regulations depending on legislation in the Land concerned. The type of school attended at lower secondary level is decided by the parents on the basis of an assessment made by the primary school. Admission to the various types of secondary schools may be subject to pupils fulfilling certain performance criteria and/or a decision by the education authority. All compulsory schooling is free of charge.

(c) Length of the school day/week/year

The school year comprises between 188 (five-day school week) and 208 (six-day school week) days in the period from August to July. The length of the school day and week is determined by each of the *Länder*. Schools open on five or six days a week (mostly mornings). Each week entails 19-28 lessons at primary school, and 28-30 lessons at secondary level. A lesson lasts 45 minutes. The average minimum number of annual teaching hours is 698 in primary education in 2002/2003, and from 875 to 987 depending on the school type in lower secondary education.

(d) Class size/pupils grouping

In 2002 there were in primary education 22 pupils per class on average and, in lower secondary education, on average 24.5 pupils depending on the school type and the Land. Pupils are generally grouped by age and, at secondary level, setting occurs in some subjects. Primary classes initially have one teacher for all subjects, whereas secondary pupils have separate subject teachers.

(e) Curricular control and content

The *Länder* ministries determine the curriculum, recommend teaching methods and approve textbooks. Core subjects in primary education generally include reading, writing, arithmetic, Sachunterricht as an introduction to natural and social sciences, art, music, sport and religious education. Secondary curricula depend on the type of institution, but usually continue primary core subjects, and include at least one foreign language and natural and social sciences.

(f) Assessment, progression and qualifications

Continuous assessment based on written examinations and oral contributions is universal practice at all levels. Pupils may be required to repeat a school year. Pupils who reach the appropriate standard at the end of lower secondary education receive a leaving certificate. Assessment is teacher-led in most cases.

Upper secondary and post-secondary education

(a) Types of education

General upper secondary school (Gymnasiale Oberstufe) at the following school types:

Gymnasium/Berufliches Gymnasium/ Fachgymnasium/ Gesamtschule	16-18/19 years of age
Berufsfachschule (full-time vocational school)	15/16-18/19 years of age
Berufsoberschule (full-time vocational school)	16-18 years of age
Duales System (Dual System: part-time vocational school and part-time on-the-job training)	15/16-18 years of age
Fachoberschule (full time vocational school)	18-19 years of age

(b) Admission criteria Admission to the gymnasiale Oberstufe (upper level of the Gymnasium) requires a lower secondary leaving qualification meeting certain standards of achievement. Admission requirements for full-time vocational education depend on the type of school chosen.

The *duales* System is open to all lower secondary school leavers, irrespective of their results.

(c) Curricular control and content

The curriculum varies in accordance with the type of upper secondary education and training. Pupils in the *gymnasiale Oberstufe* must study subjects from three groups: languages/literature/

the arts; social sciences; and mathematics/natural sciences/technology. Vocational programs in *Berufsfachschulen* include German, social studies, mathematics, natural sciences, a foreign language and sport, as well as vocational subjects.

The vocational training in the *duales System* is organized for 350 professions following nationally coordinated training rules (the workplace element) and curricula established by the *Länder* (the school-based activity) in all economic fields.

(d) Assessment, progression and qualifications

Pupils who pass the *Abiturprüfung* receive *the Zeugnis der Allgemeinen Hochschulreife*, which grants access to higher education. Vocational courses at full-time vocational schools prepare pupils for a specific occupation, or for access to higher education (*Zeugnis der Fachgebundenen Hochschulreife and Fachhochschulreife*). Candidates from the *duales System* pass a final examination before an examination board of the competent bodies concerned (chambers of craftsmanship, chambers of industry and commerce, chambers of liberal professions or other public-law corporations), and receive a leaving certificate from the competent body. Concomitantly, the Berufsschule issues a leaving certificate if the trainee has achieved a least adequate performances in all subjects.

Higher education

(a) Types of institution

The tertiary sector encompasses institutions of higher education and other establishments that offer study courses qualifying for entry into a profession. Higher education institutions include Universitäten (universities) and equivalent higher education institutions (Technische Hochschulen/Universitäten, Pädagogische Hochschulen, Theologische Hochschulen), Kunsthochschulen (colleges of art), Musikhochschulen (colleges of music) and Fachhochschulen (universities of applied sciences). He Berufsakademie – offered by some *Länder* – form part of the tertiary sector and combine academic training at a Studienakademie with practical in-company professional training in keeping with the principle of the dual system.

(b) Access

The *Zeugnis der Allgemeinen Hochschulreife* entitles the holder to admission to all subjects and subject areas at all higher education institutions. The *Zeugnis der Fachgebundenen Hochschulreife* entitles the holder to study particular subjects at a university or equivalent higher education institution.

Admission to studies at colleges of art and music generally requires the *Zeugnis der Allgemeinen Hochschulreife* and proof of artistic aptitude. The prerequisite for admission to a *Fachhochschule or Berufsakademie* is either the *Fachhochschulreife* or the *Allgemeine /Fachgebundene Hochschulreife*. All applicants who meet the entrance requirements are registered for the course of study of their choice without having to go through any special admission procedures. If the number of applicants exceeds the places available in certain subjects, places are allocated on the basis of selection procedures that are operated either at national/regional level or at the relevant higher education institution. The main selection criteria are the average mark obtained

by the applicant and recorded in the higher education entrance qualification certificate and the period of time between obtaining their certificate and applying to the institution of higher education. Further criteria may be: interviews, selection procedures carried out by the higher education institution and subject-related tests. As of 2005, access to publicly-funded higher education institutions is still free of charge up to the first academic degree qualifying for an entry into a profession. This also applies to a consecutive course of study leading to a second academic degree. On the other side this does not exclude the possibility of administration fees for registration and tuition fees for an additional course of study or for long-term students.

(c) Qualifications

Qualifications in higher education vary according to the length and type of course followed. Studies at a university or equivalent institution are concluded by an academic examination (*Diplom* examination, *Magister* examination), a state examination, an ecclesiastical examination (in theology) or an artistic examination. In order to adapt the higher education system to the degree structure based on two main cycles, a new graduation system of Bachelor's and Master's degrees has been implemented since 1998 in all higher education institutions.

Studies at *Fachhochschulen* lead to the *Diplom* (FH) degree, Bachelor's and Master's degrees. Students who successfully complete their examination at *Berufsakademien* may be awarded a *Diplom* degree (to which the abbreviation BA for *Berufsakademie* is added) or a Bachelor's degree *Universitäten* (universities) and equivalent institutions of higher education hold the right to award doctorates. *Fachhochschule* graduates holding a Master's degree or a qualified *Diplom* (FH) degree may be admitted for doctoral studies at a university with specified additional requirements.

Special needs

The main form of provision is in special schools, but programs have been introduced to encourage the integration of pupils and students with special needs into mainstream education. In 2002, just over 4.8 % of all pupils in primary and secondary schools attended separate schools and a growing number of pupils with special needs were in inclusive settings (13.3 % of all pupils with special educational needs). In the Dual System of vocational training, help is provided and regulated by law (*Sozialgesetzbuch* III) for young people who have special learning problems or who are socially disadvantaged (e.g. support in on-the-job training or vocational training in institutions outside the workplace). In 2002, 8.8 % of some 1,62 million trainees received this help.

Teachers

All pre-school staff are trained at upper secondary level. Teachers for primary and secondary schools are trained at universities and colleges of art and music, and pass the first and second Staatsprüfung (state examination) in usually two subjects and in educational science. Primary teachers are generalists and secondary teachers are subject specialists. Teachers are generally employed by the Land and have civil servant status as a rule.

2) Vocational Training in the German Dual System[37]

More than 60 % of young people in Germany undergo vocational training in the dual system lasting, as a rule, for three years, depending on their chosen occupation. It is described as a dual system because training is carried out in two places of learning: at the workplace and in a vocational school (Berufsschule). The aim of training in the dual system is to provide a broadly based basic vocational training and impart the qualifications and competences necessary to practise a skilled occupation within a structured course of training. Those successfully completing the training are entitled to do skilled work in one of 350 recognized occupations requiring formal training (anerkannte Ausbildungsberufe).

Compulsory full-time schooling must be completed before commencing vocational training. There are no other prerequisites for admission to the dual system; training in the dual system is generally open to everyone. The training is based on a training contract under private law between a training company and the trainee. The trainees spend three or four days a week at the company and up to two days at the Berufsschule. The training companies assume the costs of the on-the-job training and pay the trainee a training allowance in accordance with the collective bargaining agreement in the sector concerned. The amount of the allowance increases with each year of training and is, on average, about a third of the starting salary for a specialist trained in the corresponding occupation.

The skills and knowledge to be acquired in the course of training at the workplace are set out in the training regulations (Ausbildungsordnung) and broken down in terms of content and time in a framework training plan, the particulars of which are specified by the training company in an individual training plan. Berufsschule classes cover the material for each recognized occupation requiring formal training as set out in the training regulations in line with the framework curriculum (Rahmenlehrplan).

On-the-job training

Vocational training places outside school (on the job) are available in industry and the civil service sector, in independent professions and in private households. Based on the Ausbildungsordnungen (training regulations), the training companies impart specific and general technical skills for practical application on the job. The qualifications and competences acquired at the Berufsschule are combined with work experience and applied in specific situations. The binding Ausbildungsordnungen (training regulations) have been established to set uniform national standards that are independent of the companies' current operational needs and meet the requirements in the respective occupation. Training may only be provided in training companies in which the skills demanded by the training regulations can be imparted by training personnel with the necessary proven qualification. The qualification of training companies and in-company training personnel is determined and continually reviewed by the competent autonomous organizations (chambers) of the various occupations and branches of industry. The chambers also monitor the training to make sure it is conducted properly.

[37] from http://www.eurydice.org/Eurybase/Application/frameset.asp? country=DE&language=EN.

Training at the Berufsschule

In the context of the dual system of vocational education the Berufsschule is an autonomous place of learning. It works together on an equal footing with the companies participating in vocational training. The function of the Berufsschule is to provide pupils with general and vocational education, having particular regard for the requirements of vocational training. Berufsschulen are also expected to offer courses preparing for vocational education or accompanying professional activities. Berufsschulen equip their pupils with basic and specialized vocational training, adding to the general education they have already received. The purpose is to enable them to carry out their occupational duties and to help shape the world of work and society as a whole with a sense of social and ecological responsibility.

About a third of total teaching time at the Berufsschule is taken up with general education subjects, namely German, social studies and economics, religion and sport. Foreign languages are included in vocational education to the extent they are likely to be of importance in the pupils' future career, e.g. office jobs. Pupils attend the Berufsschule on a part-time basis and usually have at least 12 periods per week. Together with the companies providing training, the school supervisory body and the relevant bodies from industry, the Berufsschule decides on how to organize teaching time, drawing on a wide number of possibilities. Teaching can, for example, be provided two days a week every week throughout the course or may alternate between one day and two days from week to week. Instruction may also be given in the form of coherent blocks. The aim of the various different ways of organizing the course is to guarantee the best possible attendance rate of the pupils within the companies providing training and, at the same time, to create a favorable situation in terms of educational gain and learning psychology.

It is also possible to follow a one-year course of basic vocational training, either in the form of full-time schooling or on the basis of a cooperative arrangement between a company and the school (so-called Berufsgrundbildungsjahr). The purpose of this basic vocational training year is to provide general knowledge and skills required in every occupation and every field as well as special theoretical and practical education in one particular career area and in this way to lay the groundwork for subsequent vocational training in this field. Pupils may choose one of the 13 currently existing career areas (business and administration; metallurgic engineering; electrical engineering; construction engineering; woodworking techniques; textiles and garment making; chemistry, physics and biology; printing technology; color technology and interior design; body care; health; nutrition and home economics; agronomy). Successful completion of a basic vocational training year may be counted as the first year of training in the specific recognized occupations requiring formal training associated with the chosen career area.

The annual Vocational Training Report of the Federal Ministry for Education and Research (Berufsbildungsbericht) provides more detailed information about the dual system (find in http://www.bmbf.de)

3) Ongoing Reforms and Topics of Debate in Education

By virtue of the federal structure of the German state, discussions on reform are carried out at both *Länder* and Federal level. Although the individual *Länder* are initially responsible for the implementation of reforms in their education systems, they cooperate with each other within the framework of the *Kultusministerkonferenz* (Conference of Ministers for Education and Cultural

Affairs) on matters of importance for all *Länder* in order to prepare educational reforms by means of joint recommendations. The discussion forum responsible for all educational issues jointly affecting the Federal Government and the *Länder* is the *Bund-Länder Kommission für Bildungsplanung und Forschungsförderung* (*Bund-Länder* Commission for Educational Planning and Research Promotion), in which the Federation and the *Länder* cooperate under the provisions of Article 91b of the German Constitution. The permanent advisory bodies of the Federation and the *Länder* also include the *Wissenschaftsrat* (Scientific Council), which draws up recommendations concerning development of the content and structure of higher-education institutions, science and research. Only a number of the points being discussed in the ongoing debate on reforms in all areas of the education system can be presented here. The following overview therefore sets out only those reform plans that are of supra-regional interest and are being dealt with at Federal level or in the Bund- *Länder* bodies and are of particular significance.

Essential areas/aspects of reforms at the preparatory or planning stage

- Quality assurance in schools, introduction of educational standards binding for all *Länder* and establishing of a regular reporting by the Federation and the *Länder* on the German education system that covers all the various stages of education throughout life.

- Reduction of the close relation between the socio-economic background of pupils and their performance.
  Furthering children at an early age and improving individual support
  Providing of schools offering all-day activities and care
  Furthering of children from migrant families, especially in the knowledge of the German language
  Furthering of literacy in reading, mathematics and science
  Shaping future-oriented teacher training programs
  Strengthening the autonomy of higher education institutions in conjunction with evaluation, performance-related funding mechanisms, reform of civil service law
  Implementation of the Bologna Process by means of the introduction of the new system of study courses based on two main cycles with Bachelor's and Master's degrees
  Enhancing the international attractiveness of Germany as a study location
  Development of internationally competitive and highly efficient universities as well as networks of excellency in higher education research
  Promoting the new generation of academics and scientists
  Reform of the procedures for admission to higher education institutions (allocation of study places)
  Distance learning and new media in higher-education teaching
  Continued strategic development of further education and life-long learning
  Development of open, flexible and company-oriented training regulations and of new occupations and professions
  Necessary strengthening of empirical educational research
  The education levels affected by reform plans are:
  Pre-primary and primary education
  Secondary education
  Tertiary education
  Quantitative and qualitative objectives of the reforms

Establishment and development of schools offering all-day activities and care

The half-day school is the traditional form of teaching and all-day schools are still the exception in Germany. The extension of all-day schooling is intended to have lasting effects on the process of educational reform. The individual support of pupils shall move towards the centre of the schooling process in order to break the strong link between social background and educational success. The establishment of all-day schooling is intended to achieve the following goals: individual support for all pupils; reform of teaching and learning through the combination of lessons, additional offers and leisure time activities; integration of the school into its social, cultural and economical environment; qualification of pedagogical staff.

Shaping future-oriented teacher training programs

Development of new approaches regarding the implementation of standards for the effectiveness and professionalism of teacher training a more extensive practical orientation during teacher training

Intensification of the relations between the theoretical and practical phases of training

Measures to improve teaching practice with regard to diagnostic and methodical competence

Particular significance of the induction period for newly qualified teachers

Qualification of higher education graduates without formal teacher training (*Seiteneinsteiger*)

Improvement of the image of the teaching profession

4) Reform of Vocational Training

Training Pact

In the face of the persistently tense situation for the provision of places for in-company training, the Federal Government and the major trade organizations concluded a 'National Pact for Career Training and Skilled Manpower Development' in Germany (*Nationaler Pakt für Ausbildung und Fachkräftenachwuchs in Deutschland*) in summer 2004.

The cornerstones of this pact are:

The industry and the Federal Government commit themselves to significantly increase training opportunities within the next three years,

The industry sets itself the binding goal of providing a total of 90,000 new places for in company training (*Ausbildungsplätze*) over the next three years

The industry agrees to offer – as a first step towards vocational training – within the next three years a total of 75,000 internships for pre-vocational qualifications

The Federal Government agrees to raise training opportunities in Federal Administration by 20 %.

By the end of the year 2004, the pact has already produced some first favorable results: More than 58,000 new places for in-company vocational training have been created in trade and industry. This means that an additional 20,000 training contracts have been concluded, compared with the previous year.

Reform of the Vocational Training Law:

In summer 2004, the Federal Government initiated a basic reform for the modernization and flexibilization of the Vocational Training Law. The reform measures shall serve to offer vocational training to an even greater number of young people, to ensure international competitiveness, to promote regional responsibility, to heighten permeability between the educational systems and to strengthen cooperation between the companies actively involved in the training (*Ausbildungsbetriebe*) and the vocational schools. Furthermore, bureaucratic effort shall be reduced by downsizing the committees on vocational training.

Support Measures for the Less Privileged:

For a comprehensive modernization and structural development of the support measures for the less privileged in the area of vocational training, the Federal Ministry of Education and Research has launched the program 'Promotion Skills – Vocational Qualification for Target Groups with Special Learning Problems and for the Socially Disadvantaged' (*Kompetenzen fördern – Berufliche Qualifizierung für Zielgruppen mit besonderem Förderbedarf – BQF-Programm*). Co-financed by the European Social Fund (ESF), the program will run through 2006. This program shall offer new starting points and qualification pathways to youths who have not yet completed a vocational training. The model measures funded within this program concentrate on optimizing support structures, improving the work of the educational facilities, strengthening approaches to prevent lack of vocational training (*Ausbildungslosigkeit*) already at school, as well as improving the vocational training prospects of immigrants.

Structural reform of the higher-education sector and enhancing the international attractiveness of Germany as a study location

Introduction of Bachelor's and Master's degrees as well as performance-point systems to facilitate the transfer of study credits

Accreditation procedures to enable the establishment of a quality assurance system based on diversity and competition, providing sufficient scope for the development of new Bachelors' and Masters' courses of study, creating transparency, facilitating international recognition

A greater degree of autonomy and independence to provide scope for creativity

Introduction of a more performance-oriented salary system, opportunity for academics and scientists to qualify at an earlier stage for a professorship, greater flexibility in personnel deployment.

To introduce these structural reforms the Framework Act for Higher Education was last amended in December 2004 and the Law on the Remuneration of Professors at Higher Education Institutions came into effect in February 2002. For the accreditation of degree programs the *Länder* set up an independent Accreditation Council as Germany's central accreditation organization which

will become a foundation under public law in 2005. The Council's responsibilities are defined in a Statute and a resolution of October 2004 on the further development of the accreditation of degree programs (*Eckpunkte für die Weiterentwicklung der Akkreditierung in Deutschland*).

Equal opportunity

A socially just and transparent system of financial assistance for pupils and students (the reform of the Federal Training Assistance Act came into effect in April 2001)

Equal opportunities for men and women

Essential issues being dealt with in the consultations/public debate related to the planned reforms or the education sector as a whole

Participation in international and national comparative studies of pupils achievement

A comparison between the *Länder* of school performance relating to reading skills, mathematical and natural sciences knowledge, as well as cross-curricular competencies of 15 year-old pupils is intended to serve as an empirical basis for decision-making on education policy. Germany is taking part in the OECD Program of International Student Assessment (PISA). After the publication of the results in December 2001, the Standing Conference of the Ministers of Education named seven areas in which the *Länder* will act. These include the improvement of pre-primary, primary and secondary education, the development of educational standards for primary and secondary schools as well as the further professionalization of teacher training.

The results of comparative tests have made clear that various reforms are necessary in order to develop and enhance the quality of the German education system. The required measures include strategic educational objectives, output-oriented control for central areas of the education system, the focusing of all available resources as well as the evaluation of the reform measures based on previously established criteria. Additionally, empirically based research into the causes of success or failure of pedagogical processes is required. Various documents pertaining to the results of international surveys of pupil achievement (e.g.PISA-2000, PISA-2003, PIRLS) can be found on the internet at http://www.kmk.org/schul/home.htm-leistung.

Quality assurance through educational standards

The Federal Government and the *Länder* believe that the development, the implementation and the evaluation of educational standards (*Bildungsstandards)* binding for all *Länder* is a central element in order to assure the quality of the German education system. The necessary basics and requirements for the introduction of educational standards already have been scientifically elaborated (on the concept of the standards as established by the Standing Conference see

http://www.kmk.org/schul/Bildungsstandards/Argumentationspapier308kmk.pdf).

In 2003 and 2004, the Ministers of Education agreed on educational standards at three key stages: at the end of the primary level after grade 4 in the subjects German and mathematics and at the end of the lower secondary level for the leaving certificate of the *Hauptschule* in the subjects German, mathematics and first foreign language (English, French). For the school leaving certificate obtained on completion of grade 10 at *Realschulen* educational standards for the same subjects (German, mathematics, first foreign language) as well as for the natural

sciences (biology, chemistry, physics) have been adopted by the *Länder* for implementation in the school year 2004/05 and 2005/06 respectively. The standards are based upon the areas of competence of the individual subject and take up the basic principles of the respective subject. Pools of questions and exercises are to be set up which are to be continually further developed, and which serve the *Länder* and their schools for internal and external evaluation. The Institute for Quality Development in Education (*Institut für Qualitätsentwicklung* – IQB) which has been set up by the *Länder* at the Humboldt University Berlin in 2004, is to regularly examine whether the educational standards have been met.

Standards for teacher training programs

With regard to the improvement of diagnostic and methodical competence, the development of standards for teacher training provides an additional basis for a teacher training aimed at professionalism. The Standing Conference of Ministers of Education has commissioned a working group including external experts to develop standards relating to professional theory (*Bildungswissenschaften*), which comprises educational science and subject-related didactics. In December 2004 the Ministers of Education adopted the standards which will be implemented by the *Länder* in teacher training comprising the study courses at higher education institutions and the preparatory service (*Vorbereitungsdienst*) as the second stage of teacher training.

Quality assurance and evaluation of teaching and research in higher education

The compulsory assessment of the quality of teaching has only been provided for since the amendment to the Framework Act of Higher Education of 1998. The first evaluation structures covering several higher education institutions have emerged since 1994. The results of the evaluation may have a direct effect on the higher education funding. Increasingly, the quantitative performance indicators are being used as a basis for allocation of resources. For the introduction of new Bachelor's and Master's Study Courses, an accreditation procedure has been established to guarantee minimum standards in terms of academic content and to check the vocational relevance of the degrees. In 2005, the Standing Conference of Ministers of Education will discuss a general concept on quality assurance for teaching and research in higher education.

Regular reporting on the development of the education system

In 1999, the Federal Government and the *Länder* established the Forum *Bildung* in order to ensure the quality and future viability of the German education system. The recommendations published by the Forum *Bildung* in 2001 affect both the Federal Government and the *Länder*, but are also directed at those who work in the institutions and who are directly involved in the education processes.

The Federal Government and the *Länder* agree upon the necessity of an overall national reporting on education as a basis for all programs and measures to improve and to ensure the quality of the education system. A first report on school education (*Bildungsbericht für Deutschland: Erste Befunde*) was published in autumn 2003 to take conclusions on the further development of the German education system (summary available at http://www.kmk.org/aktuell/bb_ zusammenfassung.pdf).

