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THE WAY OF MODULARIZATION STRATEGY BY HYUNDAI

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INTRODUCTION

The auto industry's experiment with modular assembly systems is raising big concerns among automakers about innovative achieving cost reduction and efficient new methods of work. Korean automakers emerged under specific economic conditions, which have since changed considerably. We have seen, among other things, (1) the severe global competition of automakers; (2) increased R&D and cost cutting and (3) the end of continuous market growth in Korea, leading to severe recession for automakers. All of these trends have put severe pressure on the existing managerial strategies, which could put in question traditional forms of labor-intensive product system. In concert with the growing pressures on increased profit and new technology development, there is pressure for new managerial strategies in favor of more flexibility, increased quality and innovative cost reduction. For this purpose, Korean automaker has introduced modularization as a method of increased productivities, elimination of workers and reduced cost.

Modular supply philosophy calls on parts makers to build large chunk of a vehicle and deliver these modules to an assembly plant. Modular assembly system allows automakers to shift design, engineering and supply chain management.

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Automakers would take different approaches to modular design and assembly, all tailored to their own specific situations. Korean auto industry fell far behind its European counterpart in the case of modularization. With this view in mind, my paper will deal with examining the characteristics of modularization of Korean automaker. In the first part of this paper I will give a brief description of the modular assembly system of Hyundai. Then I will describe in detail the new trend toward the establishment of a subcontracting system, which will bring about a fundamental restructuring of inter-firm relationships in the Korean automobile industry. Following that, I will discuss the change of work organization. The modular assembly system takes on particular importance as a factor that will lead to the establishment of a new production system.

NEW PRODUCT STRATEGY AND MODULARIZION

In the late 1990s, Hyundai achieved the level of economies of scale with a yearly production capacity of around 2 million units. At the same time, the maturity of mass production exposed the limitation of the Taylorist-Fordist model of manufacturing in Hyundai. Management faced the problem: how to manufacture a increasing labor productivity and engaging in other cost cutting measures, on improving quality control and, perhaps most importantly, on increasing the flexibility of production systems. The main elements of the increasing flexibility are the introduction of microprocessor-controlled robotics; other computer numerically controlled machine tools and automated process control. These new forms of automation have dramatically increased the flexibility of the manufacturing system. The automation strategy is most meaningful for the understanding of the Hyundai strategy after the crisis in the late 1980s. First and foremost, this strategy aimed at the introduction of the modularization. Next, it was oriented to implementing a higher level in quality, cost cutting and productivity.

Therefore, Hyundai decided to make a restructuring to the production system in order to maker work more efficacy. Since 1997, Hyundai introduce new production system at Greenfield Plant Asan that is undertaking the humanization and automation of its production system based on advanced automation. Management is defined as a “worker friendly factory”, however the representative of employee interest is not involved in the technical-organizational design of the work. The Asan production system is characterized as follows:

1. The platform used is equipped with a base that can be adjusted for height, depending upon the height of the worker, so those production workers do not have to work in a difficult posture. Productions workers are able to undertake there task while

remaining on the platform and do not have to walk along.

2. The assembly line is divided into a dozen mini-lines and it is possible to keep buffer stock between them. The traditional assembly line is more than a kilometer long and does not buffer stocks based on the principle of "just in time". With buffer stocks, the work pace can be adjusted by line segment. If one mini-line stops due to a problem, the others continue to function and the line affected can catch up to them by accelerating its pace of work. Also some parts assembly is conducted off-line in sub-assembly modules.

3. A working group is responsible for a mini-line. The team leader can regulate the work pace of his team. In this way more autonomy and more responsibility are given to the team, and at the end of the mini-line there is a quality control post. Now each team can assure the quality of its products. As a result of this the working groups began experimenting with self-quality control and self-maintenance techniques under a Total Production Maintenance program [1].