2. Quality assurance in manufacturing and changing job requirements

1) Understanding of Quality

The four studies focused on quality assurance in initial training and in production. Discussions were held with training and human resources managers, apprentices and skilled workers in the production facilities at DaimlerChrysler (in Gaggenau and in Mannheim), at Ford (in Cologne) and at AUDI (in Ingolstadt). These discussions show a clear trend. While the concept of 'quality' and 'quality assurance' is used very heterogeneously, and operationalized at different stages of initial and continuing vocational training in the different corporate contexts, it nevertheless denotes an overarching interest: how to maintain the high quality of the company's products and services in the face of increasingly rapid technological change and the now pervasive competitive pressures of globalization. A high standard of initial training in the context of real work-processes should guarantee a high-quality production process, and hence an end product which meets the highest standards. This should result in being able to fulfil customer requirements reliably and systematically. In this respect, corporate practice in relation to initial and continuing education and training proves to be compatible with the quality concept defined by the ISO 9000 family of standards, where there is an explicit focus on the customer benefit of every element of a service process (or equally, a training process) (CERTQUA 2002).

2) Instruments for quality assurance

To meet this standards, the companies mentioned made use of specific teaching and learning concepts in their training contexts (the 'process learning workshop' at DaimlerChrylser Gaggenau, the 'training factory' at DaimlerChrysler Mannheim, 'training islands' at Ford in Cologne, the 'E-Learning Framework' at AUDI Ingolstadt) to implement didactic approaches in a targeted way. These schemes for initial training include elements from quality management systems based on the international set of standards ISO 9000 ff and other quality awards (the European Quality Award of the European Foundation for Quality Management), or elements from educational cost-accounting or Total Quality Management (TQM).

The common denominator is the intention to make the process of initial and continuing vocational education and training relevant to the situation and the workplace, to evaluate it within the overall course of business within the company, and to optimize it continuously. The working assumption is that adopting the envisaged quality assurance strategy in the training context can ultimately improve the company's entire value creation process and make it more competitive. Thus customer focus and quality assurance are made the guiding principles of initial and continuing vocational education and training, not only in the automotive industry but in industry[38] as a whole (Keim 1998, Orru 2002).

[38] Generally speaking, companies in the automotive sector now only accept suppliers which operate similar quality management systems and are certified to the ISO 9000 ff series of standards.

3) Organizational concepts and qualification requirements

Against this backdrop, ever since the 1990s the training sector has been bringing learning processes back into the workplace (Dehnbostel 2004, Dehnbostel/P*ä*tzold 2004, Severing/ Düring 2001). The recent call for process competence has further underscored this trend. The latest updated training regulations in the metal-working and electrical sectors now validate this development. Starting from the need for employees in specific fields, from now on initial training will be directly aligned with the individual company's processes. Ideally, initial training should be part of the company's work processes (Bahl/Koch/Meerten/Zinke 2004). Although this may – depending on the capabilities of initial and continuing education and training staff – result in considerable differentiation in the contexts of initial training in individual companies, the uniform national examination standards still guarantee that skilled worker training will be of comparable quality.

The introduction and use of the quality management systems mentioned also gives a clear signal that all business divisions are integrated into what becomes a company-wide process. Accordingly, the quality of the product is reflected directly in the quality of the whole development and production process, including the quality of the skilled staff involved in the workflow. The same approach applies to the supporting framework, i.e. each company's organizational structures, initial training programs and course content, didactic approaches and methodologies for initial training of apprentices and continuing education and training of skilled workers, appropriate deployment of skilled training personnel, measurement (evaluation) of the success of each phase of training and of the resulting human resources development strategies. This philosophy also facilitates the development of company-specific quality management systems, which companies can adapt flexibly to the profile of elements in their own production chain.

In summary, in the individual case studies (Annex 1-4) the following reasons are cited for lifelong, on-the-job learning[39]:

Quality assurance,

Reduction of stoppage times,

Developments in the organization of work,

Cross-cutting competences such as process competence, responsibility, cooperation and communication skills,

New technologies and techniques, including information and communication technologies,

Internationalization.

The training ordinances which were updated for the electrical occupations in 2003 and for the metal-working occupations in 2004 make a framework available in which these qualification requirements can be put into practice, right from the outset, in initial vocational training. In-company continuing education and training provision will then follow suit.

In cooperation with external training advisors and universities, the selected companies developed their own tools and strategies for providing initial and continuing training in an enterprise-

[39] Cf. the Daimler Chrysler Mannheim case study, Annex 3. The other case-study authors arrive at a similar assessment of qualification requirements.

based context. Some of these strategies have since been taken up by other companies. One example of this is the 'learning island' concept which initially emerged in Gaggenau from a pilot project supported by BIBB in the 1980s/1990s[40], and is now also used, for instance, at Ford in Cologne.

What all four examples have in common is the value they place on initial and continuing vocational education and training. The case studies show that in addition to company-specific schemes such as ALF (Arbeiten und Lernen im Fachbereich – 'work and learn in the department'), the 'production learning system' (PLS), the 'e-learning initiative', the 'process learning workshop', 'learning islands' and so on[41], – other methods of initial and continuing vocational education and training have become generally established and are used in all companies: mention should be made here of the Continuous Improvement Process (CIP), quality circles and job rotation.

In this respect, the learning concepts developed in companies are also means for companies to bring about change, continuous development, staff participation and motivation. They ensure continuous development in the area of training, and reinforce the employees' attachment to the company. In the final analysis, the goal of these initiatives is that quality assurance should contribute to corporate success and to a positive atmosphere in the workplace.pp.52 ff)

3. Target group specific training programs in initial and continuing education and training

The following charts, Overview 1-4, show the recognized training occupations for which initial training is available in the selected companies. Overviews 1 and 2 on the metal-working and electrical occupations also show which industrial occupations[42] exist in Germany in these occupational fields.

[40] The Gaggenau case study also sets out the story of this development in detail.
[41] These concepts originate from Annexes 1-4 and are described there in more detail.
[42] The craft occupations are not included here.

Overview 1: Electrical occupations

Occupational Qualifications Case study[43]	Length of training in months	Daimler Chrysler Mannheim	Daimler Chrysler Gaggenau	Audi Ingolstadt	Ford Cologne
Electronics Technician for Automation Techno-logy (m/f)	42				
Electronics Technician for Industrial Engineering (m/f)	42		x		x
Electronics Technician for Building and Infrastructure Systems (m/f)	42				
Electronics Technician for Devices and Systems (m/f)	42				
Electronics Technician for Aerospace Systems (m/f)	42				
Systems Informatics Technician (m/f)	42				
Motor Vehicle Mechatronics Technician (m/f)	42	x			X[44]
Mechatronics Fitter (m/f)	42	X	X		

Overview 2: Metal-working occupations

Occupational qualifications Case study	Length of training in months	Daimler Chrysler Mannheim	Daimler Chrysler Gaggenau	Audi Ingolstadt	Ford Cologne
Industrial Mechanic (m/f)	42		X		x
Tools Mechanic (m/f)	42		X		X
Milling Machine Operator	42				X
Automobile Mechanic (m/f) [45]	42			X	X
Production Mechanic (m/f)	36	X	X		X
Plant Mechanic (m/f)	42				
Model Maker (m/f)	42				
Component Adjuster (m/f)	24				

[43] The stated length is the officially specified duration of initial training, but in certain circumstances (prior attainment of skills and progress of initial training) it can be shortened.

[44] Recognized occupation formerly known as Automobile Mechanic (m/f).

[45] This occupation existed only up to 2003 and has been subsumed into the occupation of Motor Vehicle Mechatronics Technician (m/f).

Overview 3: Occupations in other occupational fields including commercial occupations

Occupational qualifications Case study	Length of training in months	Daimler Chrysler Mannheim	Daimler Chrysler Gaggenau	Audi Ingolstadt	Ford Cologne
Vehicle Varnisher (m/f)	36				
Warehouse Logistics Operator (m/f)	36				X
Process Mechanic (m/f)	36				X
Industrial Clerk (m/f)	36	X			
Information Technology Officer (m/f)	36	x	x		
Office Communications Clerk (m/f)	36	X	X		

Overview 4: Other initial training routes outside the dual system of initial vocational training.

Occupational qualifications Case study	Length of training in months	Daimler Chrysler Mannheim	Daimler Chrysler Gaggenau	Audi Ingolstadt	Ford Cologne
Diplomingenieur/in (BA) College of advanced vocational studies graduate in Engineering -Mechanical Engineering [46]	36	x	x		
Diplomingenieur/in (BA) College of advanced vocational studies graduate in Engineering -Mechatronics	36	X			
Diplom Betriebswirt/in (BA) College of advanced vocational studies graduate in Business Management	36	X			
„Do 2“[47] dual qualification in Technology	48				X

A comparison of the occupations in which the individual companies provide initial vocational training shows that there are differences, both in the number of occupations and the specific occupations on offer. In this regard, the following comments can be made:

[46] Colleges of advanced vocational studies (Berufsakademien) are full-time vocational education and training institutions which only exist in certain states (*Länder*) in Germany. As a rule, students must have a qualification for entry to higher education (the Abitur) to meet their admission requirements. Training takes three years and is normally offered in cooperation with companies in which students complete placements during the program of studies.

[47] This is Ford's name for a dual study program leading to a double award: an engineering qualification at the level of a degree from a University of Applied Sciences (Fachhochschule) together with a skilled worker qualification. This form of initial training is becoming more widespread, although compared with other degree programs, take-up is still low.

while their qualification requirements are comparable in every way, individual companies can evidently meet them on the basis of different recognized training occupations. This is made possible because the occupational profiles overlap and because training in different occupational fields, exemplified here by the metal-working and electrical groups, equips the participants with a common set of core skills.

Whereas some companies only provide initial vocational training in a small number of recognized occupations, others like Ford in Cologne cover a relative broad range of company qualification requirements. This is explained by the fact that the DaimlerChrysler plants only manufacture components (motors, drives) whereas Ford Cologne both produces components and fully assembles motor cars, and therefore has a broader range of training needs (e.g. vehicle varnishers).

The duration of initial training in the selected recognized training occupations is at least 3 years. The sole exception is the occupation of Parts Finisher, for which the duration of training is only 24 months[48].

Alongside the recognized occupations within the dual system, initial vocational training is also provided for higher-level occupational qualifications. This is how the companies meet their needs for specialist engineering staff with skills which have been closely aligned to company practice from the time of their initial vocational training onwards. The complexity and the demands of the tasks these employees will later perform are generally above the level required of skilled workers[49].

In the selected companies, there is a fundamental understanding that the next generation of skilled workers will be recruited via the company's own initial vocational training program. In the companies belonging to DaimlerChrysler AG, there is a group-wide agreement which regulates this matter. This means that skilled staff are only ever recruited via the labor market if a sudden increase in demand makes it necessary to hire additional workers. The training ratio (the number of apprentices in relation to the number of employees) is above 8 % at DaimlerChrysler Gaggenau, for example. For replacement purposes alone, a ratio of 5 % is the generally accepted norm.

Unskilled and semi-skilled workers are only assigned to jobs assisting production staff. They make up a low proportion of the overall workforce.

The main career progression opportunities for skilled workers consist of being promoted to Meister (master craftsman) and Techniker (technical engineer), from skilled industrial-technical occupations, or to Fachwirt (middle-level commercial clerk), from skilled commercial occupations. These qualifications, which are primarily certificates of competence giving access to higher occupational grades, are awarded by the chambers of industry and commerce. The associated 'master craftsman' courses are also offered by the chambers, while relevant vocational schools offer 'technical manager' training. This training usually takes place on a part-time basis. The costs are borne by the participant or the company, depending on agreements and interest. At the same time, in its other sense, Meister designates a function within the company.

[48] On the whole, the typical duration of training for recognized occupations under the dual system is three to three-and-a-half years; there are very few two-year programs of initial vocational training.

[49] In the authors' view, once again this clearly shows that the dual principle of initial training applies not only to the occupational training system, but also to access to higher-level qualifications. This trend is becoming increasingly established in Germany, in spite of all criticisms levelled at the dual system.

For the acquisition of additional qualifications which are necessary in order to perform particular tasks at work, the companies offer special further training courses, or send selected employees to take part in such courses. For example, these may consist of manufacturer-provided training following the purchase of new plant and machinery, or courses on occupational health and safety, etc.

A third vital pillar of continuing education and training is continuous learning during the work process. Here, the summary of the field observation at DaimlerChrysler Gaggenau, in particular, shows how such learning processes are supported within the company[50].

All four of the selected case studies are unanimous in giving a clear priority to high quality, enterprise-based initial vocational training and continuous upgrading of their employees' skills in a context of ever-changing demands. (In no small part, this reflects the high level of acceptance and appreciation of the dual system of vocational training in these companies.)

4. New Media in German VET

Differences are found between the case studies on the use of new media (e-learning) – apparently even within a single company, Daimler Chrysler AG. At its Mannheim plant, what is known as a 'production learning system' (PLS) is a central feature of initial and continuing vocational education and training (VET)[51]. In Gaggenau, on the other hand, while electronic media are certainly used, they are not given the same prominence as in Mannheim. Instead, all the more use is made of communicative learning in many forms, and training is geared strongly towards the workplace. Note the concept of the 'process learning workshop', for example.[52]

Similarly, differing approaches to initial and continuing VET are seen at Ford in Cologne and at Audi. Ford Cologne uses electronic media in the form of sequential learning modules in particular phases of initial training, whereas Audi tries to operate its e-learning concept as a systematic policy and has already carried out specific campaigns with this in mind (the IT competence-building initiative[53]). The fact that Ford Cologne has not yet taken a similar route is partly due to its legal form and the way it finances vocational training. The training centre is a stand-alone enterprise which is independent from the parent company. As a consequence, company management is somewhat distanced from training strategies and does not readily release sufficient resources for costly pilot projects. On the other hand, as the DaimlerChrysler case studies show, the attitudes of training staff obviously have an influence on how new media are used. The observations that took place on site made plain, in any event, that it would be wrong to conclude that initial training would necessarily be worse without the systematic use of new media.

To sum up the situation, two of the selected companies only use e-learning where relatively tried and tested media are available, whilst the other two see e-learning as a field for experimentation and integrate it closely into the development of corporate training policy. The latter are developing new content and learning environments for e-earning.

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[50] Cf. Annex 5.
[51] Cf. Daimler Chrysler Mannheim case study, Annex 3.
[52] Cf. Daimler Chrysler Gaggenau case study, Annex 4.
[53] Cf. Audi case study, Annex 1.

In all the examples the use of new media is understood primarily as an organized form of learning. There are few signs as yet of provision or support of informal learning opportunities, e.g. open access to learning platforms, learning on forums and participating in online communities.

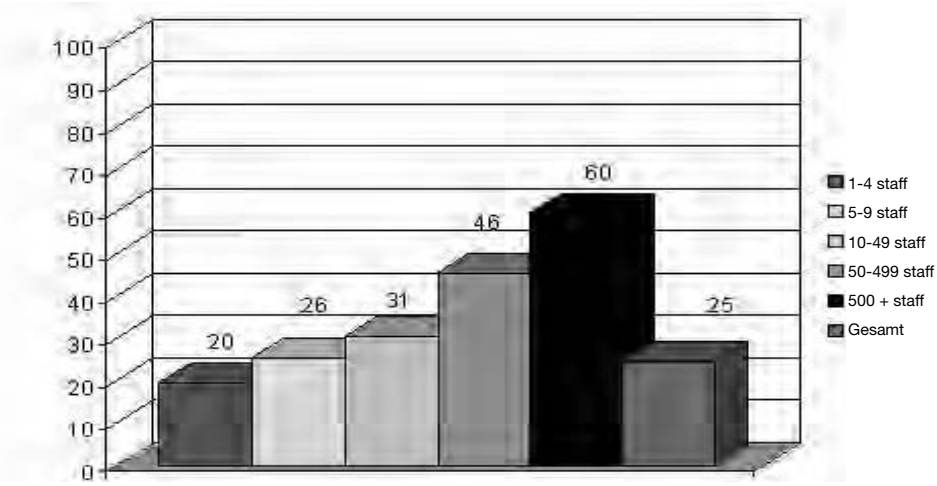
All four selected companies are users of e-learning. However, not all companies in Germany are using e-learning, by any means. A survey conducted recently shows that the prevalence of e-learning varies in line with the size of establishments and their business sector.

Excursus: New media in enterprise-based continuing VET – a survey of German enterprises

For this research, two questions on e-learning issues were included in a questionnaire for the 2003 IAB-Betriebspanel (Institute for Employment Research (IAB) Establishment Panel survey). This is an annual survey of a panel of German businesses, now numbering some 16,000 establishments of all sizes and across all sectors. One question aimed to find out whether establishments were making any use of PCs and the Internet for continuing VET purposes; the other sought to establish how this was being supported in practice. Since the IAB Establishment Panel survey yields a range of information on various aspects of business and employment policy, it is now possible to look at the use of e-learning in the context of other workplace factors. A selection of findings from this survey is presented in the following section. National totals – for all establishments in Germany with at least one employee subject to social insurance – were projected from the survey results.

Overall, a quarter of establishments stated that they supported the use of PCs and the Internet for training purposes. The proportion of companies in eastern Germany (29 %) is slightly higher than that in western Germany (24 %).

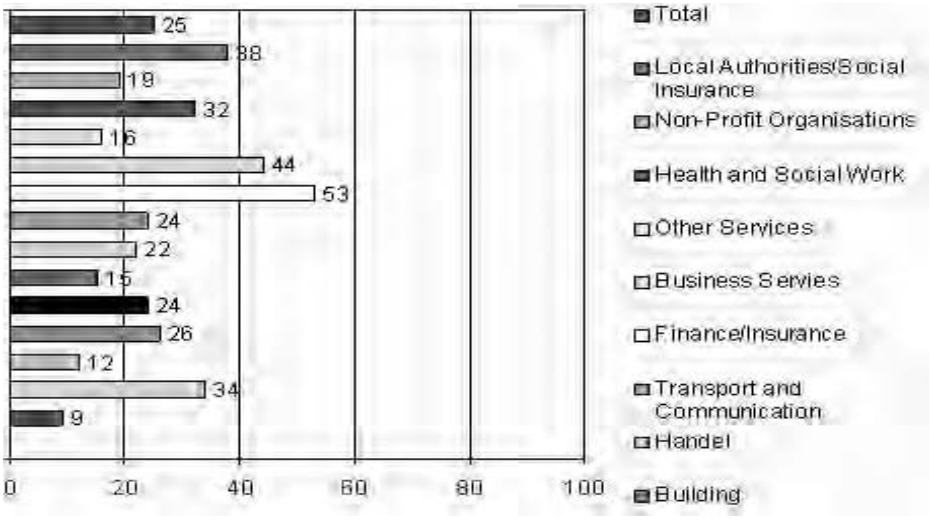
Figure 3.1: Support for PC and Internet use for continuing VET, by establishment size



Source: IAB-Betriebspanel 2003 in %.

The rate of PC and Internet use for training purposes rises significantly with establishment size: whilst only one in five workplaces with up to five employees reported any use of e-learning, as defined here, six out of ten establishments with 500 or more employees are already doing so (cf. Figure 3.1).

Figure 3.2: Support for PC and Internet use for continuing VET, by sector



Source: IAB-Betriebspanel 2003 in %.

The prevalence of e-learning also varies between establishments in different sectors: the most active sectors prove to be 'Finance/Insurance' and 'Business Services'; participation is below average in the 'Agriculture and Forestry', 'Consumer Goods', 'Building' and 'Other Services' sectors (cf. Figure 3.2).

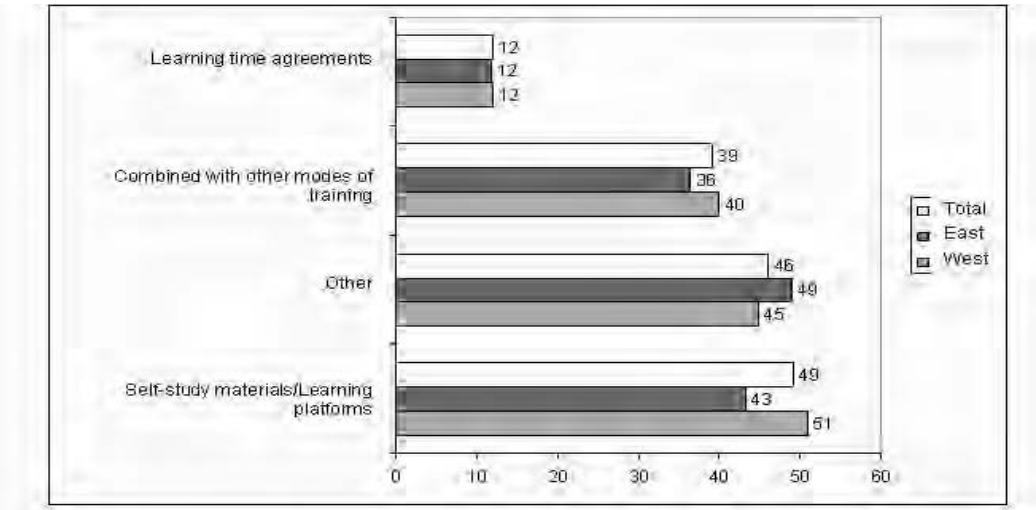
Viewing e-learning provision in relation to other features of the workplace, the following findings can be noted: establishments that are technologically innovative make more use of PCs and the Internet for continuing VET than those which are less innovative. This is particularly apparent when e-learning is considered in association with investment in information and communications technology (ICT). 41 % of firms investing in ICT reported that they were supporting e-learning, as opposed to only 18 % of firms not investing in this area. A similar correlation can be identified between e-learning and more advanced technological facilities (as assessed and reported by the establishments themselves). Of the establishments that consider themselves equipped with state-of-the-art technology, 36 % use PCs and the Internet for continuing VET. This is only true of 11 % of the establishments equipped with less up-to-date technology.

Finally, the results of the IAB Establishment Panel survey also show a correlation between the use of e-learning and the involvement of establishments in initial vocational training. E-learning programs are more frequently offered by training establishments (35 %) than by firms not providing any initial vocational training (21 %) – either because they are not entitled to, or because they choose not to despite being qualified to do so.

Enquiring further into the ways in which workplaces use PCs and the Internet for continuing VET, the following picture emerges:[54] e-learning is most commonly delivered by giving access to self-study materials and learning platforms (on average 49 %, in large enterprises 66 %),[55] and by combining it with other modes of education and training (39 %). In 12 % of establishments surveyed (large enterprises: 25 %) learning time agreements have been reached, either in works agreements or by informal arrangement between employees and their managers.

[54] The following analysis refers to all establishments reporting PC and Internet use for continuing VET purposes.
[55] Space does not permit more detailed analysis of this question.

Figure 3.3: Mode of support for PC and Internet use for continuing VET purposes, in western and eastern Germany



Source: IAB-Betriebspanel 2003 in %.

Comparing the figures for eastern and western Germany, it is striking that more western than eastern establishments report that they support e-learning by providing self-study materials or access to learning platforms (western Germany: 51 %, eastern Germany: 43 %). This type of e-learning support also increases with the size of the enterprise. Furthermore there are differences between establishments in different sectors: significantly more enterprises in the 'Finance/ Insurance' (79 %) and 'Transport and Communication' (64 %) sectors are providing learning platforms and self-study material.

5. Case studies

Case 1: Ford Aus- und Weiterbildung e.V.[56]

Main focus : Operational assignments, training islands, quality management in training and application of the Ford Production System in training

1) Vocational Training at Ford – Framework Data

The Ford Works already have a seventy-year tradition in vocational education and training, which has been provided since 1993 by a registered association, the Ford Aus- und Weiterbildung e.V. (Ford Initial and Continuing Training Association), referred to below as the FAW.

Hence the FAW trains skilled workers not just for Ford Werke GmbH but for Joint Ventures GETRAG Ford Transmissions GmbH and Tekfor Cologne GmbH as well.

The Ford works in Cologne, with about 20,000 employees, produces over 400,000 cars of the Fiesta and Fusion categories per year. Also at the Cologne location, 4-litre engines destined for

[56] This part was prepared by Norbert Breu(Ford AW).

export to the American market are manufactured at the rate of about 2000 units a day. A small series of Aston Martin engines is also produced there for the American market.

The introduction of the Ford Production System (FPS) in 2001 made the old car body manufacturing plant at the Cologne works one of the most modern and productive car-making installations in Europe.

This production system is used by the Ford Motor Company (FMC) world-wide as a lean production system for the purpose of enhancing efficiency and productivity by preventing both time and material from being wasted.

The GETRAG Ford Transmissions GmbH joint venture produces new 5-speed and 6-speed gearboxes at the Cologne-Niehl gearbox works with a capacity of 1200 employees. GETRAG Ford Transmissions GmbH is also responsible for gearbox development in Cologne. The gearboxes are made for Ford-Werke GmbH and its subsidiaries Volvo, Jaguar and Mazda. They are also supplied to other car-makers such as VW, MG Rover and General Motors.

Tekfor Cologne GmbH, a Neumayer Holding and Ford forging department joint venture, produces 35 million forged parts a year for the whole car industry with about 350 employees.

The FAW trains 210 young people a year for those companies in Cologne and another 60 in Saarlouis.

With over 640 trainees in Cologne and 175 in Saarlouis, the FAW is one of the largest training enterprises both in North Rhine-Westphalia and in Saarland.

2) Training spectrum

The training spectrum comprises 11 industrial and technical and one commercial occupation as well as the mechatronics course of study.

Industrial field	Commercial field
Industrial mechanic	Industrial clerk
Electronics technician for operating technology	
Tools mechanic	
Motor mechanic	
Stockroom logistics expert	
Metal cutting mechanic	
Production mechanic	
Construction mechanic	
Pattern-maker	
Process mechanic	
Parts trimmer	
Do2 engineering (combined studies)	

The training takes place at these learning venues:

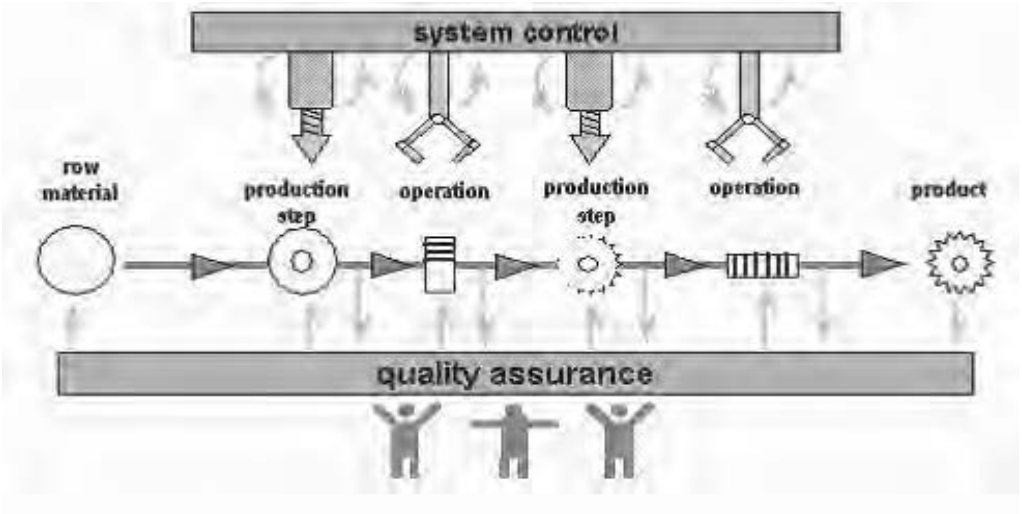
- Training workshop
- Enterprise
- Part-time vocational school
- And, for occupations with block lessons, the works school

Where possible, the content is determined in consultation with those departments; each must supplement the other in a sensible manner in order to derive the greatest benefit for the trainees.

In this scheme of things, work in the enterprise has a particularly important role to play in these days of process orientation and value added.

3) The production island concept at Ford

Because of the specific requirements of today's customers, we have to guarantee very flexible training. While in earlier times the main emphasis was on craftsmanship and general technical knowledge specific to the occupation, nowadays, owing to advanced automation and technology, it is no longer possible to have detailed specialized knowledge of all areas of an occupation. Formerly the individual units in the manufacturing process were laboriously and protractedly repaired, but now the task of the skilled worker is to localize the source of the trouble and replace the defective parts as modules. Process knowledge, not knowledge of detail, is in demand and defines our daily work in manufacturing today.



Thus arose our production island concept after the 1987 restructuring.

The concept comprises the areas presented below:

- Training islands in the three plants
- Production islands in the transmission and the body works
- Continuing training island
- Spare parts manufacturing island (currently in the process of re-planning)

Training islands in the three plants

With the introduction of production islands in the plants, the enterprise coordination, i.e. the deployment of trainees in each of the production areas, was also changed.

Prior to the 1987 restructuring, there were only one or two enterprise coordinations for all trainees. Because of the large number of industrial trainees, the relevant departments were not able t o give them technical guidance or to ensure process-oriented planning of enterprise deployment. Resulting from this, enterprise deployment tended to take the form of administration of trainees in the individual places of deployment.

This problem was solved by implementing one training island each in the transmission works, the engine works and the body plant.

The task of these training islands is to plan and arrange enterprise coordination in such a way that each trainee gets to know the entire manufacturing process and the typical manufacturing plants with all their interfaces with quality control, maintenance and logistics and performs the tasks typical for each occupation. This guarantees that the trainee is given a picture of day-to-day production with its specific demands on skilled workers that corresponds to reality.

The training phase on the training islands is intensified by standard text-supported :

Workbooks on enterprise deployment (these serve the purpose of general orientation in the three works)

Area-specific documents (these serve the purpose of operational exploration of the plant and the place of deployment)

Preparation of a report on the work (project assignment/work assignment in a place of deployment)

These documents provide the trainee with the requisite specialized and process knowledge about the plants concerned and their production and maintenance departments. Small project jobs further deepen this knowledge.

The training phase is subdivided into two time-limited sections. After the first section has been completed the trainees reflect on the place of deployment and the course of production there. They exchange experience among themselves, present the results of the exploration assignment and have to answer questions from the enterprise deployment book. Criticism and praise of the place of deployment are dealt with in the group. On the basis of these suggestions from the trainees, the trainer tries to implement the group's suggestions for improvements for the remaining second part of the operational assignment.

At the end of the second part if this training phase, the whole group of trainees gets together once again to summarize the experience. They discuss the experience they have had in the place of deployment as well as any suggestions for improvements they may have made beforehand.

A voluntary evaluation also takes place as a long-term assessment of the places of deployment and the supervision by the "island trainers", which can then provide a precise statement about the quality of the place of deployment and the trainers. Work is currently in progress with the works council on a binding evaluation.

Production islands in the transmission works and body works

Today the trainees in the enterprise are deployed primarily in selected production areas. The quality of their deployment depends decisively on the commitment of the company supervisor as well as on the kind of work assigned. The weekly rotation of the supervisor owing to shift work and the change in working tasks assigned on short notice is an obstacle to the commitment of each supervisor. It makes the development of personal relations between the department and trainees more difficult and thus makes it more complicated to get to know a potential future employee. Owing to the rotating supervision, the systematic comprehension of the production processes and their interfaces with other areas is inadequate as well.

The production islands concept was developed to overcome those disadvantages. Supported by the person in charge of training (in the day shift), trainees are supposed to perform independently the work assigned to them in a selected manufacturing area.

Special attention is given to the quality aspect. This principle makes it possible to get to know the manufacturing processes systematically. Specifically, this presents itself as follows:

Under the guidance of a qualified and experienced skilled production worker who works the day shift exclusively, a group of trainees produces the required number of units. The rest of the trainees acquire knowledge of the machines and manufacturing installations utilized, the controls used, the quality requirements and quality tools and the method of continuous process improvement.

For that purpose the trainees are deployed for part of the time in the previous training island (e.g. to acquire robot knowledge) and the departments that provide servicing for the manufacturing area or work closely with it. Special importance is attached to the fact that the trainees organize independently the course of the practical and theoretical part of the work they are called upon to perform.

At the end of several weeks of work in the enterprise the trainees have a sound knowledge of the manufacturing process with all its eventualities and dependencies. They can acquire personal experience of the relationship between customer and supplier and have acquainted themselves with the networking of the various manufacturing processes.

This training process makes possible practice-oriented preparation of the trainees for their later work in manufacturing as qualified skilled workers. A long run-up and working-in phase after the completion of training can be dispensed with.

After the end of the trial phase, all groups of persons involved in the production island concept saw improvements in in-company training. There were therefore no more reservations about continuing with this concept.

The following improvements were achieved :

1. Promotion of teamwork
   2-5 trainees form an inter-occupational group (industrial mechanic, electronics technician/ operating technology, metal cutting mechanic). They also carry out interdisciplinary tasks in the group on their own responsibility. These include attendance checks, vacation

planning, work assignment, free planning of knowledge acquisition in the independent learning center, etc.

2. Supervision of trainees by the enterprise
   The company has appointed as trainer a qualified production worker who only works the day shift. Thus the same supervisor is always available throughout the duration of the operational assignment. The result is increased motivation and a lower rate of absenteeism while the production program is carried out in the same quantity and quality.

3. Extension of subject matter
   Targeted supervision and improved motivation has made it possible to teach additional subject matter such as knowledge of dangerous substances and the use of CNC and SPs and to have minor maintenance work done in addition.

4. Facilitation of entry into vocational life
   The trainees have come to know the requirements of the enterprise in their everyday work and learned to master them. The learning experience regarding the topics group work, independence, problem-solving skills and a sense of responsibility are especially important.

After the pilot, the production island concept was evaluated by those involved and summed up as follows :

Trainees on the production island:

"The group speaker explained a great deal, could always be talked to and treated us like fully-fledged colleagues."

"The work was multifaceted and we were allowed to carry out interesting tasks. We really got acquainted with the machines used and acquired knowledge of various kinds in the independent learning center."

"The teamwork, the readiness of the colleagues to help and the working atmosphere were great. We were able to work very independently and had responsibility."

Company supervisors (master craftsman level):

"By deploying the trainees it was possible to schedule the employees otherwise used in this area for other work. Occasionally, work was done for which otherwise little time could be spared."

"By getting closely acquainted with the trainees, the department found it much easier to select the later skilled workers. The shortening of the working-in phase was another advantage."

Island trainers:

"Our own observations and the feedback from the trainees indicate that the type of deployment in the company practiced in the production islands is a possibility of employing the trainees in production without giving them the impression they are being exploited. Although some planning problems emerged during the whole period, one should try to maintain this concept and if possible to further expand it under adjusted framework conditions.

> Despite all the problems we have come a good deal closer to the actual goal (qualified deployment in the manufacturing process). Trainees and youth representatives would welcome an expansion of such company places of deployment. No company place of deployment is so much sought after by the trainees as that in the production island."

The experience we have had with this concept up to now shows that it should be applied to all other industrial occupations as well. The advantages for the company lie in the value-added deployment, and the advantages for the trainees lie in learning how to perform their tasks independently and on their own responsibility.

The only difficulties stem from coordinating the operational deployment periods, since production demands that the trainees are deployed continuously in the relevant departments. The production process demands that.

The planning of the deployment times requires consideration of vocational school blocks, special measures, premature final examinations etc. Consequently this concept can be applied only sporadically in certain spheres of production. At present there are production islands in the fields of the synchronic clutch line (transmission works) and the flanging line (body works).

Continuing training island

Another task of island training is imparting company-specific knowledge, e.g. teaching the basics of the robot systems used by Ford and GFT and manufactured by KUKA, ABB and Comau in practice. Also, teaching the Interbus, Canbus etc. BUS technologies and machine-specifically teaching CNC fundamentals in application. These subject-specific skills are required to different degrees in the various fields of production of our customers Ford, Tekfor and GFT. The acquisition of these technological skills is made possible for trainees in their training and for employees in continuing training.

The saves the works the cost of working in young skilled workers in these systems. For us as a company providing initial and continuing training this is a further possibility of offering a service that has to be paid for dearly outside our works. In addition, the contacts with the employees in the different works where we deploy the trainees is being substantially improved, since the island trainers remain available as contact persons to answer technical questions even after the courses are over.

Because of the restructuring of the electrical and metal-working occupations after 2004, the island trainers have an additional important task in the form of opening up and coordinating skilled worker examination projects (FAP part 2).

These projects have to be selected in such a way that the trainees can work on an assignment in the form of a project task independently. The level of difficulty must not be too high or too low and value added must ensue for the place of production concerned.

4) Production island for spare parts production

A training island (a protected area in manufacturing) was transformed into a production plant consisting of robots, welding machinery, conveyor systems, loading and unloading stations and measuring installations identical to those on the assembly line. This production plant made battery consoles for the Fiesta. The trainees had the task of making adequate numbers of workpieces for the spare parts centre, taking account of the relevant quality requirements. For this task the trainees were required to acquaint themselves with the control mechanisms of the plant, to master the setting of welding parameters and to independently carry out repairs if defects occurred. The main learning objective of the trainees was to understand the overall process of the plant with all its interfaces with the systems. The trainer had the task of tutoring them technically and methodologically. There was no pressure to produce, and this facilitated the planned execution of the tasks under the guidance of the trainer, who made the methodological and didactic preparations for the relevant production steps. The purpose of this island concept was systematic teaching to ensure that the relevant production processes were learned and understood. After the trainees had successfully completed this learning stage, they could transfer the knowledge acquired to other production plants. They then required a much shorter working-in phase when hired as young skilled workers.

After the new Fiesta and Fusion production started with the corresponding modernization of the manufacturing plant, this training concept was to be continued. For economic reasons, however, implementation had to be postponed.

A new concept for this training island is now in the planning stage.

5) Introduction of the Ford Production System (FPS) into training

When the new Fiesta and Fusion production was inaugurated, the manufacturing situation changed radically.

FPS, the Ford Production System, was introduced globally. All the employees working in this department were trained for this system of lean production. The increased value added and avoidance of waste resulting from this system had now been internalized by the employees.

As future young skilled workers, the trainees now had to deal with this new system as well. A workshop was introduced for the purpose of teaching the fundamentals of FPS. In it the trainees learn in a playful way how production is made more efficient through application of the Ford Production System and what tasks thereby accrue to the individual employees. Tools such as Visual Factory, Error Proofing, Kanban, Quality Process System und concepts such as Kaizen, 5 S, Poka Yoke etc. are presented, explained with examples and implemented step by step in the production simulations. With the help of key production indices such as Overall Equipment Effectiveness (OEE), Build to Schedule (BTS), Dock to Dock (DTD), First Time Through (FTT) und Total Cost, the implementation of the FPS tools and of the process-optimized ideas of the trainees are made visible. In four production simulations, the trainees learn how quality and in the end productivity can be substantially increased by simple means and through the diversity of ideas of the employees.

At the end of the workshop there is a concluding discussion and an evaluation.

Our experience has shown that the practical application of FPS in simple production simulations enables the trainees to understand the system and to implement it in practice.

After this workshop the trainees acquire an understanding of lean production in general and the Ford Production System in particular.

As an introduction to FPS the workshop is an initial module and is supplemented by the new places of operational deployment in manufacturing and maintenance. Here the trainees learn how FPS is implemented de facto.

The working-in phase in this place of operational deployment is much shorter, since the trainees have already learned the theoretical fundamentals in the FPS workshop.

The experience that some employees with years of experience in manufacturing are not as familiar with the new system as them and that they can shine with their specialized knowledge provides some trainees with a special sense of achievement. It is seen over and over in practice that it is not easy for every employee with years of experience to make the transformation from the Taylorite production system to lean production.

At present FPS is also being implemented in the "training workshop". Here, of course, the special circumstances set certain limits. Approaches to implementation are already seen in the use of certain tools, such as the Visual Factory, in the workshops, the use of Single Point Lessons (SPL) for the documentation of QM processes and important regulations and arrangements in training. We also use SQDCME indicators for our balance scorecard. (SQDCME stands for Safety, Quality, Delivery, Cost, Morale, and Environment)

Training methodology

More than ten years ago, training at Ford was characterized by the stipulations of the skilled worker examination. Items of training content were lined up and taught as in school. Thus the trainees were unable to develop an understanding of the relationships between the separate items of course content.

As a result, starting in 1993 a standard text-controlled training methodology (updating of training methodology – AdAM) was developed and introduced. It was now the task of the trainers to fill the methodology with project-related content. At first implementation was difficult because the time expended was greater than with the previous 4-stage method. Also, the new methodology demanded a greater commitment on the part of the trainer. For technical reasons and reasons of cost it was not always possible to make reasonable projects out of the previous courses. Moreover, all requisite content was to be dealt with for the skilled worker examination and other courses, for example in controls technology, hydraulics, turning and machining fundamentals etc. could not be dropped for that reason.

Because of this we tried to implement smaller projects referring to sub-fields of training such as the power supply unit project or the workbench vice project. The purpose of that standard text and project related training was to gradually introduce the trainees to a self-managed approach to a task or project (see full circle of action). For that purpose the trainee had to acquire the necessary specialized knowledge either alone or in groups, to make plans for carrying out the task and finally to acquire craftsmanship skills by working on sub-tasks.

As we see it today, the use of just one methodology proved to be too rigid. There are elements of training content that can better be taught by other methods. Today we prefer mixed methods. We select the methodology that suits each course and each project.

6) Quality assurance and transparency in training

The FAW has had a quality management system since 1996 and thus has been a pioneer in the field of initial and continuing education and training. We work according to ISO 9001. The quality management handbook (QMH), initially in paper form, was very soon made available to the employees as an online handbook. At the same time a transparent information system emerged in the Ford Intranet, which we call info-training planning.

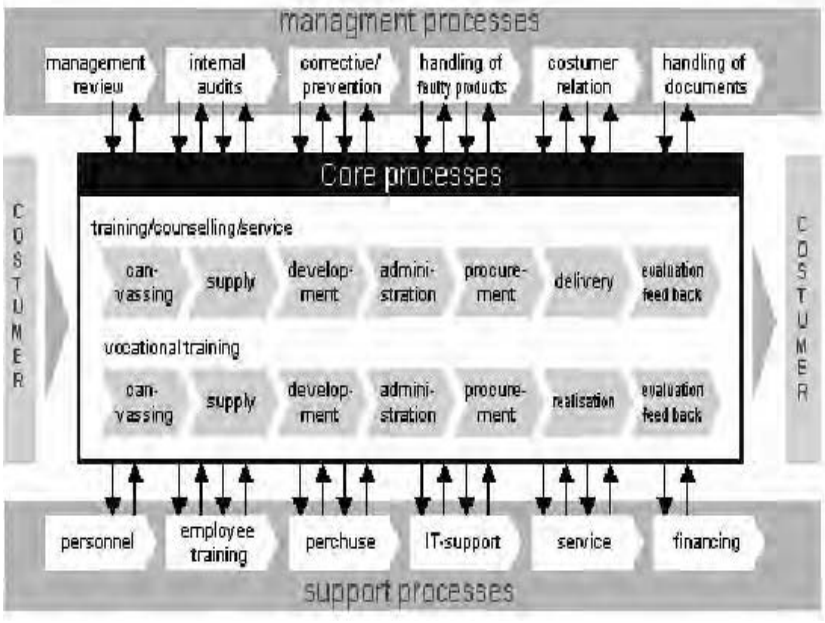
This info-training planning already contained at that time the QMH and further important information relating to training. The new process-oriented QM system was introduced in 2002 and the procedure and job instructions that existed at that time were adapted, amended and integrated into the processes from the viewpoint of process optimization.

The changeover to ISO 9001-2000 made the individual processes and interfaces in training more clear and thus easier to understand for employees of FAW e.V. The analysis of individual activities and their classification as core, support and management processes uncovered shortcomings and processes were changed accordingly.

The goal is to make our initial and continuing education and training leaner and also transparent for our customers by optimizing our processes.

The following process model was prepared for that purpose:

Figure 3.4: Process model of Ford, Cologne



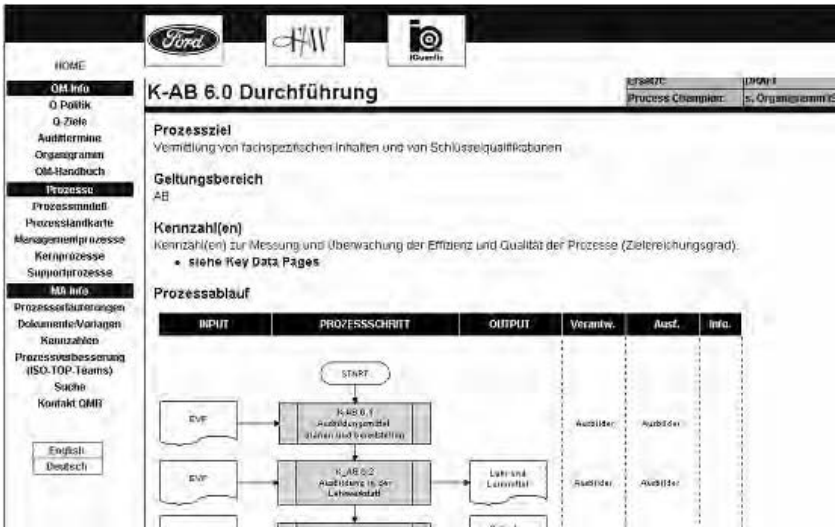
The process model is subdivided into management, support and core processes. The management processes are the processes that preventively ensure the quality of the organization's products or intervene correctively in the case of deviations.

Support processes subsume all those processes that are necessary to support the optimum course of the core processes.

Core processes define all value added activities from customer to customer. A distinction is made between the core process "training/counseling/service" and the core process "vocational education and training". The two core processes are then subdivided into seven sub-processes, "canvassing", "supply", "development", "administration/organization", "procurement", "delivery" and "evaluation/feedback".