4. Moreover, the assembly line is more efficient than the traditional line due to increasing the flexibility of the production systems. The main elements of the increasing flexibility are the introduction of microprocessor-controlled robotics, other computer numerically controlled machine tools and automated process controls. These new forms of automation have dramatically increased the flexibility of the manufacturing system. This technology strategy based on progressive automation of all manufacturing processes continued with the implementation of the CIM system. These production systems have been undertaken by computer-based automated procedures and they realize ninety-five percent of the planned target. The degree of automation has also been rising. Ninety-five per cent of the operation was automated in the press and body shops, while the degree of automation in final assembly process is 15% [2]. Automation also allows for increasing technological and organizational flexibility due to the possibilities of de-coupling worker tasks from the production process, so that this affects man-hour management. That regulates the line speed and the assignment of manpower in production processes. The UPH (unit per hour) of the production line in Asan plant is increased in comparison to Ulsan plant. For example, the cycle time of the assembly line in Asan is 60 seconds, while it is 90 seconds in the Ulsan plant.

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1 Under this program, Hyundai now carries out a 100PPM campaign that means a 0.01% of rejection rate in assembly work.

2 The doors, seats, and front and rear glass are loaded by a robot system.

5. The Asan Plant did not abandoned the principles of just-in-time, while they developed JIT-Flexibility by the combined JIT and advanced production technology in order to cut costs, improving quality control and perhaps most importantly increase the flexibility of the production systems. Moreover, the flexibility automation based on sophisticated information technology has been pushed as far as possible to eliminate arduous tasks from an ergonomic viewpoint and fixed employment structure. It caused the change of the structure of employment. The structure of employment offers fairly precise indications of the current structure of work in production. The percentage of white-collar workers in Asan was 17.7% in 1999, while the percentage of indirect blue-collar workers to blue-collar workers was 15.1 %.

6. The utilization of part-time work or temporary work also has been expanded. The company employed around 24.2% of total product workers as outside caterers in 1999 who work at the shop floor, as employees are subcontractors of Hyundai. These workers have undertaken the subassembly jobs such as door assembly or fuel tank assembly. These flexible personnel policies have a twofold effect: On the one hand, compensation for physical strains that can eliminate the conflict issue of labor management relations. On the other hand, potential reduction of labor costs.

7. As far as teamwork is concerned, it is the group leader who organizes the task rotation in his group, taking into account the skill level of his workers. The job rotation with the goal of training polyvalent workers is currently a prominent theme in work organization. However, the old plant in Hyundai has no special criteria for job rotation at the present because workers have a negative view about its being a cause of work intensification, while rotation is frequent on the shop floor. Its goal is to compensate for work-related stress and strain among the group members. Basically the job rotation in Asan, by contrast, is realized on the shop floor according to the management plan.

Top management emphasized continuous improvement on the shop floor. In 1999, the Asan plant organized 166 Quality Circles on the shop floor and 7~10 workers organized each QC circle. They hold a meeting after work in order to make clarify quality goals, communicate the goals to the shop floor, diffuse quality and cost consciousness, save energy and minimum waste, and so on. The worker paid special attention to participation in the QC Circle because an atmosphere of openness and trusts, a prerequisite for motivation and voluntary work, is constituted on the shop floor level. Intensification of trust between worker and management is one of the major