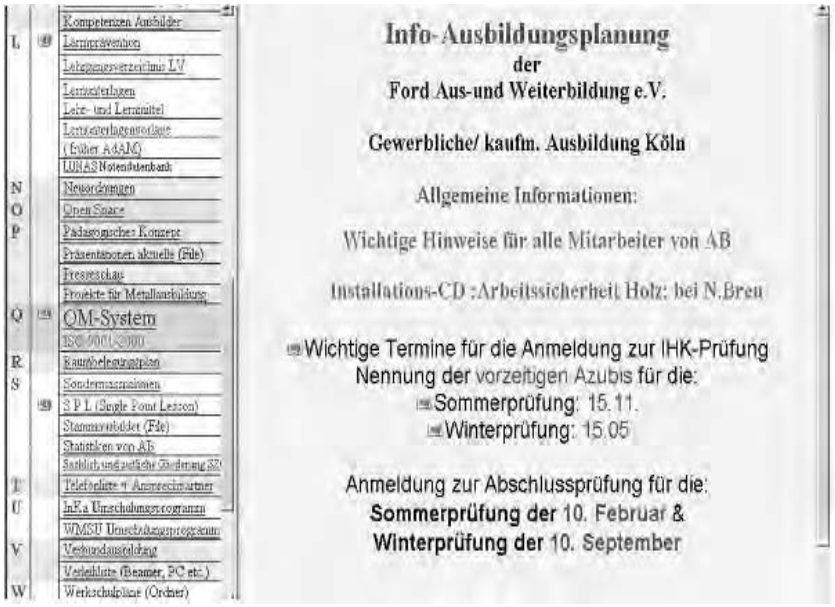
We have developed a process map for training to better illustrate the value added activities. The process map shows at a glance all core and support processes that are required in training. Link functions lead the employees as well as our customer directly to all quality-relevant training processes. It is thus possible to read clearly all process descriptions with the process target they contain, key indicators for measuring the efficiency of the processes, and the flowcharts for processes with the necessary interfaces with other processes and with input and output as well as the relevant responsibilities.

Figure 3.5: AB Cologne and Saarlouis process descriptions



We want our customers to be able to find out about the training progress of their trainees at any time. Our customers therefore have direct access to our quality management system (QMS) and our Intranet pages regarding info-training planning at any time. Information and facts of relevance to our customers, such as training progress, processes, interfaces and responsibilities, are always retrievable.

Figure 3.6: Info-training planning



The information portal, which we call info-training planning, is an important component of our transparent training. It contains all data and statistics from A as in Absenteeism statistics through C as in Competencies of the trainers to W as in Works school plans. All the data is updated on a regular basis. The grades of trainees can be retrieved online by authorized persons; this is still a pilot project at present.

Teaching and learning documents are available to all trainers in Cologne and Saarlouis. The dates of the skilled worker examinations for all groups are also posted.

The deployment and transfer schedules and the related allocation of trainers are retrievable. New arrangements for industrial and commercial training, special measures, training control, relevant statistical data and much more can be found on those Intranet pages.

Single Point Lesson (SPL)

As a supplementary source of information for employees and for our customers, when the Ford Production System was introduced a tool was initiated that we call Single Point Lesson (SPL) . This paper, produced as a one-pager, serves in our QMH as a level 3 process description (similar to a Job Instruction) and is intended not only for process descriptions but also for regulations and arrangements or as a checklist or operations plan.

The SPL is based on our organization chart, that is, it displays a hierarchic structure. The SPLs at the very top of the hierarchy are binding on all departments. Changes or new instructions can only come from top management. Simple instructions relating to day-to-day training procedure for which the trainers are responsible, on the other hand, can be suggested and noted by the trainers.

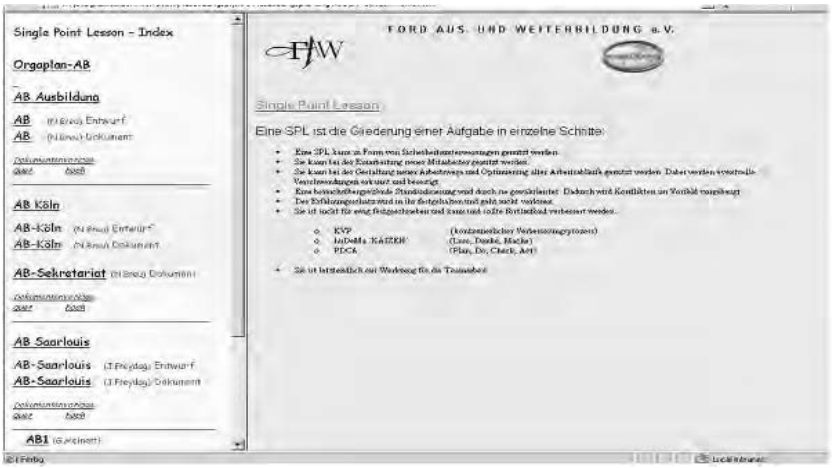
As a matter of principle, the different SPLs can be drawn up by those persons responsible for the relevant instruction.

The SPLs are administered by the QMC (QM Co-ordinator), who is the only person with administration rights in this system.

The system also allows other departments to adopt individual instructions for themselves if they seem useful for their own operations.

In this way, ideas are noted and exchanged and procedures and processes are optimized interdepartmentally.

Figure 3.7: SPL Portal



With time, information sources thus arise that make our activities more transparent for others as well as for us. Important information that used to be sent to all employees by email are now included in the info-training planning as SPLs and can be retrieved at any time.

When changes are made in operations, the SPL serves as a basis (present state) and helps in making decisions to optimize future procedures.

Since this kind of information source was introduced, the working-in of new employees has improved because the most important information on the workplace and its interfaces is kept up to date and retrievable at all times.

The figure shows an example of the Single Point Lesson. It deals with the individual theme instruction “statement of travel expenses” and explains each step in the process.

Figure 3.8: Top hierarchic level (AB level)

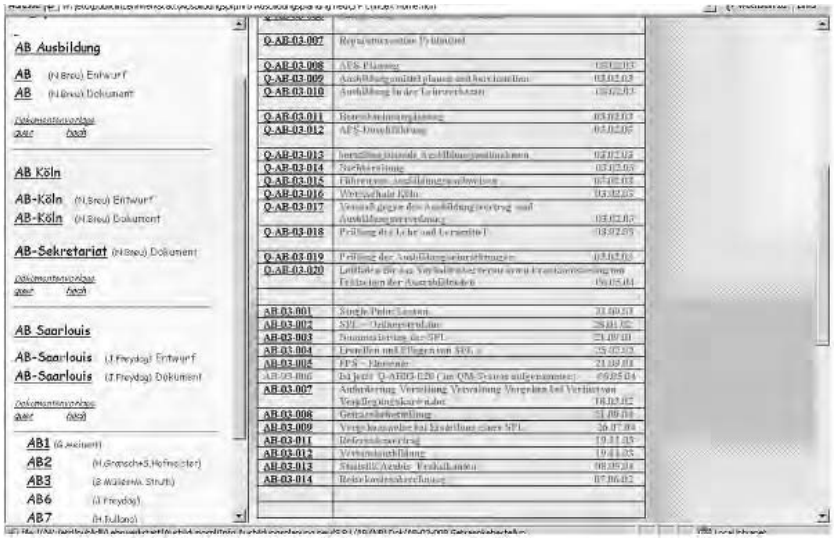
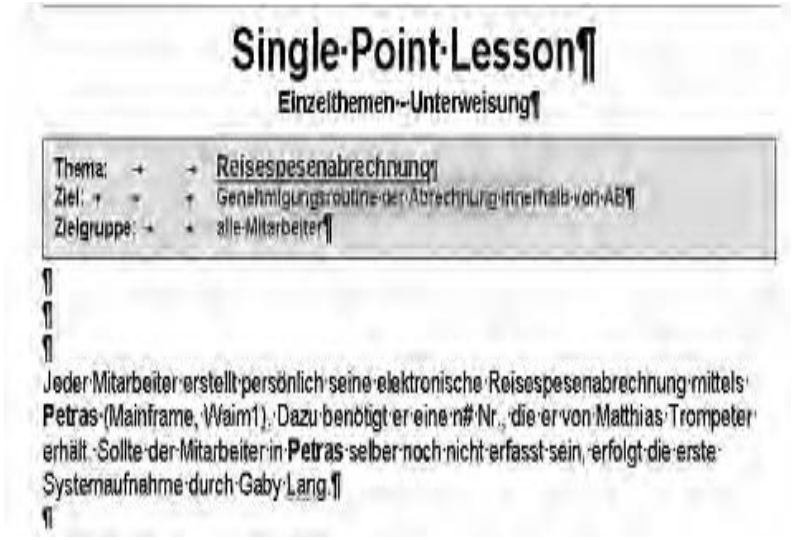


Figure 3.9: SPL



Single Point Lesson

Einzelthemen-Unterweisung

Thema: Reisespesenabrechnung

Ziel: Genehmigungsroutine der Abrechnung innerhalb von AB

Zielgruppe: alle Mitarbeiter

Jeder Mitarbeiter erstellt persönlich seine elektronische Reisespesenabrechnung mittels Petras (Mainframe, Waim1). Dazu benötigt er eine n# Nr., die er von Matthias Trompeter erhält. Sollte der Mitarbeiter in Petras selber noch nicht erfasst sein, erfolgt die erste Systemaufnahme durch Gaby Lang.

Concluding remarks

The training concepts described in this document with regard to production work (production islands, training islands etc.) have not yet been implemented everywhere for all occupation groups in the fields mentioned.

Also, there are deviations in the stockroom logistics expert and industrial clerk areas. Their training takes place mostly at the relevant company places of deployment. Courses such as are offered in trade and commercial training are not scheduled for these vocational education and training schemes.

The value-added company deployment of the prospective industrial clerks and stockroom logistics experts is supported by methodically and didactically prepared standard texts that are worked on in the group with the specialized trainer at regular intervals.

Case 2: DaimlerChrysler AG, Mannheim Plant[57]

Quality assurance through initial training and upgrading of qualifications, exemplified by DaimlerChrysler Mannheim

1) Background – Brief overview of DaimlerChrysler AG's Mannheim Plant

The Mannheim Plant of DaimlerChrysler AG is a location where tradition meets progress:

On this site...

- the first car factory was founded
- the fuel-cell drive system made its debut in a mass-produced vehicle
- some 10,000 of the group's workforce are employed

- the full spectrum of expertise is brought together from DaimlerChrysler motors, the DaimlerChrysler foundry and EvoBus GmbH (a 100% subsidiary of the group serving the Mercedes-Benz Omnibusse/Setra segment)
- diesel engines are produced for commercial vehicles of all kinds
- 100,000 tonnes of castings per year are transformed into high-grade technological products
- bus bodywork production takes place for all European assembly plants
- Citaro city buses, used for public transport, are manufactured in their entirety.

To perform such a special range of functions, special employees are needed. Only with quality, innovation and commitment can the company meet its customers' expectations. This is why DaimlerChrysler AG, one of Mannheim's major employers, offers a demanding but diverse vocational training program:

[57] This part was prepared by Volker Engert (DaimlerChrysler AG).

Formal training in recognized occupations Technical occupations:	Business/commercial occupations:
Production Mechanics Motor Vehicle Mechatronics Technicians Mechatronics Fitters Vehicle varnisher	Office Communications Clerks Industrial Clerks Information Technology Officers
Berufsakademie (College of advanced vocational studies) vocational/study programs Engineering degrees:	Business degrees:
Diplom-Ingenieur/in (BA) (Berufsakademie graduate in engineering) Specializations: Mechanical Engineering Mechatronics	Diplom Betriebswirt/in (BA) (Berufsakademie graduate in business administration) Specialization: International Business Administration

This vocational training is carried out by supervising instructors, and by additional instructors (fully skilled workers for whom instructing trainees is a secondary responsibility).

2) Changing demands at work call for different qualifications

Skilled workers at DaimlerChrysler are not only expected to manufacture products of flawless quality. Given the cost of the production systems which manufacturing workers are responsible for operating, overseeing and inspecting, these have to be maintained to ensure high production levels at all times. Possible faults or damage need to be spotted early on, and prevented or corrected as quickly as possible in order to keep stoppages to a minimum.

The newer equipment is fitted with electronic control and regulation systems and stoppages are relatively rare, but it differs from a mechanical plant in that faults are often impossible to identify directly. Instead, it is necessary to undertake abstract analytical checks. Skilled workers may not find the fault simply by inspecting their equipment, but may also have to consult circuit diagrams and drawings in order to locate the problem. This calls for knowledge and understanding of the abstract symbolic codes relating to the given equipment. One program command may indicate the machine's problem, and another program command may be necessary to restore it to working order. In both instances, an intellectual connection must be made between an abstract command and a mental representation of the process.

So the objective of training is now the following: an employee who is capable of independent planning, implementation and review; who is equipped with trade-specific and more widely applicable skills; who can apply them confidently while performing a variety of functions, and is capable of adapting flexibly to new working structures and production methods.

An indispensable complement to these high technical requirements are human qualities such as independent working, self-critical thinking and self-review, a sense of responsibility, self-directed learning, cooperation and communication skills. Increasingly, methods are being used which counteract the tendency towards narrow specialization, enrich the experience of work and frame it as a more holistic process.

From rotating, cross-departmental work assignments, employees at the Mannheim production facility become familiar with neighboring departments and are gradually integrated into them; in the process they acquire different or higher-level cognitive and occupation-specific competencies. This prevents or alleviates any experience of boredom and monotony. It also opens up the possibility of systematically upgrading qualifications throughout the work process up to the standard necessary for undertaking repairs.

This acquisition of new knowledge and skills through rotating work duties challenges individual employees and groups to take decisions concerning their role and their assigned task. Employees take responsibility, for example, for replenishing materials, arranging cover when individual employees are absent, or regulating working conditions.

A particular challenge arises from the increasingly abstract and complex nature of the technology which overstretches those employees with more hands-on, practical aptitudes; the training must therefore be very clearly related to practice. Equally, modes of training intended to facilitate induction of new employees and continuous education and training must meet this criterion.

Against this backdrop, corporate efforts to recruit and train new employees and to retain a highly qualified workforce need to change drastically.

Corporate training must increasingly be viewed as an investment in a company's ability to survive, and not as a short-term expense. It should ensure that the Mannheim works can rely on the availability of competent junior employees who can be deployed flexibly on the basis of a high level of up-to-date competence.

3) Initial and continuing education and training as part of the corporate philosophy

The quality of initial vocational training creates the foundation for success. With this affirmation of quality, initial vocational training at DaimlerChrysler is undergoing continuous improvement.

On 01.10.1999, DaimlerChrysler published a document on the tenets of vocational training ("Grundpositionen zur Berufsausbildung"), specifying the qualitative framework and future direction of its initial vocational training. Taking a joint stance, company management and the works council underscored the strategic importance of initial training to the company's long-term success.

In adopting these tenets, DaimlerChrysler is making a commitment to recruit the next generation of production workers primarily from within its own initial vocational training set-up. As a core strategic function, initial training is a shared task for which all executive staff have responsibility – from the management board to the trainer on the shop floor.

The assessment system – AiD ('Ausbildung im Dialog' – 'training in dialogue')

In parallel with the publication of the tenets of vocational training, a new assessment system was launched. Called 'Ausbildung im Dialog' ('training in dialogue'), shortened to AiD, it was introduced throughout the DaimlerChrysler vehicle business.

It is a 'holistic' process which integrates the assessment of occupation-specific and key skills. Dialogue between the works council and company management was the key to establishing a forward-looking training culture which is passed on in dialogue between trainees and trainers, between the domains of training and production, between the workplace and the vocational school. The principle of dialogue gives the trainees a full and active role in the training process.

They assess the current status of their own qualifications, and this assessment leads them into dialogue with the trainer responsible for them. Furthermore, they have the opportunity to give regular feedback on the progress of their training. This means that they contribute to the continuous optimization of the initial training scheme.

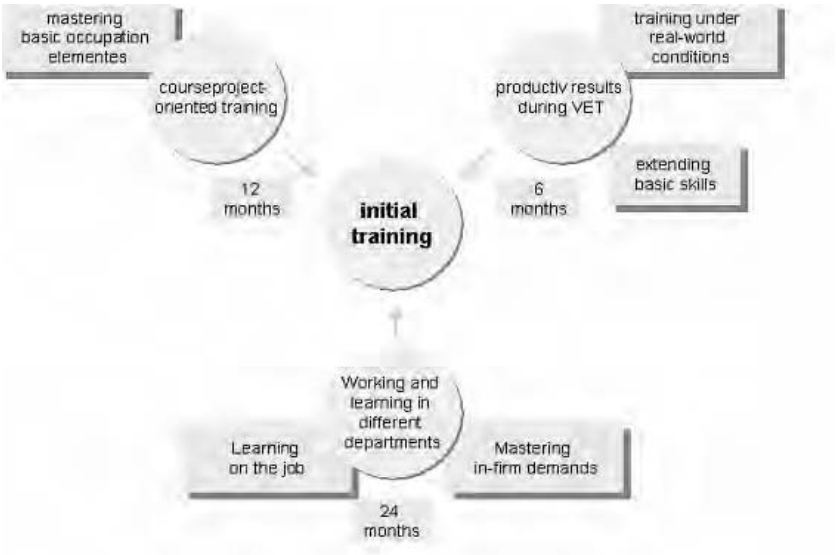
But although the trainer's latest assessment and the trainee's self-assessment are the basis of the dialogue, they do not conclude the process. The cycle is only completed when concrete steps are agreed to foster further progression.

Quality assurance and the role of training: striking a balance with corporate tradition

In Mannheim the situation is rather unusual in that the vocational school is integral to the plant, so close coordination between the school and the workplace is possible at all times. The overwhelming majority of trainees have block instruction, i.e. every third week is a school week. This gives trainees the benefit of connected learning opportunities, both in school and in the workplace.

The trainees are grouped by occupation and by length of traineeship. Throughout their traineeship, they are supported by supervising instructors and additional instructors (skilled employees for whom this is a secondary responsibility).

Figure 3.10: Core elements of vocational training at Daimler Chrysler Mannheim, Germany



At the beginning of initial vocational training (in the first few months) and in their second year (after about 14 months) all trainees take part in one-week personal and social development courses which are run by the supervising instructor directly responsible for them.

The Mannheim site has a training workshop (a factory used for teaching) which is fully equipped with modern machinery and appropriate teaching rooms. The trainees spend approx. 12 months of their initial training in the teaching factory, and approx. 24 months in different departments.

Trainees initially master basic occupation-specific elements by undertaking training courses and project-based modes of training. After that, they extend and consolidate these basic skills by applying them to real manufacturing tasks. 'Workplace placements' generally begin from the middle of the second year of training, after the basic qualification phase is concluded. Prior to this, there are short 1-2 week 'taster placements' so that trainees can learn their way around the factory.

The objective of the 'workplace placements' is to enable the trainees to consolidate and extend the basic qualifications they have gained by applying them in real conditions in the workplace. At the same time, they find out more about potential future jobs.

Quality assurance and internationalization – what can corporate training contribute?

Modern-day 'workplace placements' follow a process-oriented approach: the **'Arbeiten und Lernen im Fachbereich'** ('work and learn in the department') scheme, known by the acronym ALF, enables learning on different levels and a process-oriented approach. The individual planning of procedures and assignment of tasks is geared to the department's current needs.

ALF is a form of on-the-job learning which also lends its name to the adapted 'workplace transfer placement' scheme (whereby initial vocational training takes place in production departments) operated at DaimlerChrysler AG in Mannheim.

After acquiring the basic skills of their trade in the training workshop, trainees are assigned to departments of the company where they apply their skills under real-world conditions, consolidating and extending them in a practical context. This also enables them to get to know different departments and areas of work in which they may later be employed.

The ALF scheme aims to meet the individual needs of the trainee equally as well as it responds to the department's requirements for qualified junior employees. To achieve this, the learning opportunities available in the department must be better utilized than in the past, by organizing learning differently.

Changes in corporate structures, in technology and in society's system of values are shifting the focus of training from occupational skills and expertise alone towards key skills. The importance of key skills is constantly growing because they will enable skilled workers to adapt to changing requirements in years to come. The ALF scheme aims to promote the training of mature skilled workers by using a phased development concept.

Organizing learning differently is an effective response to reforms in the organization of work (e.g. the introduction of work groups) and may interact usefully with such reforms as they are put into practice.

The ALF scheme is also intended to promote the idea of CIP (the Continuous Improvement Process). Only by making use of every possibility for improvement can the company realize its potential for success and maintain its all-important competitiveness.

The main parameter of the reformed scheme is a longer 'workplace transfer placement' period of at least 16 weeks in one department, for 3-4 trainees at a time. The trainees have time to become thoroughly integrated and familiarize themselves with the full range and scope of the department's work. Thus they can also be introduced to more demanding kinds of work, to which they can apply their occupation-specific expertise and skills to the full. In this way, they have the chance to work purposefully and independently on complex tasks from every angle.

Another prerequisite is the innovative use of supervising instructors. These are fully qualified employees who are designated as supervisors and partners to assist the trainees in integrating into the work process.

This endows the workplace with a new meaning as a setting for learning. Concepts which have been developed for the purposes of initial training can often be used directly for the continuing education and training of skilled workers.

The activities that make up the work process are assembled and documented in operationalized learning assignments relating to particular work and activities, in line with the model of 'action competence' (Handlungskompetenz) proposed by Prof. Dr. Theo Hülshoff of the University of Koblenz-Landau. Following this methodology, the action competencies necessary for the skilled accomplishment of each activity can be systematically collected and documented.

New training medium: the ‘didactic database’ (‘Didaktische Datenbank’)

For this purpose a new training medium was developed, dubbed the ‘didactic database’ (‘Didaktische Datenbank’).

The relational structure of a ‘didactic database’ gives users the flexibility to document every conceivable work procedure and the corresponding action competencies, and to update this information on an ongoing basis. The question of ‘competence’ is the guiding educational principle, so users of the ‘didactic database’ are free to contribute their own ideas and experiences to the information on job-specific procedures previously stored in the database. New media such as digital photos, videos and flash animations can be accessed via a ‘didactic database’ in the workplace, where the learner can consult them directly.

The Mannheim Plant's 'didactic database' training medium was named the 'production learning system' (Produktionslernsystem – PLS).

Internationalization

The experience that had been gained with the PLS at the Mannheim Plant was then put to good use for bringing the new Series 900 engine into production in Korea.

The training content needed for this operation was systematically assembled in Mannheim and translated into English and Korean. In late 2003, Korean training multipliers were then trained in engine assembly in Mannheim, with the help of the PLS. First they were introduced to the training content theoretically, using the PLS as a training medium. Afterwards they received individual instruction at the relevant work station or by working on a specially prepared training engine.

These training multipliers returned to Korea and passed on their knowledge to their colleagues, communicating the training content using the 'didactic database' on assembly skills which they had brought with them from Mannheim. Afterwards, individual instruction was given and skills demonstrated using prepared engines. Colleagues from Mannheim assisted them in putting this into practice.

Using this training concept which relates directly to the skills required for a given job, self-directed learning can be implemented in a standardized form anywhere in the world.

Another advantage is evident in terms of costs and efficiency: before this, transferring training content to a different location always meant dispatching a large number of experts. One problem was that the technical specialists often lacked the teaching skills to convey their knowledge effectively to others. Moreover, when they left, they took their knowledge with them and all that remained in situ was what they had imparted during their stay.

Today the PLS is a central repository for this expertise. In place of a large number of technical experts, just a few training experts travelled to Korea to carry out the know-how transfer. The work-related expertise could be left in situ even after their departure, thanks to the PLS. Training sessions could be carried out and repeated at any time, in any part of the production facility or any training room with access to the intranet.

Target-group-specific training programs in initial and continuing vocational training

The PLS is a training medium which can be used with specific target groups as an information, qualification and knowledge management system In addition, it gives people a means of

recording and storing empirical knowledge, which can subsequently be adapted for teaching purposes and made available as a standardized training resource.

Training for existing and new employees now takes place quickly, efficiently and directly in the workplace, to meet specific objectives and without the need for lengthy preparation. At the Mannheim Plant, people are not sent for continuing education and training – it comes to them.

Knowledge is the catalyst for any action taken by employees. As such, it creates value, so company management channels its support for this philosophy through the executive staff.

The 'production learning system' (PLS) has gained universal acceptance. It has impacts on the corporate culture, but above all on the culture of learning. Employees must be motivated to continue to upgrade their qualifications. It is no use producing bureaucratic documentation of every process but not making it accessible to others Knowledge must be seen by everyone as a factor of production. Only then can everyone benefit from this system and contribute to its continuous improvement. In the federal state of Baden-Württemberg, where the Mannheim Plant is located, a collective agreement on further and continuing training is in force. It contains a defined framework for the joint planning and documentation of training by skilled workers and managers.

At the Mannheim Plant, at least in departments in which the PLS has been introduced, training is delivered using the training content stored in the PLS. This provides a basis for lifelong learning since the contents are constantly adapted to take account of changes in the workplace.

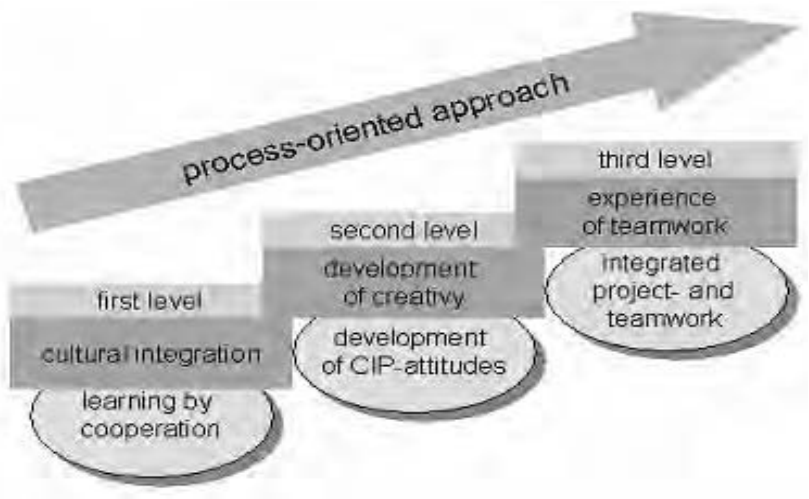
Training concepts and new media in use in initial and continuing vocational education and training

Training concepts for initial vocational training and continuing education and training of the skilled workforce in the Mannheim Plant are geared towards trainees and employees taking on autonomous responsibility. This is the purpose of the ALF (Arbeiten und Lernen im Fachbereich – ‘work and learning in the department’) training scheme which facilitates learning on three levels and follows a process-oriented approach (Figure 3.11).

The first level is intended to deal with cultural integration of the trainee into the department. Trainees experience the departmental culture and are involved to the full, both professionally and socially. They work as part of the team on all tasks that arise. Certain organizational parameters, such as trainees working the same hours as the rest of the department, make this integration easier. The learning objectives on this level are primarily accomplished by working alongside others. The supervising instructor familiarizes the trainees with the department's work, introduces them to the department's tasks, lets them assist with the work, and assigns them tasks with increasing responsibility until ultimately they can complete tasks or parts of tasks autonomously.

This process is supplemented with reflective discussions. Sometimes trainees will be able to ask questions about the broader context of their work and have this explained to them by their supervising instructor, and at other times the instructor will assess the trainees' practices, offer constructive criticism and advise them on completing their assignments.

Figure 3.11: The three levels of the ALF



('Arbeiten und Lernen im Fachbereich' – 'work and learn in the department') training scheme.

Based on the knowledge they have acquired about the department and its ground rules, during the second phase trainees can develop and apply creativity. They have the opportunity to solve problems relating to procedures and products, working independently and taking responsibility for their own work. This promotes the Continuous Improvement Process (CIP). On this level the trainees engage in learning which is self-directed, discovery-based, problem-solving and creative. In doing so, they equip themselves with vital qualifications for participating in the CIP.

On the third level, the trainees gain experience of teamwork by working on full-scale project assignments as a fully integrated team member, or in a team of trainees. They are integrated into both occupation-specific tasks and group dynamic processes. The learning objectives on this level are accomplished via full-scale project and team assignments. It is a holistic mode of learning which encompasses self-directed, discovery-based, problem-solving, creative and social learning.

The levels of the development concept described build dynamically upon one another and become increasingly demanding. The first level lays the foundation for achieving the higher levels, because without integration into the department and knowledge of the tasks and ground rules, the higher levels will be impossible to master. The boundaries between the levels are fluid because, for instance, a CIP idea can give rise to a project which can only be accomplished by means of teamwork.

With past forms of workplace assignment, the ALF scheme makes higher demands of everyone involved. To a great extent, trainees are responsible for their own success as learners. The phased development concept gives everyone the chance to be supported and challenged appropriately, and to work towards meeting the requirements step by step.

The accomplishment of the goals depends in part upon the trainee's personal motivation and commitment, and in part also upon the supervising instructor's support. For the department, this scheme does increase the manpower commitment on supervision. However this extra input is justified by the gains for all parties:

- the department has the benefit of skilled work from its trainees and improved processes and products
- trainees can work on more demanding tasks, and thus learn more, and the phased development concept provides them with more support than before.

The ALF scheme can be characterized by the following six features (Figure 3.12):

Figure 3.12: Six features of ALF

1. **Working and learning** are closely interlinked in the ALF scheme. There is unity between the organization of learning and the organization of work. Learning relates to real tasks. The setting for learning is the workplace, in the department, using its machines, systems and materials, working with departmental colleagues, according to existing corporate structures and procedures.
2. The **development of key skills** is an essential objective of the scheme. The development and transfer of key skills follows the underlying educational approach of the PLS. The defined job-specific skill-profiles enable supervising instructors to demonstrate the key skills in the learning environment
3. **Cultural integration** is the objective of the first level, and has already been described. It is the prerequisite for attainment of the higher levels of learning.
4. On the second level, the **development of CIP practices** builds upon this cultural integration.
5. The purpose of **full-scale projects and team tasks** is to promote holistic thinking and action. They must be set up in such a way as to allow the integrated transfer of key skills. These represent the highest level of learning integrated with work (see 3. Level 3, above).
6. **Development of human resources** by equipping the supervising instructors with teaching skills is a key prerequisite for the success of the 'workplace placements'. To provide effective training, they need support firstly from their line-managers who are generally designated training officers, and secondly from corporate training employees, whose advice they may need to call upon.

Acquiring the skills and fulfilling the supervising instructor role, with supervisory and 'executive' responsibility for trainees, enables instructors to gain some initial managerial experience. Responsibility for this human resources development falls to the supervising instructor's line manager, as part of his or her management role.

Supervising instructors are trained in the use and management of the PLS. There are other schemes for training instructors/supervising instructors for whom training is a secondary responsibility:

- Training in the principles of the AiD ('Ausbildung im Dialog' – 'training in dialogue') scheme
- Planning of corporate learning processes in the workplace setting
- Operation and application of 'production learning systems' (PLS)

Experience so far

With the introduction of the 'production learning system' (PLS), the link between the work process and the learning process is given much higher visibility. The work-related, standardized, educationally adapted skills profiles for individual jobs clarify precisely what there is to learned in each job, why each job is a learning opportunity, and how 'learning while working' actually works.

In the departments in which the PLS has been introduced so far, it is fulfilling its purpose. Trainees, trainers, employees and managers make use of the contents as an information and training resource. Practical information on initial vocational training and upgrading of occupational skills for any job can be accessed directly.

A high degree of synergy is also evident from the fact that trainees are initiated into the PLS methodology at the very start of their initial vocational training. This gives rise to phases of active self-directed learning during initial vocational training. In the training factory, trainees work on various projects to learn the basic skills of their occupation. One example is the 'compressed air engine' project. This involves manufacturing and assembling all 26 components of a miniature engine.

The project work is intended to develop key skills such as independence, responsibility and methodical work. The PLS functions as an information resource, i.e. all the necessary information to produce the parts is stored in the database. The trainer adopts the role of a coach and is on hand if problems arise.

Likewise, on placements in the factory, the PLS helps the trainees to get to know the department better. They in turn help the respective departments to maintain the system by entering particular jobs into the PLS as a learning assignment, or updating its contents. At the same time they can use it as a reference work to look up technical terms.

This way, future skilled workers become familiar with the PLS during their initial training and need little introduction to it when they are assigned to a department. Instead, they already know where to find the training content and how to use it.

4) Outlook

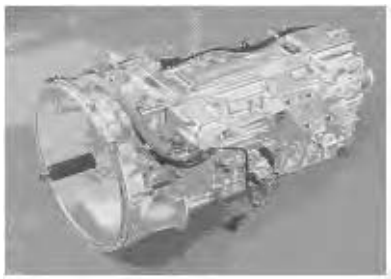
Based on past experience of using new media in initial and continuing vocational education and training, for both work-related and training-related applications, it has proved possible to integrate them into corporate reality successfully and profitably in the form of the PLS.

The concepts founded on scholarly research are constantly evaluated and reflected upon, which ensures their continuous refinement and improvement. The results clearly show that within this concept, particularly in cooperation between the training department and the production departments, new media can achieve their potential and contribute to a new quality of initial and continuing vocational training.

For the next few years, there are plans to introduce the PLS with its information, skills and knowledge management capabilities, as a networked learning infrastructure throughout all departments of the Mannheim Plant. The PLS methodology will also be transferred to service departments and commercial departments. Now that the first results and experience have been established, more are sure to follow.

Case 3: DaimlerChrysler's Gaggenau[58]

1) Factory

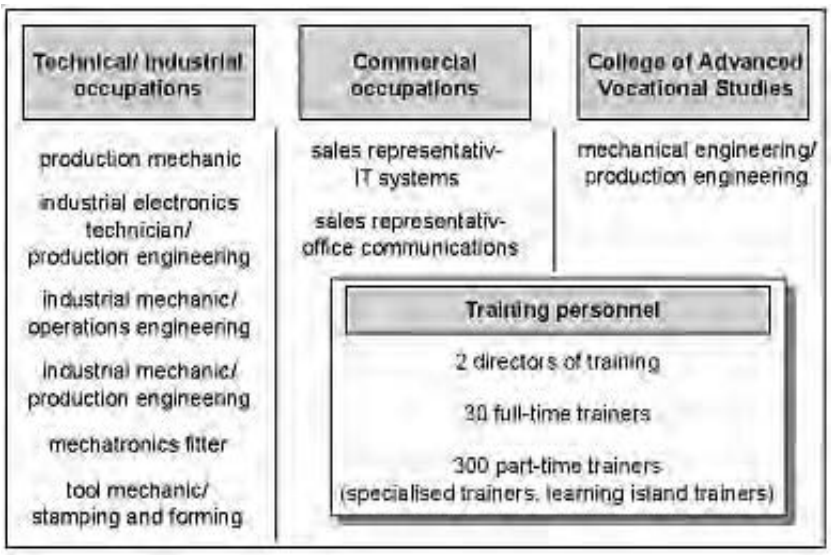


Currently 6500 employees are occupied in the production of gearboxes and axles and various other products for the automotive industry in the Gaggenau factory of the DaimlerChrysler AG. Highly advanced machining technology is typical for the Gaggenau production, with a skilled worker rate of about 60 %. Gearbox manufacturing is the main focus of the Gaggenau production, with a total yearly output of 240,000 gearboxes in 4,500 customized variants. They range from gearboxes for passenger cars and vans to units for heavy goods commercial vehicles.

Other mainstays of production are external planetary axles for use in commercial vehicles and buses, with a total yearly production of 48,000, as well as 5,000 portal axles for highly mobile all-terrain commercial vehicles. The wide range of products made in Gaggenau is rounded off by torque converters, forming parts, machining parts and packaging material.

[58] This part was prepared by Bruno Treiber and Gerwin Kohlbecker (DaimlerChrysler AG Gaggenau)

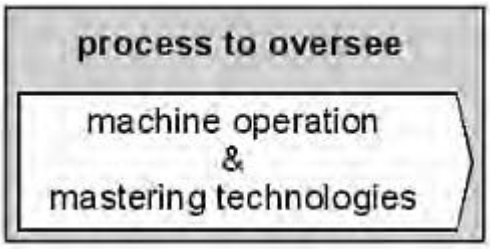
The Gaggenau site, currently with 480 trainees, is the largest company providing training in the region. Vocational education and training is being offered in six industrial and technical occupations, two commercial occupations and one BA course of study.



2) Factory and process development

Performance-oriented factory

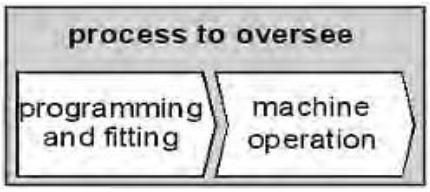
For many decades the Gaggenau factory for manufacturing gearboxes underwent almost no changes with regard to its technologies and organization. Hand-driven and mechanically automated machinery for producing gear wheels and gearbox shafts were typical means of production. Machinery for the same manufacturing method were combined in specialized departments such as the turning shop, the milling shop and the grinding shop. The number of gearbox variants was relatively small. The workplace, i.e. the process that the employee had to oversee, involved mainly feeding the machine with parts and small adjustment functions. Mastering the technology was the key to achieving high product quality. Specialized functional departments were responsible for job control, material supply and quality assurance.



The occupation adequately meeting these requirements was that of a turner trained on manually operated turning machines, with extensive machining knowledge.

CNC manufacturing (cf. phase 1)

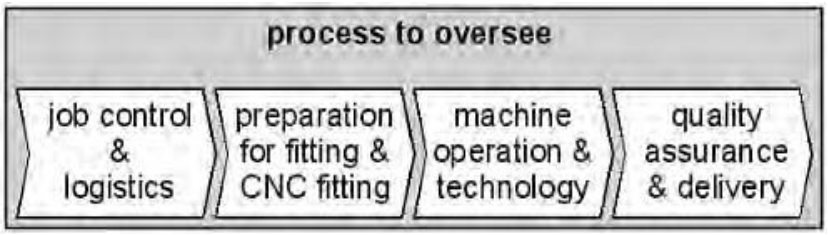
In the past 15 to 20 years the factory has changed rapidly. The widespread introduction of CNC technology was the decisive incentive for this change. It led to enormous investment needs, followed by a massive demand for qualification of the employees. CNC programming and setting up the machine became imperative at every workplace. At the same time the number of product variants increased sharply. Mastering the technology, on the other hand, became slightly less important due to more process-sure machines and tools.



Vocational education and training responded to the changes by introducing new occupations which were less focused on trades and crafts, for example that of industrial mechanic for production engineering.

Group work (cf. phase 2)

Group work became an important topic in the factory almost at the same time, accompanied by explicit reorganization measures. Machines, usually of the same technology, were grouped together, as were their operators. The workplaces were successively enriched with additional content, following the group work approach to bring "more responsibility to the place where value is created". Since then every workplace has included responsibility for job control, supply of material and tools, setting up and operating the machine and quality control. Multiple machine operation has become possible. The new requirements, particularly in the methodical and social fields, necessitated extensive team building activities, qualifications and organizational changes in the past ten years in order to reach this goal.



The occupations introduced with the reorganization of occupations in 1986 were not prepared for this development. They did not and do not include any content in the organizational field or for the development of the necessary key skills. The learning island in Gaggenau, which includes a high percentage of group work for the trainees, was a factory-specific reaction to the changed requirements.

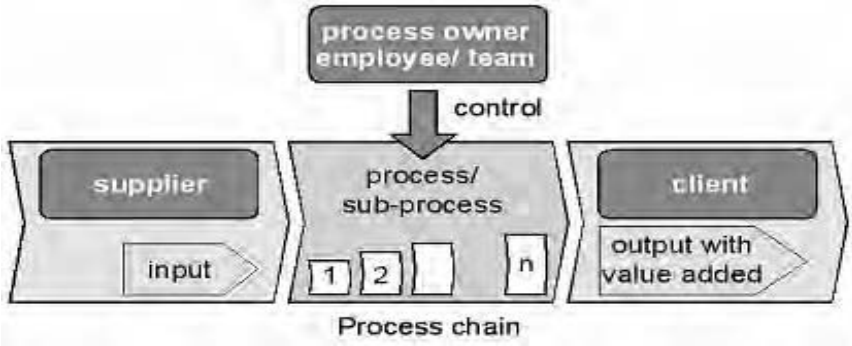
Process-oriented factory (cf. phase 3)

A process

- has a measurable input and output
- has a defined beginning and a defined ending
- has a predecessor (supplier) and a successor (client)
- has measurable value added
- is controlled and managed by a process owner

- can consist of several sub-processes and can itself be a sub-process
- can be repeated in the same manner.

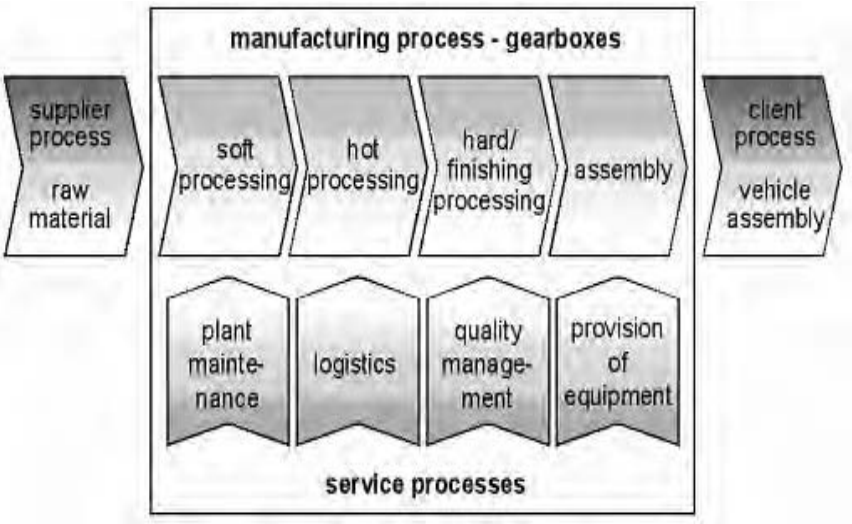
The succession of such activities is a process chain.



The goal of introducing process orientation in the factories is to create continuous processes from supplier to client without interfaces, thus achieving customer-oriented all-round processing. Process orientation attempts to shape processes in the optimum way and improve them constantly, with the help of all employees. Noticeable improvements in productivity, shorter throughput times, optimized problem solutions and better teamwork are the expected results.

Programs for implementing process orientation and for stabilizing what has been achieved so far have been started concurrently and are being realized. The titles of these programs are: Business Process Optimizing, KAIZEN, Continuous Improvement Process (KVP), and Daimler Chrysler Production System (DCPS).

At the same time the factory, which was up to that point technology-oriented and performance-oriented, was restructured. The gearboxes will in future be manufactured from raw parts to final assembly in process-oriented factories, i.e. in model-specific specialized factories.



3) Effects of process orientation on the employees

So what does thinking in processes mean- one of the most important guiding thoughts that must be internalized by the employees is the client-supplier-relationship. This concept views each successor unit as a client of the preceding unit. All employees have to understand that they are part of the process, must know their positions in it and which tasks they have to fulfil in that position. The effects of their actions on the client process or client processes must be known to them. To think in a process-oriented way means to detect current and potential drawbacks and mistakes, to learn from them and to have the foresight to effect changes which improve and safeguard the process in future.

Risks of the process-oriented factory

Today's gearbox production is directly networked with final vehicle assembly, owing to modern, computer-based order management. Gearboxes are produced in Gaggenau one day before assembly. Disruptions in the gearbox production thus have direct effects on final vehicle assembly in the Wörth truck factory. And the new process-oriented manufacturing systems for gearboxes are of course very susceptible to malfunction due to their high degree of mechanical and electronic interconnectedness. The changed technological requirements and the process-oriented combination of machinery have made it necessary for the employees to master various different manufacturing technologies.

Experience in companies implementing process orientation has shown that there were resistance and anxieties among some of the staff. Typical fears were loss of one's job, excessive demands on one's professional and social competence and changes to the familiar environment.

For that reason in particular, companies have to face the major task of already preparing "tomorrow's ideal employee" for the future today. New occupational profiles need to be created, and the foundations for process-oriented thinking have to be laid already in vocational training. Thinking in processes will already be demanded and promoted during training if it takes place in process chains. This allows not only an outlook in different directions but also an integrated view of the workings of a factory.

4) Vocational Education and Training in Gaggenau

Steps towards Development of Process Competence

The willingness of all participants in the training process to be innovative can be regarded as one of the most formative characteristics in the long history of vocational education and training in Gaggenau. But innovativeness alone was not enough to initiate processes of change. Time and again, visionary impulses from those responsible for training were necessary to transport future forms of learning and working into the immediate present.

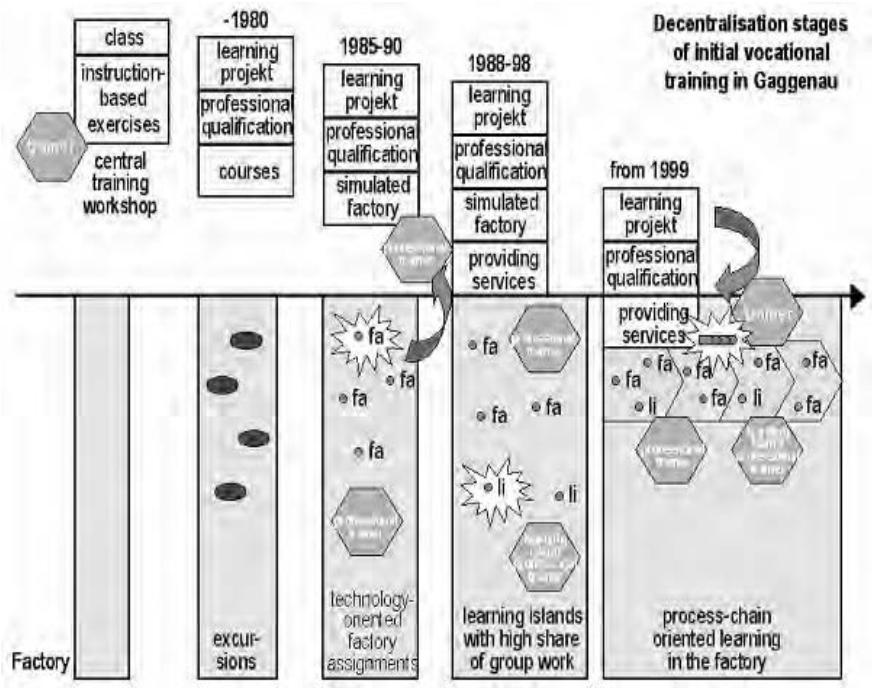
The now legendary Steam Engine project in the 1970s was in this regard already the predecessor of a changing working and learning environment. Back then we could already observe the first

tendencies to overcome Taylorist structures which left a major share of the employees' potential unexploited.