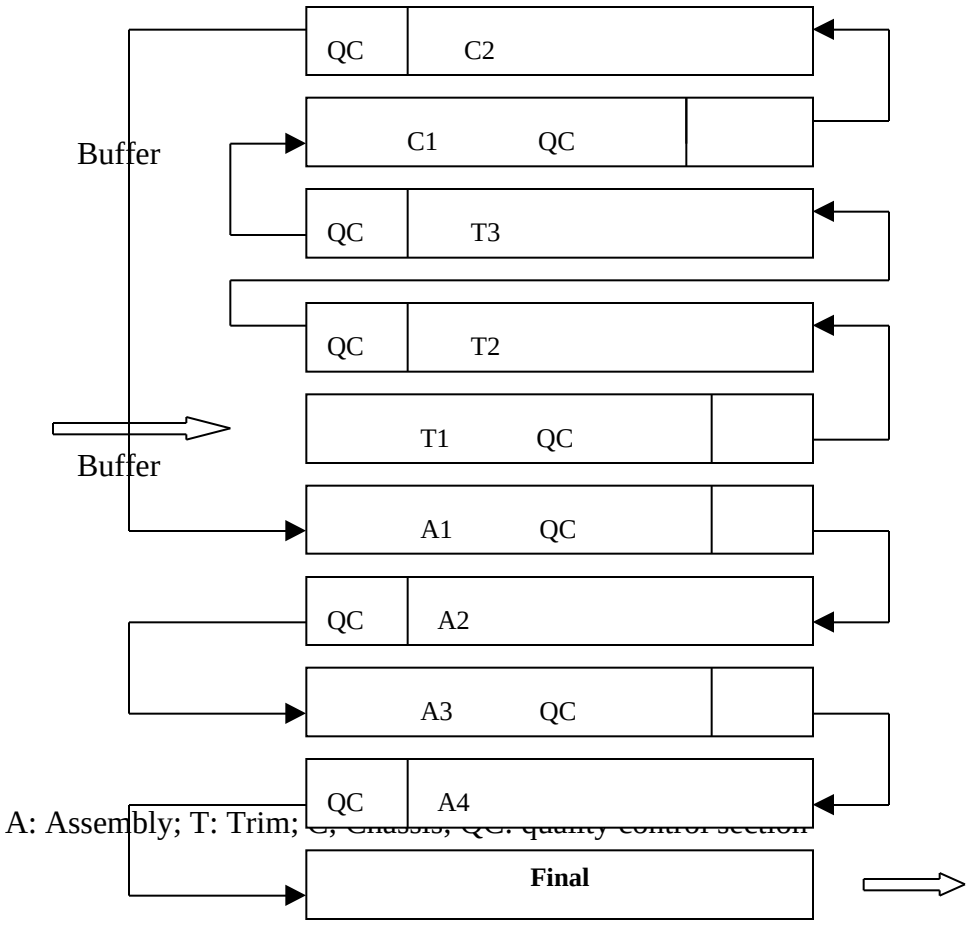
reasons for the high quality. According to the new car initial quality survey of the Hyundai Audit team, the assembly defects rate of the Asan Plant was 75% lower than that of the Ulsan Plant in 1997. The number of suggestions per worker exceeds 15 per year. 70 percent of these ideas are realized at shop floor in 1999.

To sum up, the new production system based on the green field strategy has been to promote cost-efficient labor utilization, flexible job deployment and workers' multi-skilling. At the plant level, Hyundai management has strategically focused on three policies to cope with the challenges posed by the labor union and growing market competition: (1) the stabilization of labor-management relations, (2) the reform of the personnel management system, and (3) the rationalization of manufacturing operations. These policies have achieved relatively good relationship between management and workers and then contributed to improvements in performance.

By the mid-1990s Hyundai strategy was to expand production capacity in order to improve market segmentation. The result was that Hyundai has introduced a large number of disparate platforms, rather than created model variations from an individual platform to leverage investment. This effectively means higher R&D and material cost, few common parts across different models, more complicated production processes, and low capital productivity from assembly assets. This results in a low model per platform ratio of roughly 1 model per platform compared to a roughly 3+ for Japanese and European manufacturers. Hyundai has produce 8 model based on a 5 platforms. In order to solving this problem, Hyundai has lunched new platform strategy. They will be integrating 5 platforms and produce 15 models. The volume of each platform will reach 500,000 units and each model will produce 150,000 units [3].

3 Hyundai Motors, The Direction of the Korean Auto Industry, Hyundai Motor Company, Seoul 1998, p.8

Figure 1: The assembly line at Asan Plant



A: Assembly; T: Trim; C: Chassis; QC: quality control section

In Parallel of the new adopted product strategy, Hyundai have implemented the concept of modular production into their assembly operations in Asan Plant. Management also began to adopt calculation method of production standards, called MODAPTS [4], in determining manpower allocation and production line speed for the assembly lines. Now, Hyundai classifies auto parts into 13 modules and plans to gradually upgrade the level of modularization for new car models. Hyundai's categories of modularized auto parts are as follows: cockpit, pedal, head-lining, doors, rear package tray, front suspension, rear suspension, fuel tank, muffler, tubes, cooling device, rear bumper, front bumper.

As exemplified in Table 1, it is noticeable that the modularization of auto parts supplied by outside vendors has grown from the level of 10% for the car model (A) and (B) to over 30% for the most recent car model (F).

Table 1. - Modularization of Hyundai Motor

	Model A	Model B	Model C	Model D	Model E	Model F
Total No. of Auto Parts (A)	640	934	633	666	820	805
No. of Modularized Parts (B)	65	85	128	165	167	244
Rate of Modularization (B/A)	10.2%	9.1%	20.2%	24.8%	20.4%	30.3%
Reduced Man-Hour	0.33	0.53	0.64	0.83	0.84	1.22

Source: Internal company document

Hyundai Mobis, an auto parts-making unit of the Hyundai Motor Group and biggest chassis & cockpit module supplier in the nation, is supplying and developing Strut Assemblies, Corner Module, Front Chassis Module, Rear Chassis Module, and other various types of module. With complete interpretation of structure, they are producing highly reliable chassis modules. Cockpit module is a basic frame unit that provides assembled instrument panel, cross bar, colling & heating system, air bag, various dash board, steering column of electrical part such as audio, pedal assembly etc. The newly developed Cockpit Module is much more than an old concept of Sub Assembly. Cockpit Module will innovate the entire ways of assembling all related parts. Furthermore, newly adopted CAE, Digital Mock-up, and Rapid Prototype will bring drastic reduction in development period, thereby it can attain lowering of manufacturing costs, and even weight reductions. And to promise prompt modules supply, they are

4 The MODAPTS stands for Modular Arrangement of Predetermined Time Standard, which is a technical method to calculate working man-hours by analyzing production processes on the basis of modular tasks, comprised of various motions like moving and assembling. (Hyundai Motor Workers Union 2000)

vigorously taking a JIT (Just-In-Time) supply chain system. In order to further modular production, Hyundai Mobis build a new car module plant in Ulsan, end of the first quarter of 2001. The new plant, covering 62,700 square meters, will be designed to produce 600,000 units of driver-seat modules and chassis modules a year.

Otherwise, unit suppliers has installed inside of automakers' automobile assembly plant. In Asan plant has three sub-assembly lines as engine, ABS and door. There, components are supplied by sub-module makers and assembled into module parts, and then they are supplies to the final assembly line by J.I.T.

Module suppliers assemble various kinds of components into module and /or units and supply them to the final assembly lines. The advantage of this process is that it is not only alleviate the complexity of work on the part of automakers, but also production labor cost is reduced because the larger pat of labor cost is shouldered by module suppliers. In generally, the labor cost of suppliers is 20~30% lower than that of automakers in Korea.

MODULE SYSTEM AND CHANGED SUPPLY CHAIN

The increased module purchasing policy of parts will lead to the integration of the affiliated-firm into the overall design and manufacturing process. The modular production system, in which Korean carmakers have been lagging behind the American and European producers, carries several merits from the point of view of production control and reduced transaction costs when introduced in the assembly process.

Table 2. - Supplier selection criteria for first supplier

Large Supply Volume	Contribution for Assembly	Geographical Advantage	Big Company	Others
17(11.8%)	92(63.9%)	5(3.5%)	12(8.3%)	18(12.5%)

Source: Jeong (1999)

The introduction of module system is induced into the change of supply chain. The former first suppliers, who were left out the selected Tier 1 supplier, became the Tier 2 suppliers. For example, D company, cockpit module supplier, is a medium-size company with annual sales of 91 billion won.

They have 14 subcontractors. Among them 5 supplier are a large-sized company with annual sales who were first supplier at Hyundai before the introduction of module system. Now this suppliers are become Tier 2 suppliers.