The past three decades of vocational education and training in Gaggenau resembled a continuous improvement process where we again and again had to answer two questions: Are we doing the right things, and Are we also doing things right-

Vocational education and training in Gaggenau until the beginning of the reorganization of the electrical and metalworking professions was shaped by centralized working and learning independent of the factory. In the run-up to this reorganization the Development Network Pilot Experiment, carried out in cooperation with partners from nine different companies providing training, led to a reorientation of initial training with the clear goal of using the factory as the primary learning place. The reason for setting this goal was the common prediction of a continuous technological change in the future, clearly discernible in the development and increasing use of electronic control systems.

This new direction was the prelude to a large scale decentralization which today stands for process-oriented working and learning in the factory. On the solid basis of a tried and tested basic vocational education, three phases of decentralization were necessary.



Phase 1 – Optimizing deployment in the factory

The reorganization of the electrical and metalworking professions in 1987 created occupational profiles which, for the first time, took the requirements of industrial production into account. As an example we can take CNC technology which required a completely new type of skilled worker with the skills to master whole manufacturing systems and a significantly reduced focus on traditional crafts skills.

In the framework of the Development Network Pilot Experiment we took advantage of the windows of opportunity offered by the Ordinance and developed and tested approaches to utilizing parts of the production process as a new learning place, based on the experiences with project-oriented, guiding-text-based and team-oriented training concepts.

A few of these approaches were:

1. Developing and stating teaching and learning strategies for all the factory assignments of a given occupation, thereby guaranteeing the trainee an optimum order of stations in the factory. The idea behind this was to offer the trainee not a rigid order of relocations but branching points and possibilities of choice which encourage creativity and are adapted to the individual learning behavior.

2. Increasing learning productiveness through a range of various forms of working and learning in preparation and as accompaniment and wrap-up to factory assignments. While previously only the act of doing and the preparations for it were the center of attention, there was now also a focus on reflecting about what is being done. An important milestone on the path to today's process learning.

3. Using full-time trainers to qualify part-time vocational trainers and training representatives so that they can support in-factory training. With this personnel development measure at the skilled worker level we not only created a close-meshed and wide-ranging network in production and fields adjacent to production but also clarified the roles of vocational trainers and training representatives, which were not clearly defined before.

4. The consequence of all these approaches was to give the trainers more room for action and to greatly expand their responsibility for the organization of learning. While the main responsibility for conceptual work in the further development of learning organizations lay previously with the director of training, now the trainer responsible for a particular subject area took over this important task completely. Equipped with this so-called concept competence the trainer could now plan, execute, supervise and control the training independently. In this phase of change and transformation in the training sphere it was the task of the director of training to develop strategies for a projected change of his area of responsibility. The strategic approaches to dealing with change, as determined in the Development Network Pilot Experiment, namely working in processes, working topics from the Workshop of Change and learning projects for trainers, supported this process of reorganizing the responsibilities of the director of training.

The decentralization process carried out consistently during phase 1 required enormous efforts from all participants, but especially from the staff members at the factory. In their new roles they assumed additional responsibility as trainers or training representatives for a part of vocational education.

Phase 2 – Learning Islands

A study conducted by MIT in the mid-eighties caused quite a splash in the whole automotive industry. A worldwide comparison of the economic efficiency of car manufacturers saw Japanese companies at the top of the list. The forms of work organization used by them, better known

under the term lean production, triggered far-reaching and fundamental changes in the world of automobile factories.

At about the same time preparations for building the new passenger car factory for the A-Class in Rastatt were started. The plan was for that factory to follow up the latest insights in work organization. Group work was supposed to be the central principle. Our factory in Gaggenau was instructed to develop skilled workers who were prepared and qualified for the new factory.

In vocational education and training in Gaggenau, decentralization of training had continued in the meantime and had already reached a high level. The trainers had had significant experience with learning within the immediate production process, even if they had to overcome mental inhibitions in the process. The changes undertaken by competitors worldwide had their effects on the structures and processes at the Gaggenau site as well, and it was foreseeable that this development would change the factory landscape. A new requirement profile for the employee resulted already from the delegation of responsibility to the place of value creation and the group work connected with this. The workplaces were enriched with new content such as logistics, doing changeovers independently, quality assurance and job control, and the employee took on a large measure of responsibility within the group in this context.

Everyone involved in the training process realized that the approaches to training practised so far did not reach far enough. The traditional training workshop could no longer emulate the reality of the changing factory, not even a simulated factory reality with expensive production lines.

Answers to these challenges could neither be provided by the reorganized electrical and metalworking professions nor by our technology-centered assignments in the factory.

Once again we had to enter uncharted territory and found learning islands. A new pilot experiment under the working title Decentralized Learning in Teamwork (shortened to DELTA) accompanied an exciting development process which we once again carried through in cooperation with innovative partners from other companies.

Learning islands developed into a new place of learning and action-oriented learning fields immediately within the production process, where they promoted methodical and social learning to a high degree, as well as cooperation transcending generations and cultures.

The Rastatt factory was still in the planning phase, so the first learning islands were tested with success in Gaggenau and were met with a high degree of acceptance and support from the factory management. Here the actions taken to network the factory showed their first positive results.

The learning islands combine all skills acquired so far in the professional, methodological and social competence field under the conditions of actual production. They promote integrated thinking and acting in the sense of vocational capacity. The learner is introduced to the process structures of the company gradually. Learning islands are characterized by the following basic ideas, although the various individual characteristics can be more or less pronounced:

- Learning islands integrate learning and working within the immediate production process

- Learning islands combine functions of planning, controlling, producing, quality assurance and economy
- Learning islands promote procedural learning and working in the sense of planning, acting and drawing up the balance sheet
- Learning islands promote independence, personal responsibility and self-organization on the part of semi-autonomous groups
- Learning islands promote responsibility for cooperation and for the quality and quantity of the working and learning performance provided by the team
- Learning island teams consist of people transcending professional, generational and cultural barriers

Individual learning processes and learning processes of the team affect each other in learning islands and require particular attention from specially qualified professional trainers, the so-called learning island trainers. While traditional professional trainers focus on imparting skills and knowledge required for a particular segment of the production process, learning island trainers pay additional attention to the methodological and social sphere. Their task is to observe and promote the development of both the individual and the group and to make sure that problem solving and decision making take place systematically and in structured form.

The learning island trainer as a link between production and the central training workshop guarantees the effectiveness of the learning island model.

Today learning islands are an important part of our factory organization and serve as prototypes and testing grounds for new forms of work organization.

Phase 3 – Process Learning Workshop

Understanding the whole – Learning how a factory operates

An optimization of our business processes carried out in 1997 in our company analyzed all important business processes with regard to the three criteria time, cost and quality. The analysis showed a much higher complexity of the factory processes than we assumed before. Vocational education and training was also the object of a process analysis and had to answer the question of how it prepares the staff members for these complex processes.

Most of management was aware of the fact that the employees, although mastering their place of work and the immediate surroundings, know little about the preceding or subsequent processes, but nothing was done about it.

With the growing complexity in the factory in the last few years, demands on the staff members have also increased dramatically. While they only had to supervise and master parts of the production process in earlier times, they now have to deal with the whole production system with its production, service and method processes.

With the concepts used up to that point, namely technology-oriented factory assignments and learning islands, only partial processes could be represented. If trainees were to understand and master this complexity, they had to dive into this process themselves. It was inevitable that the role of the trainers also changed. They were now close enough to the manufacturing

process and integrated enough into the communication processes in the factory to no longer coordinate their factory assignments from the central workshop but rather to find themselves in the factory as a part of the process. The current situation where full-time trainers supervise customer-oriented and process-oriented training and cooperate in shaping the professional field as education consultants is the climax of a decentralization process that has been going on successfully for years.

The Process Learning Workshop allows the trainee to experience all the major production and process steps of a product while passing through the relevant assignment chains. Learning assignments take place in the associated service sectors logistics, quality assurance, planning and maintenance. At the same time the trainee can participate in KAIZEN teams or in group work to become familiar with the most important new method processes within the factory. .

A Process Learning Workshop is characterized by the following features:

- A network of decentralized learning places directly within the actual production, connecting processes and content of factory assignments and learning islands
- The trainer is on location and controls all learning processes for the training phase concerned together with the trainees
- The organization of learning is modelled on the respective process chain of manufacturing and the service and method processes connected with it
- Individual and group work assignments in the process chain are carried out according to defined intervals
- Process orientation is more important than occupation orientation
- Understanding of the process develops through constant, intensive process reflection
- The trainer supports company management in the shaping of transformation processes

Process reflection

Process reflection is the most important element of the Process Learning Workshop. Experience with factory assignments has shown that learning in various company departments and at various workplaces alone does not lead to an understanding of the procedural interrelations. Only the logical combination of learning and working assignments, in connection with reflection about these assignments, allows the understanding of the complex interrelations of a production landscape.

As a general principle, trainees in the manufacturing and service process are learning and reflecting based on everyday situations and the problems arising from them. This happens on the one hand in assignments along the process chain and, on the other hand, at the various interfaces, like the interfaces with planning or logistics, or during shift changeovers.

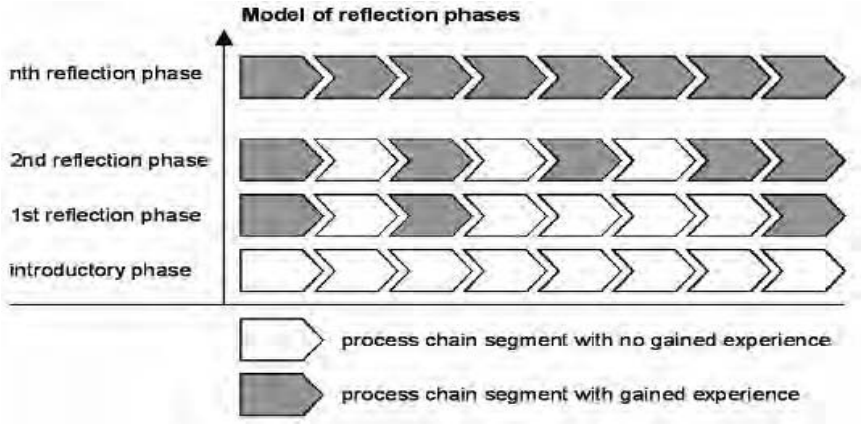
Trainees must therefore be gradually familiarized with the following goals of process learning:

- Ability to observe consciously
- Ability to identify interrelations and dependencies
- Ability to detect consequences and anticipate effects

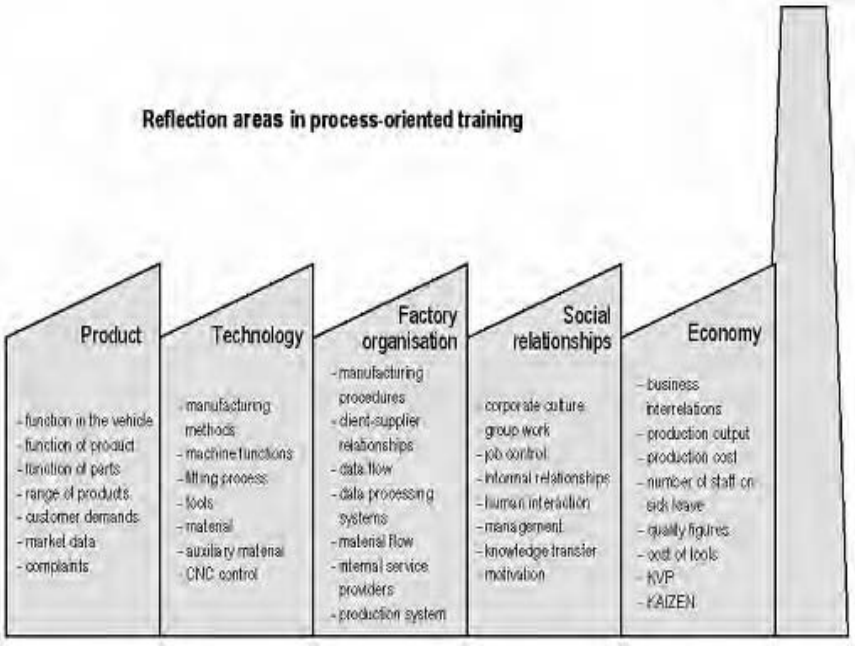
- Ability to distinguish relevant facts from irrelevant ones
- Ability to analyze situations, to derive implications for one's own actions and to take the appropriate action

These objectives are the core of process reflection and require of the trainer not only extensive knowledge of processes but also a high degree of sensitivity in the accompaniment of individual and group-oriented learning processes.

The following model of reflection phases is meant as an example to illustrate the course of the learning progress.



In the introductory phase the trainees obtain all the information necessary for the assignments in the process chain. Apart from purely organizational matters in the professional field concerned, the main focus of the information lies on the goals of process learning. In this introductory phase the trainees gain no experience themselves, apart from a few visual impressions.



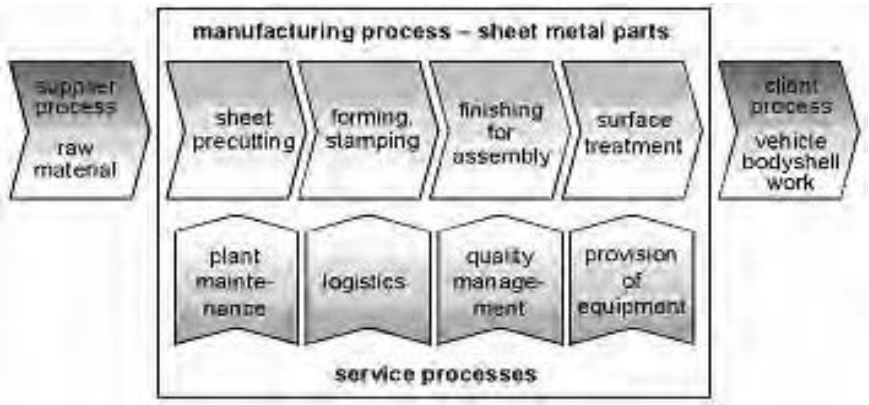
In the ensuing reflection phases the process reflection is subject to a standardized ritual. First, the trainee must reflect the individual learning assignment in the process according to a guideline

given to him, document it and discuss it with the trainer. The trainee must learn to discern the peculiarities that make one workplace different from the other and also the features that different workplaces have in common. The main focus of inspection lies in the fields of product, technology, factory organization, social relations and economy.

At certain time intervals the whole group engages in process reflection together with the trainer. In this step all individual learning experiences are exchanged and discussed openly, but in a structured way, and documented again as one aggregate item of information. In this way each individual obtains a picture of the overall system with its internal structures that becomes ever more clear from phase to phase. All the trainees can thereby benefit from the knowledge and experience of their peers before their next working and learning assignment. However, the trainer would be well advised to point out the danger of forming prejudices at this point. This process-transcending reflection and analysis of flaws and sources of disruptions points up a new dimension of the Process Learning Workshop: It can initiate, accompany and implement transformations in the factory.

The Metalworking ProcessLearningWorkshop

The metalworking product field, once a production technology shaped by traditional craftsmanship, developed just like the gearbox factory into a highly automated and process-oriented factory with challenging working and learning assignments. They formed the basis for the second Process Learning Workshop installed on our site. Here the production process takes place on just one factory floor, in contrast to the Process Learning Workshop in the gearbox factory, and this leads to significantly faster coordination and decision-making processes between trainers, specialized trainers and training representatives. This served also as support for the rapid and comprehensive integration of trainers and trainees into this department.



Experience after 3 years

The Process Learning Workshops have developed into a success model for vocational education and training in the three years since their introduction.

Trainers, trainees, staff members and management of the factory all see clear advantages for themselves. Never in its long history was initial vocational education and training in Gaggenau as close to the factory as it is today.

Since the trainees are now soon fully integrated into the factory, they outgrow their status as "pupils" more quickly. They work together with the adults and cultivate their social contacts in the factory.

> Sabrina Motz says: "In the process assignments I always have to adapt to new situations, and that challenges my own initiative."
>
> Sascha Merkel reckons: "I acquire awesome impressions and insights into the technologies and my future workplace. What I like is the good work climate vis---vis us trainees."

The trainers, working detached from the education centre, develop more autonomy and use their given leeway in the implementation for realizing new ideas. The sense of "belonging" to the factory by being integrated into the processes and communication structures and the recognition received from company management further strengthen their motivation.

One factor that should not be underestimated is that the trainees can make themselves known to colleagues and management in the factory. The process of getting hired after completion of training thus goes more smoothly for those who manage to anchor themselves in a positive way.

> Master craftsman Jürgen Joram says: “Trainees can get their first impressions of the labor world, find out what everyday life in the factory is like. The borders between workers and trainees crumble, a lot of interest is shown by the trainees in information about the work being done, the training occupation and the PLW. “Young” and “old” approach each other. Starting the PLWs has stood the test.”

The organization of the final examination represents a hurdle that is difficult to overcome. While the work samples made on the factory's production facilities represent a useful process-integrated element challenging the trainees in their skilled worker competence, the examination samples prepared and created in the central training workshop following standardized instructions must be seen critically as a process disruption. The content from basic training queried in the examination is in blatant contradiction to the experienced reality of the factory.

The conversion of the functionally oriented factory into a process-oriented one is still just at the beginning in Gaggenau. The product groups will be reorganized in the coming years, based on attempts already made. Today's employees have to be prepared for the new organization. We expect that the trainers, owing to their management and process competence, will increasingly become contact persons and advisors to the company management. The role of the trainer will expand considerably and will ensure even more than before the anchoring of training in the factory.

5) Outlook

With the experience obtained in several pilot experiments we have managed to develop two Process Learning Workshops and to implement them in the factory in a very short period of time.

However, in order to stay faithful to our tradition following scientifically proven concepts, we will undertake an extensive evaluation in the near future. The focus will be on process learning and instrument of reflection connected with it.

The success so far has persuaded us to project another Process Learning Workshop in our axle product department. Implementation is supposed to take place in 2003. With this the fields of application of our manufacturing occupations will be covered for the most part.

Another focus of future discussions will be the integration of the service occupations into the existing process chains, or alternatively the identification of other process chains while searching for possibilities of integration.

We need to clarify the requirements of the Process Learning Workshop and their implications on the concepts for initial training applied during the first and second year of training, and also the consequences for the skills required of the training staff.

The first steps in the right direction have been made. Many further steps have to follow.

Case 4: Audi AG[59]

– E-learning in initial and continuing vocational training at Audi

1) Specifications for training processes are derived from workplace challenges

It is over 100 years since August Horch, one of the founders of AUDI AG, made it his mission to design "good and well-built vehicles for discerning buyers". To this day, – and no longer just in the automotive sector – a distinctive impulse for change and innovation has remained the company's competitive hallmark, together with a firm guarantee of high quality standards, another absolute necessity. Business success is crucially dependent upon the constant, rapid development of new technologies and technological innovations, in vehicle design, vehicle engineering and vehicle production alike.

This challenge has implications for Audi employees in relation to their work processes: to cope with shorter and shorter innovation and product cycles, they need to respond with high performance and motivation. For instance in the year 2004, several new models were launched almost simultaneously at the Ingolstadt and Neckarsulm plants alone, each relying on wholly new technological procedures within the manufacturing process as well as in vehicle design and engineering. Similar developments are planned for the year 2005.

Two locations in Germany are more or less synonymous with Audi: Ingolstadt and Neckarsulm. There follows a brief introduction to each facility.

Audi Ingolstadt

Audi's Ingolstadt site is both the AUDI AG corporate headquarters and the company's largest production facility. At the Ingolstadt plant, the models currently rolling off the assembly lines are the Audi A3, the Audi S4, the Audi A4 and the Audi A4 Avant. Bodywork and varnishing

[59] This part was prepared by Christiane Nicolai(AUDI AG).

takes place for the TT Coup- and the TT Roadster. The total area of the Ingolstadt site is around two million square metres.

The Ingolstadt site has a multicultural flavor, with a workforce drawn from 71 different countries. At the end of April 2004, the total number of employees was 30,963. The workforce consists of 20,285 manual workers, 9,551 non-manual employees and 1,127 trainees.

Annual production at the Ingolstadt site in 2003 ran to 476,964 vehicles, consisting of 151,117 Audi A3 and 327,463 Audi A4 models (including 153,785 A4 Avants). In addition, the integrated production network with the Györ plant in Hungary produced 20,807 TT Coupés and 11,530 TT Roadsters.

Audi Neckarsulm

The Neckarsulm plant, the second mainstay of the Audi brand in Germany, has employees from 48 different countries. With a workforce of around 13,730 (as of the end of April 2004), Audi is the largest employer in the Heilbronn-Franken region in southwest Germany. Of its staff, 10,582 are manual workers and 2,457 are non-manual employees, while 691 trainees make up the remainder of the Neckarsulm workforce.

In the year 2003, a total of 220,426 cars were manufactured. Production ran to 27,323 Audi A2 and 148,477 Audi A6 models (of which more than half were A6 Avants). A further 17,634 Allroad Quattros and 21,748 Audi A8 models completed the total.

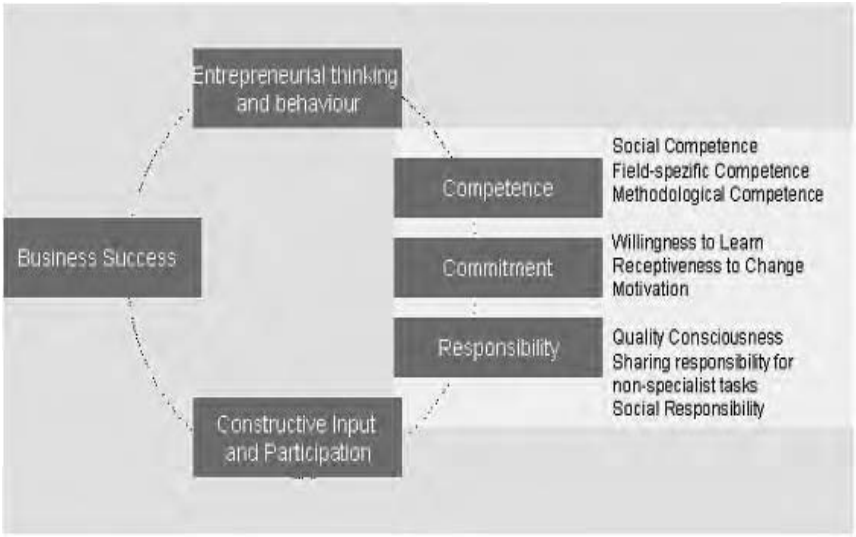
The Neckarsulm plant is renowned worldwide, particularly for the work of its Aluminium and Lightweight Construction Center which developed the Audi Space Frame (ASF) for the A2, the Audi A8 and the Lamborghini Gallardo.

2) Entrepreneurial thinking and behavior

At Audi we believe that in order to keep pace with the changing times and respond to challenges, everyone in the company needs to think and act like an entrepreneur. Only this way can we can compete successfully on the basis of consistent high quality and diligent quality assurance.

This paradigm not only makes new demands of employees, but has substantial implications for the organization and management of the company itself, since it has to provide opportunities for participation and constructive input. Only this creates a space in which entrepreneurial thinking and behavior can make any significant difference. To facilitate constructive input and participation in the company's activities, and hence in the company's success, however, we insist on a very individual principle: the willingness to take personal responsibility and show initiative. Among other things, this encompasses the employees' commitment to and responsibility for their own competence at work. Opportunities, facilities and strategies must be put in place to address the growing need for training and the increasingly high specifications for training delivery processes, which include efficiency and the guaranteed transfer of skills.