In this sense, this system will expedite the selection and restructuring of suppliers. Hundred of small-scale parts makers are extremely concerned about their fate in the aftermath of the "restructuring". This change could, perhaps, more than halve some 366 first suppliers, which supply parts directly to the final assembler involved in the restructuring. Hyundai is set to screen their suppliers first and then choose contract winners through bidding. From those suppliers two or more qualified makers would be identified for each component parts in early 2000. Parts contractors would be determined later through bids from qualified firms. The capability of supplying integrated parts in modules will be taken into account in the screening stage. Hence, at least one-third or up to nearly half of the 366 parts suppliers may be eliminated in the process.

Now, some of the requirements of Tier 1 parts makers expected by Hyundai can be listed as table 2. Hyundai set up very strict criteria for the selection of new suppliers. 63.9 per cent of subcontractors surveyed have agreed the development competence, quality and risk sharing as first criteria for maintain first tier supplier (see Table 2). Most first layer of subcontractors quickly implement process innovations needed for the cost-effective manufacture of new products. This trend has caused first supplier to regard technology development. An import outcome of this shift in supply relationships implies recognizing the strategic role of subcontractors in determining the quality and costs of cars. An extension of R&D is taking place in the area of new product development and improvement of productivity. The most module suppliers have gained technology through the joint venture. These suppliers with an open network organization are heavily dependent on orders placed by assembler. The buyer-supplier relationship could be changed into a more vertical integration that pushed down the price of auto parts, if they cannot complete design and engineering capabilities. That allows enhanced arm’s-length relations.

The core knowledge of the big supplier based on important R&D work came not only from their own research work, but also from transferred technology from license and technical alliance with foreign makers. Because engineering service firm does not exist in Korea. For example, Hyundai MOBIS plans to expand the current size (30 employees) of the R&D department up to over 100 employees, in order to develop those modules. He plans to set up a joint venture with Textron to roll out the modules for driver's seat, including instrument clusters and driving wheels. They also plan to set up

a strategic technical alliance with ZF and Bosch of Germany to produce chassis and airbag modules. They are set to inject a total of W150 billion into the module production projects. In its Ulsan plant, the firm will be building a production line of chassis modules for 800,000 units a year by investing a total of W10 billion. Another W20 billion is earmarked for the production of anti-lock brake system modules [5]. The most of the Korean supplier are small and medium size, which has a poor R&D capability in generally. Korea Auto Part Research Institute – state research center – support the development of technology/engineering capabilities at parts and automobile related industry.