Figure 3.13: Entrepreneurial thinking and behavior as the key to business success



High-priority questions concerning the "demands of the future", or indeed the competencies staff will need to carry out planned production processes, are of considerable importance in the constant and necessary endeavor to adapt for the future. However they are not easy questions to answer. These days, the world is changing so fast that a vision of the future can be little more than a blur, giving only a nebulous impression of what shape and form things might take, not only from a technological perspective but also in terms of values. One thing is clear: challenges which we already face will not go away – for instance, how to keep up the vital competitive impulse to change and innovate while also maintaining high product and process quality, and how to cope with new knowledge being generated at an ever-increasing pace. The constantly growing volume of knowledge to be learned, and indeed 'un-learned', makes continuous education and training essential. (cf. Back/Bendel/Stoller-Schai, 2001, 40). Coupled with this growing need for learning, which Back goes so far as to describe as a "vortex of demand for learning" ("Nachfragesog nach Lernen"), two additional factors call attention to the necessary processes of change in education and training, and also set a crucial agenda for the integration of e-learning: the unmistakable supply push created by technologies, and the transformation of internal business processes with the arrival of e-business.

E-learning-supported training delivery at Audi

To address this situation and to be prepared for the company's future education and training demands, AUDI AG set out to develop an e-learning strategy. The process, begun in the fairly recent past and still ongoing, has culminated in a comprehensive redesign of its corporate training processes. The redesign encompasses both the company's initial vocational training program and its internal continuing education and training schemes. This strategy evolved from a sequential progression of steps, always tested against practical experience, into a systematic integration of e-learning throughout the company's initial and continuing education and training.

IT competence-building initiative – a company-wide online learning process

A first key step was a company-wide IT training process involving every employee of AUDI AG regardless of function or status, to enable them to use IT and the Internet. Everyone needed to be equipped to service or operate the IT and e-business technologies which were coming into widespread use within the company. Over time, these technologies have penetrated almost all of the company's business processes, so that already, a certain level of IT competence is essential to meet basic job requirements.

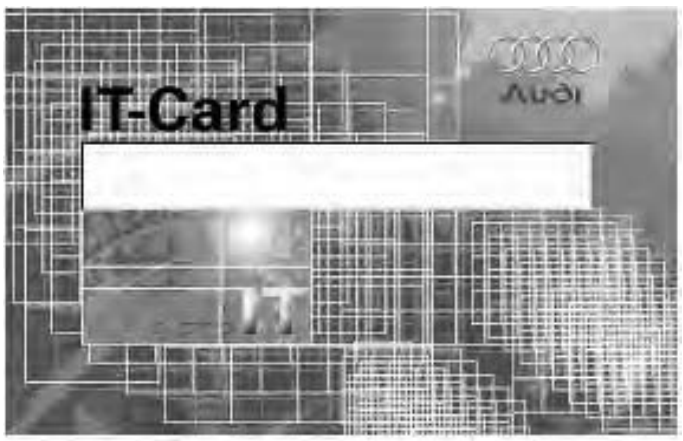
Furthermore, if every individual can participate in the company's internal communication and information processes it enhances their identification with the company. In addition to the key job-securing role of basic IT competence, AUDI AG saw it as especially important for the employees as individuals: with access to today's IT-based information channels – like the Internet – nobody need feel 'out of the loop' or cut off in any way from our information society.

But it was not just the content of the IT competence-building initiative that made it such a crucial first step in the redesign. In fact, the initiative itself was a learning process based purely on e-learning, i.e. every employee, including trainees, manual workers, supervisors, managers and board members, engaged in online learning and self-testing on the Audi intranet. Their web-based training (WBT) was accompanied by online self-tests for individual needs assessment and certification. This enabled everyone to gain experience with WBT and self-administered tests – an important first step towards individual competence in self-directed learning, laying the foundation for all subsequent e-learning activities.

For a project scheduled to last for just one year from the beginning of 2001, its goal was ambitious: to put all 44,000 employees in a position to bring their personal IT skills up to the standard currently required and to consolidate their existing know-how. With the help of the online learning process, everyone was able to gain the skills for systematic use of information technologies within a very short time.

After working through various courseware modules on basic topics relating to IT and the Internet, and going on to pass the corresponding tests, each employee was awarded the Audi IT Card. By the time the project ended in March 2002, almost 90 % of the entire workforce had achieved this target.

Figure 3.14: The Audi IT Card as a certificate of basic IT competence



Beyond the company, the IT competence-building initiative earned high accolades. The initiative won the "Weiterbildungsaward 2002" (professional development award) at the MUWIT International Congress for Training and Development in March 2002, and in May 2002 it was awarded the "Initiativpreis Aus- und Weiterbildung 2002" (prize for initiative in initial and continuing education and training) by the German Association of Chambers of Industry and Commerce (DIHK).

Figure 3.15: Self-organized learning processes with e-learning in the production facility

The courseware used for the IT competence-building initiative was left on the intranet unchanged after the project was over. The purpose of this was to enable any new Audi employees to bring their IT skills up to the required standard. At the beginning of 2003, the entire program was updated and new resources added. Now, whenever IT problems or questions about functionality or usage arise, for instance when working with MS-Office programs such as Excel or Word, the employee can access the corresponding learning module at any time and use this as a problem-solving tool.

Once the IT competence-building initiative had ended, and employees had experienced a self-directed online learning process, they increasingly requested opportunities to use e-learning for further training, including for topic areas other than IT. There was particular interest in the technology-related topics which play a major part in production processes, but many people also wanted to use e-learning to tackle issues surrounding the product development process.

3) Systematic integration of e-learning into corporate training processes at Audi

In Audi's view, e-learning can only support the delivery of training successfully if it is integrated into the overall context of initial and continuing education and training with a view to establishing a holistic and user-centered new approach. As a prerequisite, a strategic concept for teaching and learning must be developed. To ensure coherence, it has to be needs-driven and matched to workplace demands. Its innovative potential derives from linking workplace learning with enjoyment and efficiency, with a focus on accomplishing business goals.

The questions that need to be addressed are not whether to introduce e-learning across the board; rather, analysis is necessary of the following three key issues:

- In which areas of training delivery does it make sense to integrate e-learning?
- Bearing in mind the target group, can the content or parts of the content be delivered effectively if supported by e-learning?
- How can e-learning help to organize existing training delivery processes more flexibly and efficiently-

The prime objective of the broad e-learning strategy was to establish and maintain acceptance of the principle of learning processes supported by e-learning, and to initiate a culture of learning in which self-organized learning processes are understood and practised as a natural element of the work process, and supported as such by managers throughout the company. On the foundation of this kind of learning culture, entrepreneurial thinking and behavior can develop and flourish, the aim being for employees to take responsibility for their own competence at work.

The underlying didactic principles of the company's existing initial and continuing education and training processes were thoroughly reviewed and revamped, and an important role was assigned to e-learning within the new methodology: to support the move towards a new learner-centered approach.

Blended learning

In concrete terms, the integration of e-learning at Audi involves the use of multimedia web-enabled courseware as part of a 'blended learning' system. Employees who take part in this form of training follow a learning route which lasts approx. 6-9 weeks and includes a number of different phases.

The learning route begins with **a preparatory phase** consisting of:

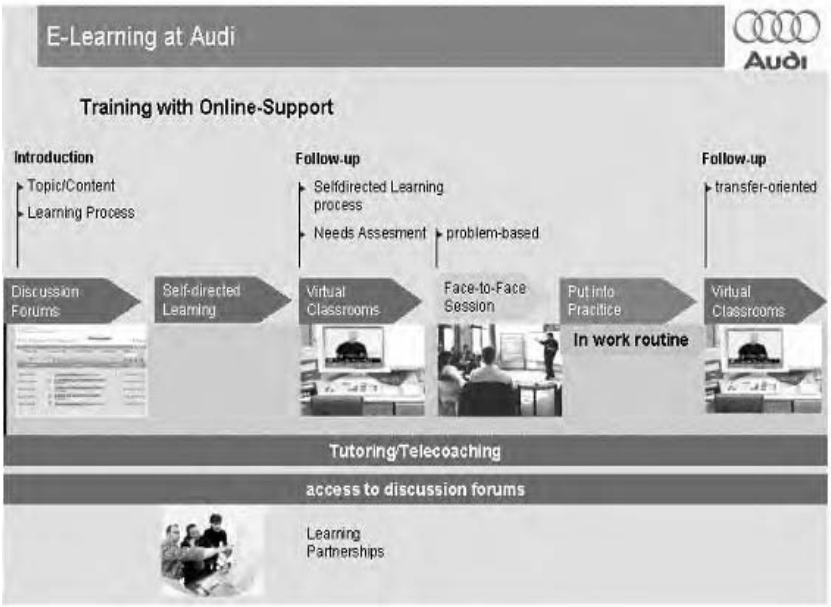
- a phase of self-organized learning in which employees use courseware to prepare for the face-to-face session.
- a follow-up virtual classroom session (VC), during which participants meet as a group for the first time to discuss the topic.

This is where information is gathered on workplace situations relating to the theme, with the aim of identifying unresolved work problems which highlight specific training needs. These will be addressed in the subsequent face-to-face session.

In the **face-to-face session** the foundation knowledge and skills gained in the independent-learning phase provide the basis for developing practical solutions in cooperation with trainers and other participants.

By way of **follow-up**, another VC session is held some time later to discuss the solutions again and review their usefulness in the context of the workplace routine (ensuring skills transfer).

Figure 3.16: Example of a learning route in the blended learning system



Didactic principles are central to e-learning integration

Certain risks attach to the introduction of e-learning, which can quickly result in a 'rude awakening' if not anticipated. One of these, in our view, is the superficially appealing prospect of purchasing a technology which, it is hoped, will deliver excellent results 'out of the box' for all eventualities of corporate training. The technology is expected to be able to reproduce all the processes of training, be available on demand to learners, gain instant acceptance as a mode of learning, and achieve a massive business impact sufficient to justify its not inconsiderable expense. Although avoidable, the risk is that too much faith is often placed in the seemingly vast capabilities of the technology, and an important stage of planning and design is overlooked.

But it is only possible to take sufficient account of company-specific plans if the system is designed using process-oriented methods. Such a system design should also answer the following questions:

What should be the specific form of future learning processes combining e-learning and face-to-face sessions, e.g. from the viewpoint of learners within the company? Which e-learning elements can and should be used to cover which objectives and tasks within the training process? What changes can and should be made to the face-to-face session, in the light of the e-learning introduction and follow-up?

As more details take shape, the immediate issue is to define specific didactic criteria for the courseware, to ensure that it will actually facilitate self-organized learning within the company.

Company-specific questions are rarely mentioned in technical specifications because they call for process-oriented answers. These alone will yield the company-specific parameters for using technology for the delivery of training processes.

The decision as to whether and how e-learning could be integrated into Audi's initial and continuing education and training processes was the product of three sequential steps:

1. Sound (didactic) analysis to determine which didactic principles and methodological approaches are inherently suitable and feasible means of achieving the defined training objectives, for given topics and target groups. Of course there is nothing unusual about tackling methodological and didactic considerations before planning a training program; in fact it is a fairly traditional approach. Even before e-learning, those responsible for training would systematically plan training programs, defining objectives and designing courses within the threefold parameters of the target group, the content and the didactic methods. A new approach is not needed in order to integrate e-learning, quite the opposite. Yet, given the great fascination of the vast array of options which the technology can offer, and the desire to use them as soon as possible, i.e. even at the stage when fundamental training objectives are still being defined, there is a risk of pursuing a technology-driven or technology-dependent approach. But this gives insufficient prominence to the learner and to the desired learning outcome.
2. Planning of a training process or a learning route, which can consist of components or phases in a variety of combinations. Possible components may be: e-learning (WBTs/CBTs) or e-learning supported teaching and learning opportunities (discussion forums or virtual classrooms) and/or conventional, interspersed face-to-face instruction. This phase of planning continues and elaborates upon the didactic specifications defined in the first phase.
3. Implementation of the program in the learning management system, the event management system or the computerized personnel management system. Here the learning objectives based on the didactic principles and the learning route are documented and made available to learners.

Thus the didactic model known as blended learning systematically defines a learning route which combines e-learning (e.g. a WBT, a discussion forum or a virtual classroom) with face-to-face sessions. The critical design principle is that the content to be taught should be usable and useful when put into practice by participants in their own workplaces. This is why such an emphasis is placed on (problem) situations experienced by participants in the course of their work. The aim is to develop the competence to solve such problems, and of course to ensure the transfer of what has been learned into the learners' work processes.

As a general principle, learners' expectations need to be taken into account in order to build acceptance of e-learning as part of the learning process. Primarily, of course, their expectations will focus on course content, but they may also be concerned about the options for accessing the content they need. The desire for fast access correlates with the demanding nature of work processes in the corporate environment in which learners have to operate. They want to be able to find the right answer to any job-related question as quickly as possible for the sake of company productivity. Motivational aspects of this kind are critical when working towards a culture of learning involving autonomous and self-organized learning. From the technical angle of learning process design, incidentally, this is not a trivial requirement!

Self-organized phases of learning depend on individual personal commitment, ideally backed by an attitude of intrinsic motivation and interest in the topic to be learned. It is nobody's job to motivate learners to take the next step, i.e. no trainer is immediately on hand. A self-organized learning phase relies on learners doing this sometimes tiring or laborious work for themselves,

e.g. in order to find a solution to their problem at work. Therefore the underlying system for the training programs should always be logical and comprehensible to all.

E-learning – technology as a critical success factor

In e-learning – a form of learning designed around computer-based media – there are interdependencies between technology and learning and technology and methodology. By this stage at the latest, technology becomes a critical success factor: the more appropriate the technology used to implement the methods and the learning environment, the more it will promote learning and ensure learning success. If its power to mediate knowledge and support learning is not fully utilized or not implemented appropriately, the resulting learning process will be less than optimal, as will the success of learning. In that event, e-learning is not worthwhile because the objective is to achieve the specified learning objectives, i.e. learning success.

In order to fulfil this fundamental requirement, the Audi training department decided to develop an integrated 'E-Learning Framework'.

The Audi E-Learning Framework is intended as a supplementary in-house platform for virtual learning. It gives employees access to content meeting the company's didactic and methodological standards and enables them to engage in high quality learning processes. It is based on the Audi E-Learning Player, a standardized multimedia application which sets a common standard for the production of course content to be used anywhere in the company. What this means is that learners have a familiar learning environment in which the content they need is easy to find. The design, navigation, behavior and functionality remain the same and do not distract the learner from the content itself or from the learning process. The player's behavior and functionality are influenced by didactic principles, while the design is coordinated with Audi's corporate image (CI).

Technology-independence with XML to protect the investment

A particular technology is always dependent upon the system environment in which it runs. For instance, a tool used for programming a piece of courseware may no longer be supported under a new browser version or an updated IT security policy. As a consequence, all the course content that has been produced with that technology can no longer be used, and the company has to write it off. More than once, the training department has realized with distress that content could not be transferred at all, or only at inordinate expense, to the currently supported version of the technology.

This led to another specification for the Audi E-Learning Framework: strict separation of technology from content. This was achieved by using XML technology which enables the content and its structure to be stored in a technology-neutral format. Whatever the technology used to display the content on the learner's screen, it can be changed without rendering the content itself unusable – bearing in mind that content-creation can represent a substantial investment. The Audi E-Learning Player which 'plays' these XML files is currently implemented in Flash. Tomorrow the IT department may decide to stop supporting Flash and standardize on some newer technology. In that case, only one new player would need to be built in whatever is now the latest technology, and all the content would become accessible again. It is important for course content to be future-proofed in this way.

The separation of technology from content also allows the separation of content from presentation layout. The player interprets the content recorded in XML in much the same way as a content-management system (CMS). It is within the player – not the content – that certain text formatting is set to 14 point bold type, or a particular logo or design theme is displayed. In other words a unit of content can be displayed in a completely different way by an Audi player and a VW player (or others). The content only had to be compiled once, however. Moreover, it is possible to respond dynamically to localization needs with different language versions as needed. German players for the Audi and VW brands have already been produced, and there players are planned for the Skoda (Czech) and Seat (Spanish) brands.

To guarantee that content will be interchangeable among the different players, the content in the XML files must be formalized according to the same data model. Simply using XML, which is just a data format, is not enough. For the formalization of learning content, specialized data models, i.e. recognized e-learning standards and specifications are available. Some of these are SCORM (covers content communication and content management), IMS (for distributed learning), QTI (for exercises and tests), MMeLG (for interactivity, inter alia). Content created in compliance with these standards can be interpreted by any player which supports these standards. Courseware is integrated into a learning platform (LMS, LCMS or CMS) by means of a SCORM interface implemented within the player.

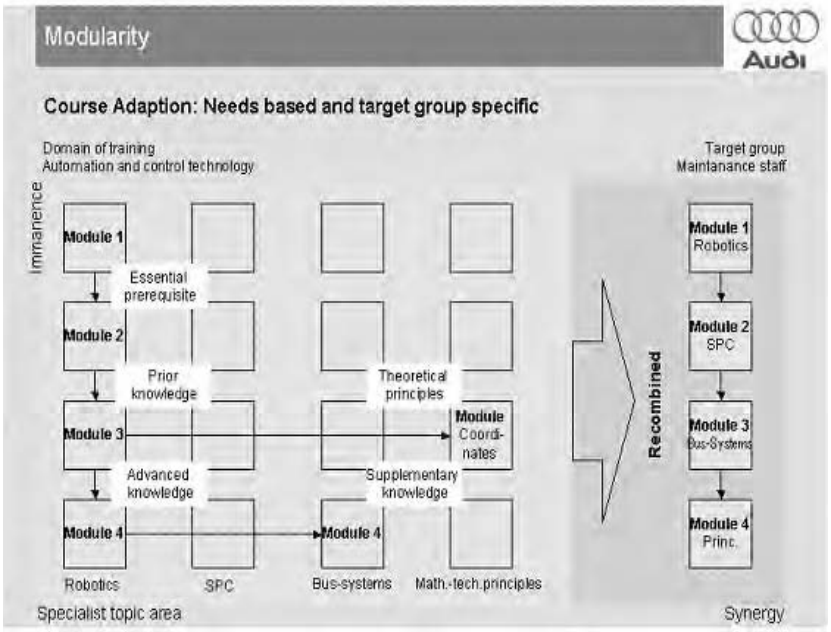
Since the standards cited are established industry standards, course content in these formats can now be purchased commercially without the otherwise usual expense of programming a player for each proprietary format. This shifts the focus away from the dazzling array of technologies on offer, which is the market norm, towards the quality of the content – the component with a far greater bearing on learning processes. Content can now be purchased strategically by the company according to need (content strategy) and integrated into the existing bank of resources. Open standards also reduce dependence on individual manufacturers.

Benefits of modularization: needs based, greater flexibility, potential group-wide synergies

The interplay of e-learning standards and the Audi E-Learning Framework facilitates one other key innovation which relates to the structuring of learning content: modularization. What this means is that courseware is no longer developed in a large block which requires the learner to work doggedly through a fixed, predetermined structure. Instead, it takes the form of a number of smaller units called learning modules. Depending on the given needs – of an individual learner, of a target group, of a training program – these modules can be combined and recombined into longer learning sequences, as appropriate. Moreover, a learner can jump into the learning process at any point in the sequence – depending on his or her prior knowledge or immediate problem.

In the broad domain of ‘Automation’, training programs would originally have been planned around four topics, shown here in diagrammatic form: robotics, bus systems, stored program controls (SPC) and mathematical-physical principles. It was decided that all topics should be supported through the integration of e-learning and the use of WBT. Without the technical options opened up by modularization, the end result would have been four separate pieces of courseware corresponding to the four topics, each covering the content of one topic in its entirety.

Figure 3.17: A modular content strategy enables customization of e-learning courses for specific target groups



But within the individual topics, not all content or all sections of the WBT are relevant to all target groups. Some may only require certain extracts of the WBT content, i.e. a tailored selection of elements.

Only by combining different sections from a range of topics can the specific training need be met.

For example, the 'maintenance staff' are a target group with a special characteristic – they need to address aspects of every topic listed: robotics, bus systems, stored program controls (SPC) and the corresponding mathematical-physical principles. All of that knowledge comes into play when maintenance staff are called to a problem in the production facility, to eliminate whatever fault has arisen. It is not efficient to release these staff to attend four different training programs. Also, too much of the course content would either be familiar to them already or too specialized for their needs. Putting together a customized selection of course elements is the most efficient mode of training delivery.

The modularization strategy allows for meeting diverse and even personalized needs from within a larger portfolio of e-learning content, without having to create and finance a unique solution each time. Any necessary maintenance and updating can be carried out on smaller units and completed all the more quickly and cost-effectively. The same is true if modules need amending or extending.

Once all modules are technically standardized and can be viewed on any player used within the corporate group, an attractive dimension is opened up: all types of course content are compatible and networkable with each other. If the system is deployed throughout the VW group – and meets high quality standards – the multiple uses of the material could generate valuable synergies.

IV. Summary and Conclusion

This study set out to explore the different concepts of vocational education and strategies for their implementation in Korean and German companies. This line of enquiry was pursued with reference to examples of vocational training strategies in the automotive industry in each country. The main focuses of interest in the study were:

- Quality assurance in production and new demands faced by employees in their work,
- Training programs for specific target groups in initial and continuing vocational education and training,
- Training concepts and new media used in initial and continuing vocational education and training.

The results documented in the study are based on an intensive process of communication and consultation between the German and Korean partners, during which common issues were identified and differences in research procedures were worked out.

1. Comparison in the context of vocational training strategies in automobile industry

Profound economic changes are taking place as both Korea and Germany undergo globalization. The most distinctive feature of these is a transition from what was once a providers' market towards one which is customer-focused (and highly individualized). What this means for the companies – illustrated here by examples from the automotive industry – is that the quality of their products (and services) is critical to their competitiveness. Their policy of developing new models on ever shorter cycles necessitates regular restructuring of the production process, and calls for a high level of adaptability from production staff. Simultaneously, with the move towards flexible production, there is a growing emphasis on high quality, fault-free production. This can only be achieved if employees' skills are kept up to date. Comparative research based on case studies was undertaken to analyze the impacts of these organizational models on initial and continuing vocational education and training.

The challenges faced by both countries, however, in terms of the global competitive environment and the transition towards a knowledge and information society, are entirely comparable. The results of the joint study highlight the differences in occupational and employment systems, cultural contexts and structural conditions.

1) Korea

Vocational education and training systems

Initial vocational education in Korea is provided at schools (senior high schools and two-year junior colleges) under the formal education system and initial vocational training is provided at training institutions as non-formal training. Further training is conducted in enterprises with the financial support coming from employers.

Traditionally initial vocational education and training in Korea has been supply-oriented with little involvement of the industries. The government has standardized vocational curriculum and training standards. Whereas initial vocational education emphasizes generic knowledge and skills leaving the acquisition of higher level skills at a later stage, initial vocational training focuses on specific skills needed in actual workplaces. However, as skills gaps widened with rapid technological advances, the government introduced measures to support the collaboration between schools and industries.

Meanwhile, further training is provided in enterprises. The government has introduced the Vocational Competency Development Program (VCDP) as a component of the Employment Insurance System (EIS) to promote workers' skills development by providing financial support to employees as well as employers. It was found that OJT, job rotation and informal learning by doing are the major mechanisms of skills formation.

Quality assurance

In Korea, automotive companies have introduced new technologies into their production systems for the purpose of improving work environment and enhancing quality and thereby reducing costs and raising productivity.

Quality is understood as the quality of the company's product in Korea. As the quality of overall production process is reflected in the quality of products, it is necessary to examine corporate strategies to improve productivity and develop human resources.

Korean automotive companies have introduced various schemes to improve productivity and product quality. Self- maintenance system and quality control system, for example, were adopted as parts of Total Productive Maintenance. As these initiatives, which had been borrowed from Japanese companies, led to mannerism bearing limited results, companies have introduced new attempts such as Self-Inspection System (only in the engine plant), Workplace Innovation Project, and Name-based Quality Assurance to enhance product quality. Although these schemes are not training programs themselves, they make up for the lack of OJT.

It is noted that while certain efforts to strengthen the quality assessment system has contributed to reducing the defect ratio, others failed to promote voluntary participation by workers at the bottom of the plants' organizational pyramid.

Training programs for production workers

Technical high schools and junior colleges are the key educational institutions offering vocational programs that train skilled workers and technicians for the automotive industry. The programs equip students with theoretical knowledge as well as practical skills. To acquire practical skills, students in technical high schools must participate in field training in companies for 1~12 months depending on the training program. Junior college programs are practical in that they consist of on-site training organized in the form of school-industry collaboration programs.

Korean automotive companies provide workers with training opportunities in leadership, professional skills, job skills, computer training, etc. The programs train general skills and specific job skills. In terms of training contents, corporate ethics training is emphasized to motivate workers to work hard.

On-the-job training, job rotation and learning by doing were among the most visible forms of skills formation. In addition, training programs were also being conducted in special training quarters while the makers of facilities and controllers also sent their experts to train workers.

Use of new media in VET

Korea has experienced a rapid expansion of opportunities for e-learning to occur in educational institutions and in business. It was the policies and strategies adopted by the Korean government that spurred the expansion of e-learning and the rapid development of ICT and its hardware infrastructure.

Taking advantage of these favorable conditions, automotive companies began to provide e-learning programs in 2000, which have developed in size and quality during the past couple of years. The progressive trend in e-learning is expected to continue well into the future. In 2003, Hyundai Motor founded Learning Center as its focal point of e-learning organization. E-learning at Hyundai Motor initially targeted employees in research and administrative work, but plans to expand to include all employees.

E-learning training programs are divided into three course areas: general administrative skills, specialized business skills, and foreign language and information technology. As of 2004, a total of 142 training courses have been offered mainly for white collar workers. E-learning programs for production workers have been negligible. Only 408 auto repair workers participated in five courses which were specially designed for them in 2003 (i.e. engine mechatronics, how to read circuits, diesel engine, introduction to A/T, electric engineering).

E-learning initiatives at Hyundai are relatively new and there is a long way to go. Improvements can be made in a number of ways: promoting greater diversity of programs, introducing mobile means of learning, fostering on-demand learning, training e-learning professionals, and international cooperation in courseware development and exchange.

2) Germany

Vocational education and training systems

In Germany two-thirds of the young population undergo vocational training in the dual system. Dual system spans, in principle, three years, but the duration may vary depending on the chosen occupation. It is referred to as a dual system because training is carried out in two places of learning: at the workplace and in a vocational school (Berufsschule). The aim of training in the dual system is to provide a broadly based basic vocational training and to foster, within a structured training course, the qualifications and competencies necessary to practice a skilled occupation. Those successfully completing the training are qualified to perform skilled work in one of 350 recognized occupations requiring formal training.

The training is based on a training contract under private law between a training company and the trainee. The trainees spend three or four days a week at the company and up to two days at the Berufsschule. Based on the conditions of training, the training companies impart specific and general technical skills for practical application on the job. The qualifications and competencies acquired at the Berufsschule are combined with work experience and later applied in specific situations.

For further training of existing workers, a company (DC Mannheim) has introduced the 'production learning system (PLS)' in which training is delivered using training content stored in the PLS. This provides a basis for lifelong learning since the contents are constantly adapted to take account of changes in the workplace.

Quality assurance

As in Korea, German automotive companies have introduced new technologies into the production systems for the purpose of improving work environment and enhancing quality and thereby reducing costs while raising productivity. To take full advantage of the new flexible system, it is necessary to establish a decentralized work organization made up of skilled workforce. Skills required for the flexible system include not only job skills but also soft skills such as skills of self-directed learning, cooperation, communication, sense of responsibility and critical thinking.

The changing demands of the workplace require target-oriented training. With the different structures of economies and different cultures, automotive companies in both countries have different definitions of "quality." In Germany, quality is understood as the quality of training and skills while it is defined as the quality of product in Korea.

Ford has introduced ISO 9001-2000 to make their education and training leaner and also transparent for their customers by optimizing their process. Other companies also have introduced programs for quality assurance (i.e. Process Learning Workshop in DC Gaggenau, The assessment system (AiD) in DC Mannheim, Work and Learn in Department (ALF) in DC Mannheim).

Training programs for production workers

German case studies show a tendency to organize training programs with a workplace focus. The emphasis is shifting from knowledge of specific skills to knowledge of processes. Group work has become an important agenda in the factory. Programs for implementing process orientation have been started. The titles of the programs at DC Gaggenau include Business Process Optimizing, KAIZEN, Continuous Improvement Process (KVP), and Daimler Chrysler Production System (DCPS).

At DC Mannheim, 'workplace placements' follow a process-oriented approach: 'work and learn in the department' scheme, enables learning at different levels and a process-oriented approach. The individual planning of procedures and assignment of tasks is geared to the department's current needs. The scheme is also intended to promote the idea of CIP (continuous improvement process). Nevertheless all the examples show the efforts in the companies to enlarge the use of ICT in learning processes, particularly in those at the workplace: An example is the Production Learning System (PLS) of DaimlerChrysler Mannheim.

Use of new media in VET

The German case studies show that companies pursue different strategies in the use of new media, quite possibly because they have distinct corporate cultures.

Audi AG set out to develop an e-learning strategy to address ever growing demands for learning. The process, begun in the fairly recent past and still ongoing, has culminated in a comprehensive redesign of its corporate training process. This strategy evolved from a sequential progression of steps, into a systematic integration of e-learning throughout the company's initial and continuing education and training. The company began with IT Competence-building Initiative – a company-wide online learning process aimed at enabling each employee to use IT and the Internet. With the help of the online learning process, everyone was able to gain the skills for systematic use of information technologies within a short time.

DC Mannheim has developed a new training medium called 'didactic database' to keep track of activities systematically (production learning system – PLS). The relational structure of a 'didactic database' gives users the flexibility to document every conceivable work procedure and to update this information on an ongoing basis. New media such as digital photos, videos and flash animations can be accessed via 'didactic database' in the workplace, where the learner can consult them directly. The PLS can be used with specific target groups as an information, qualification and knowledge management system. In addition, it gives people a means of recording and storing empirical knowledge, which can subsequently be adapted for teaching purposes and made available as standardized training resources.

A comparison of vocational training strategies in automobile companies in Germany and Korea is shown in Table 4.1.

2. Lessons from the Korean-German experience

The experiences of companies studied in this research render important implications for the future of vocational education and training in Korea and Germany.

Training strategies of automotive companies operating in the two countries reflect the differences that exist in their industrial structures, education and training systems, and cultural differences. These differences are outlined in the national framework of vocational education and training discussed in the first section of each country report.

Notwithstanding these differences, the vocational training strategies in both countries need to be responsive to growing competitive pressure, globalization of markets, introduction of new technologies in production, and a more individualized customer behavior.

The training strategies responding to these common trends include emphasis on generic skills, knowledge of production process and fine tuning of relevance at the stage of initial education and training. With regards to the last strategy, it should be taken into consideration that initial training is provided mainly in schools in Korea while in the workplace in Germany.

Increasingly, both countries will need to pay greater attention to continuing training of employees as the existing jobs require new skills as work organizations change. In addition, use of new media in initial and continuing education and training is becoming more important in both countries.

Table 4.1: Comparison of training strategies in automobile companies

	Korea	Germany
VET system	Initial training is provided in high schools and two-year junior colleges in the formal education system. Continuing training is provided at firms with financial support from employers (Employer Insurance System)	Initial training is provided under the dual system where training is carried out in two places of learning: at the workplace and in a vocational school (Berufsschule). Continuing training is provided in enterprises.
Quality assurance	Quality is understood as the quality of products. In order to improve product quality, Korean companies have introduced self-maintenance system and QC as parts of TPM. Recently, new initiatives such as self-inspection and workplace innovation project have been introduced. The programs make up for the lack of OJT.	Quality is defined as the quality of training and skills. In order to make education and training leaner and also transparent for their customers by optimizing their processes, German companies have introduced programs such as ISO 9001-2000 (Ford), Process Learning Workshop (DC Gaggenau), Single Point Lesson (Ford), etc.
Training programs for production workers	Courses available for production workers include fostering general skills and job-specific skills. Continuing training programs for senior production workers include job skills training and leadership training. On-the job training, job rotation and learning by doing are among the most visible forms of skills formation.	There is a tendency towards workplace-oriented training programs. With the introduction of process orientation in the factories, programs for implementing process orientation have been started (DC Gaggenau – Business Process Optimizing. Kaizen, Continuous Improvement Process, Daimler Chrysler Production System)
Use of new media in training	With a well developed ICT infrastructure fostered by government policies and strategies, automotive companies have developed e-learning in size and quality during the past couple of years. However, this expansion is not even across courses and specializations and there continue to be certain fields where the use of e-learning is far less common.	The companies demonstrate that very different implementation strategies in the use of new media can be found due to the differences in corporate culture. While Audi has widely adopted electronic media in initial and continuing training, DC Mannheim places greater emphasis on international education and training.

1) Lessons from the Korean experience

Lifelong vocational education

Vocational education has been stigmatized as being “second class” education system chosen only by those who have failed to get admission to a college. Graduates of vocational high schools have had little chance to pursue college education. The reform in the mid-1990s was thus aimed to expand the scope of vocational education to establish a lifelong vocational education system.

Measures have been taken to facilitate transition not only from vocational high school to higher education, but also from work to higher education. To encourage vocational high school graduates to move into higher education, the government has introduced initiatives such as ‘integrated high school program’ and ‘2+2 linkage program’. Graduates of vocational high

schools, moreover, are given admission to junior colleges and polytechnic universities in related fields of study. Meanwhile, to encourage workers to be transferred to higher education institutions, they are given preferential consideration when polytechnic universities screen candidates for admission.

The policies for promoting lifelong vocational education resulted in a dramatic increase in the rate of vocational high school graduates admitted to college education in the last decade. On the contrary, percentage of workers pursuing college education has remained minimal. This can be attributed to the fact that compensation systems of enterprises do not provide incentives for employees to continue their studies in institutions of higher education.

Case study findings indicate that government initiatives to open college education for those who are in the labor market are inadequate to promote lifelong vocational education. These policy initiatives need to be supported by corporate HR management, which encourages employees to participate in further education in colleges and universities.

Fostering continuing training–the Employment Insurance Scheme

Traditionally, continuing education and training of the employed in Korea has mainly been the responsibility of the enterprises. As large industrial conglomerates grew, workers were often given the opportunity to stay under one employer for a long time, often until their retirement. This work culture has meant that the larger employers were virtually assured of recouping the benefits of any investment made in the training of employees.

The Korean government has introduced the Employment Insurance Scheme (EIS) in 1995. Vocational training forms part of this scheme and the contribution rate for the vocational training component of the system ranges from 0.1 per cent to 0.7 per cent of the total wage depending on the size of the firm. The Vocational Competency Development Program (VCDP) under the EIS is an incentive scheme to foster voluntary training funded by the EIS fund.

Since the introduction of EIS in 1995, VCDP has expanded its scope of coverage and subsidies to include private vocational training. VCDP thus became the most important subsidy program to upgrade skills of employees.

Despite the incentives it provided, the scheme has had limited success in increasing the amount of training provided by small firms. Large firms have been the main beneficiaries of the training programs with ‘windfall’ gains accruing to large firms. Not all firms that contribute to the fund actually provide training for their workers.

Therefore, a scheme such as the EIS could be considered by German governments as a means of encouraging firms to provide higher–level training for their employees. The Korean experience suggests that, to be successful, a scheme of this type should be designed to include part-time and casual workers and older workers.

Developing e-learning infrastructure

There are increasing demands for affordable, accessible and timely education and training. With the rapid development of information and communication technology over the last two decades, e-learning has become extremely important.

The Korean government has made efforts to provide the information and communication technology infrastructure and funding required to promote and support e-learning in educational institutions and enterprises. The government had realized that availability of financial incentives was not enough to ensure that individuals and enterprises will engage in e-learning. There had to be the necessary infrastructure to provide a platform for e-learning delivery.

In Korea, policies and strategies adopted by the government have created the appropriate environment to enable the development of e-learning. The National Information Framework, represents an endeavor by the Ministry of Information and Communication to build ICT infrastructure. In addition, the Korean government has also supported ICT education for students at all levels of education. The Ministry of Education and Human Resources Development has legislated for the establishment of cyber-universities whose main purpose is to provide higher education programs via e-learning. The Ministry of Labor has provided financial support to encourage the uptake of e-learning in Korean enterprises. Due to the government policies and strategies, Korea has shown exceptionally rapid growth in terms of Internet access and Internet use. Its performance has placed it among the leading countries in this area.

The Korean experience provides an example of the role of the government in promoting e-learning by taking initiatives in developing e-learning infrastructure.

2) Lessons from the German experience

Quality assurance

In German companies ‘quality’ is understood as the ‘quality of training and skills’ while it is defined as the ‘quality of products’ in Korea. This approach is based on the belief that a high standard of initial training in the context of real work-processes should guarantee high-quality of the production process, and hence an end product which meets the highest standards. The final outcome should naturally fulfill the demands of the customers reliably and systematically.

To meet this standard, the companies made use of specific teaching and learning concepts in their training contexts (the ‘process learning workshop’ at DC Gaggenau, ‘training islands’ at Ford in Cologne, the assessment system (AiD) at DC Mannheim) to implement didactic approaches in a targeted way. These schemes for initial training include elements from quality management systems based on the international standards of ISO 9000 family and other quality awards.

Recently, many countries have tried to introduce schemes to enhance the quality of skills and training in enterprises by evaluating and certifying corporate training activities. The German examples show that the scheme for quality assurance should be examined in the broader context of total quality management system.

Involvement of social partners in initial vocational training

In Germany, vocational training takes place primarily in the so-called ‘dual system’. For one or two days a week apprentices attend public vocational schools and they spend the rest of their work hours in their workplaces.

The term 'dual system' denotes a combination of two different training locations within the same training program. Vocational training follows general schooling and precedes actual working life. As a rule, vocational training programs span three years. The German training system, with its nationally standardized and rigorously enforced curriculum, is governed in a "corporatist" fashion, i.e., by employers associations and trade unions together under a state umbrella. There is not much in the system that individual employers can decide on their own. Chambers regulate, supervise, and sanction the firms whose training they are charged with guiding. The "corporatist governance" of enterprises is supported by state regulations. Adherence to training regimes is also enforced by work councils.

As a result, the German economy has an abundant supply of skills. The role of the social partners in initial vocational training in Germany has been highly regarded as a major source of providing the 'right skills' in response to industrial demands.

Germany's current VET system, involving organized social partners in developing training regulation and training curricula, would simply not be possible without strong corporatist institutions.

Use of new media in international education and training

Case study of DaimlerChrysler Mannheim illustrated an example of the use of new media in international education and training. The Mannheim Plant's "didactic database" made it much more efficient to bring the new Series 900 engine into production in Korea. In late 2003, Korean multipliers were trained in engine assembly in Mannheim using the PLS as a training medium. Afterwards they received individual instruction at the relevant work station or by working on a specially prepared training engine. These training multipliers returned to Korea and passed on their knowledge to their colleagues, communicating the training content using the database on assembly skills they had brought with them from Mannheim.

The DC Mannheim's experience indicates that using a new training medium for internationalization offers advantages in terms of cost and efficiency. It reduces the number of trainers required to transfer knowledge and skills, which substantially cuts traveling costs. Even after the departure of experts, the work-related expertise is left behind to be repeatedly accessed for training.

As the world becomes more globalized, enterprises including automotive companies are expected to have more collaborators and suppliers abroad in the future. The DC Mannheim's experience in VET internationalization was a prime example of how international cooperation in education and training can be promoted with the help of new media.

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Glossary

Abitur

Secondary school qualification, normally obtained at the upper →Gymnasium level →Gymnasiale Oberstufe) after 12 or 13 years of school education. Constitutes general higher education entrance qualification permitting the holder to study any subject at any higher education institution. In the Abitur examination, Allgemeine Hochschulreife

Allgemeinen Hochschulreife

General higher education entrance qualification. Entitles holder to admission to all subjects at all higher education institutions and is usually obtained at upper →Gymnasium level (→Gymnasiale Oberstufe) by passing the →Abitur examination. The certificate of Allgemeine Hochschulreife incorporates examination marks as well as continuous assessment of pupil's performance in the last two years of upper →Gymnasium level (Qualifikationsphase).

Anerkannte Ausbildungsberufe

Recognised occupation requiring formal training. Occupation regulated at the federal level by legal ordinance for which training is received within the dual system at two different places of learning, i.e. at the workplace and through part-time attendance of a vocational school (→Berufsschule).

Ausbildungsordnung

Training regulations. Legal ordinance governing the in-company training section of vocational training within the dual system. Training regulations also exist in other areas (e.g. for careers in the Civil Service).

Ausbildungsordnungen

Training regulations. Legal ordinance governing the in-company training section of vocational training within the dual system. Training regulations also exist in other areas (e.g. for careers in the Civil Service).

Berufliches Gymnasium/Fachgymnasium

Type of school at upper secondary level offering a three-year course of education which includes both the general education subjects taught at upper →Gymnasium level (→Gymnasiale Oberstufe) and career-oriented subjects, such as business and technology, but which also leads to the general higher education entrance qualification.

Berufsakademie

Institution of tertiary education, in eight *Länder*, offering three-year courses of academic training at a Studienakademie (study institution) combined with practical professional in-company training within a dual system, i.e. in the study institution and in the workplace.

Berufsfachschule

Vocational school at upper secondary level offering a wide range of branches and courses of varying duration. A full-time school, it prepares or trains students for a specific occupation at different levels of qualification.

Berufsgrundbildungsjahr

Basic vocational training year at upper secondary level – basic training in one of 13 vocational fields which may be counted as the first year of vocational training within the dual system. The year may be made up of full-time instruction or may be a combination of school and in-company training

Berufsgrundbildungsjahr

Basic vocational training year at upper secondary level – basic training in one of 13 vocational fields which may be counted as the first year of vocational training within the dual system. The year may be made up of full-time instruction or may be a combination of school and in-company training.

Berufsoberschule

Vocational school at upper secondary level existing in a few →*Länder*. Offers those who have completed vocational training in the dual system the opportunity to obtain a higher education entrance qualification. Providing two years of full-time education or correspondingly longer part-time education, the Berufsoberschule leads to the →Fachgebundene Hochschulreife and, with a second foreign language, to the →Allgemeine Hochschulreife.

Berufsschulen

Vocational school at upper secondary level generally providing part-time instruction in general and vocational subjects to trainees receiving vocational education and training within the dual system. Vocational school offering continuing vocational training courses of between one and three years which build on initial vocational training and subsequent employment and lead to a further qualification in a profession.

Berufsvorbereitungsjahr

Preparation for those young people who do not have a training contract, helping them to choose a career and providing them with vocational training in the form of full-time instruction designed to provide an introduction to one or two occupational fields.

Duales System

Training carried out at two places of learning, i.e. at upper secondary education establishments (→Berufsschulen) or tertiary education institutions (→Berufsakademien, →Fachhochschulen) and in companies. Trainees either attend the two places of learning alternately or simultaneously.

Fachhochschulen (FH)

University of applied sciences. Type of higher education institution established in the 1970s, which has the particular function of providing application-oriented teaching and research, particularly in engineering, business, administration, social services and design.

Fachhochschulreife

Qualification entitling holder to study at a →Fachhochschule. May usually be obtained after 12 years of schooling at a →Fachoberschule or – under certain conditions – at other vocational schools.

Fachoberschule

Vocational school at upper secondary level providing two-year courses in various subject areas leading to the qualification of →Fachhochschulreife. The first year consists of both practical training in the workplace and lessons, whilst the second year covers general and subject-specific lessons.

Hauptschulabschluss

General education school leaving certificate obtained on completion of grade 9 at the →Hauptschule or any other lower secondary level school. This first general qualification is generally used to enter a course of vocational training within the dual system. In some →*Länder* pupils who have achieved a particular level of performance may be awarded a so-called qualifying Hauptschulabschluss at the end of grade 9 and in some *Länder* it is possible to obtain what is known as an extended Hauptschulabschluss on completion of grade 10.

Hauptschule

Type of school at lower secondary level providing a basic general education. Compulsory school, unless pupil is attending a different type of secondary school, usually comprising grades 5-9.

Länder

Constituent state of the Federal Republic of Germany (16 in all) which, like the Federation, has original state authority. However, responsibility for the execution of state powers and the fulfilment of state tasks is divided by the German constitution, the Basic Law, between the Federation and its constituent states. Of the 16 *Länder*, the five *Länder* in the area of the former GDR are known as the *Länder* in eastern Germany, whereas the other 11 constituent states of the original Federal Republic of Germany are known as the *Länder* in western Germany.

Mittlerer Schulabschluss

school leaving qualification of the →Realschule.

Rahmenlehrpläne

Framework curriculum for vocational subjects at the Berufsschule within the framework of vocational training in the dual system. Framework curricula are decided on by the Standing Conference of the Ministers of Education and Cultural Affairs of the →*Länder* once they have been coordinated with the training regulations for the in-company part of training within the dual system and are implemented by the *Länder* in specific curricula for each Land.

Realschule

Type of school at lower secondary level, usually comprising grades 5-10. Provides pupils with a more extensive general education and the opportunity to go on to courses at upper secondary level that lead to vocational or higher education entrance qualifications.

This study looks at examples of initial and continuing vocational education and training in the automotive industry in Germany and Korea. It demonstrates the different approaches of the Korean Research Institute for Vocational Education and Training (KRIVET) and the German Federal Institute for Vocational Education and Training (BIBB) in the context of their exploratory research. Whereas KRIVET placed greater value on a thorough treatment of enterprise-based initial and continuing vocational education and training, exemplified by Hyundai Motors, BIBB favoured a composite analysis of four company case studies from the same industry, which drew attention to current initial and further training practices in the companies concerned, highlighting both common features and differences.

The results of the joint study highlight the differences in occupational and employment systems, cultural contexts and structural conditions. Whilst the Korean vocational education and training system is primarily school-focused and companies have little involvement in initial and continuing vocational training, in Germany both school-based and dual forms of initial vocational training are found. In the continuing education and training sector in Germany, enterprise-based concepts make a major contribution. The challenges faced by both countries, however, in terms of the global competitive environment and the transition towards a knowledge and information society, are entirely comparable.