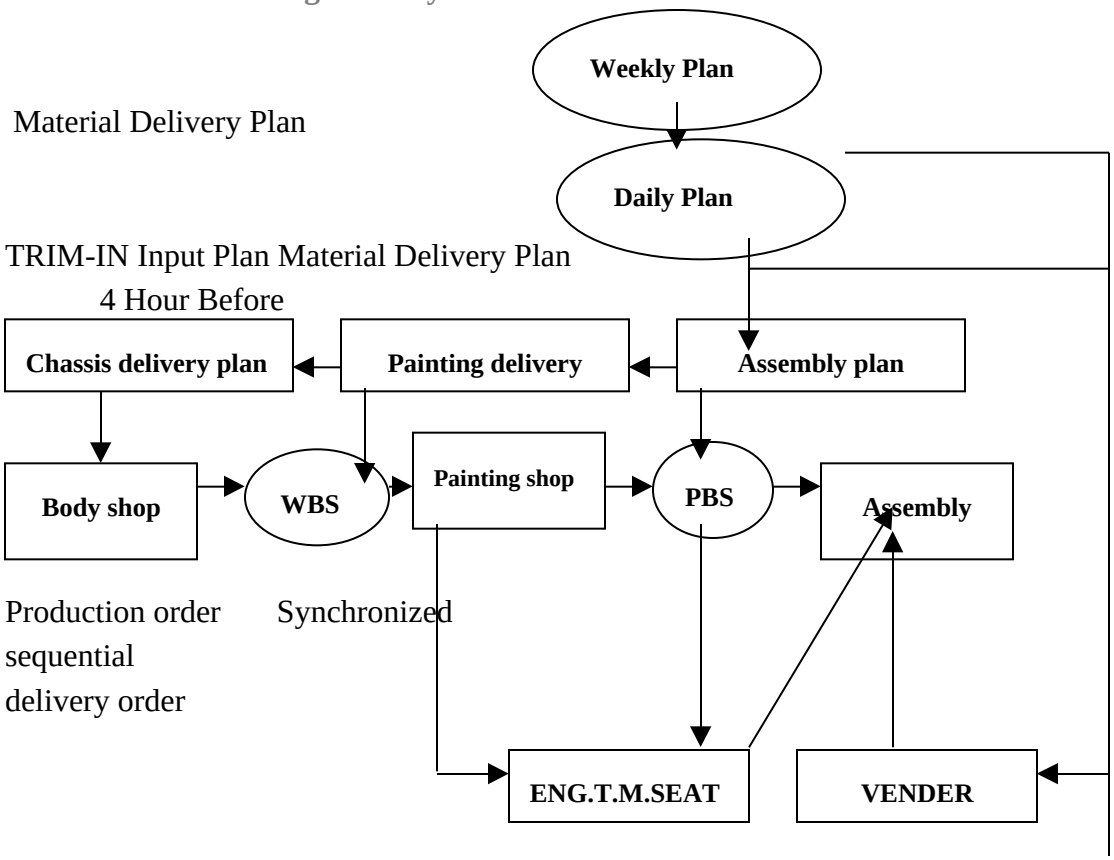
Even though the module system has introduced already in production system, the involvement of supplier in product development has been very limited. It is resulted from low engineering capability of suppliers. The increasing module system required for high engineering capability and design activities for Tier 1 supplier. Hyundai's design and engineering are able to manage product and component design and innovation without using out-sourcing. The first layer of subcontractor participation in the design process effected the reduction of cost and lead-time. The bilateral relation between customer and supplier resulted in formalizing the "black box" design concept. Hyundai has common laboratory facilities in order to provide bilateral design and development of new components between Hyundai and their subcontractors. Around 50 engineers from 50 subcontractors resident in these facilities and another 50 engineers from other suppliers cooperated with Hyundai's engineers irregularly. The degree of "black box" components development was only 29%, in sharp contrast to the Japanese automobile components development.

The introduction of modular configuration has modified existing suppliers' delivery routines under synchronized production process. Hyundai also started to rationalize and reorganize its logistics through the use of modern information and communication technologies such as the value-added network. A rationalized logistics system was set up in 1994 with 329 suppliers. With the development of this system Hyundai could completely control the logistics chain, which permitted greater flexibility in logistical Planning. With the adoption of just-in-time deliveries the unit of time used for delivery scheduling was radically reduced, from months to days to hours. The average inventory at Asan Hyundai was 0.8 days of production. Hyundai also installed warehouses at its plants to collect and distribute parts supplied by subcontractors. Every day several trucks go round 108 suppliers to collect component. Many of these component manufacturers were so small and their technical abilities so poor that they

5 Chosun Ilbo, July 22, 2001

simply could not afford small lot production and JIT. This common gathering system has reduced 20% of logistic cost (about 6.5 milliard Won) in every year.

Figure 2: Synchronized Production Process



The adopted modularization had stimulated synchronized delivery method. Material and parts delivered to assembly plant of Asan in two ways. One is a synchronized sequential delivery method, which is applied to function components such as engine, transmission, instruments panel, radiator, brake drum etc. The other is scheduled batch delivery method, which is usually adopted the other parts [6].

A scheduled bath delivery method is flexible to market fluctuation. Asan Hyundai makes plan to material delivery to suppliers 7 days before its production starts and orders to suppliers 3 days before its production starts. Consequently company can not holding inventories and cope with the fluctuation of production volume during the interval between material delivery plan and production order to supplier. They reached

6 Je Wheon Ohe, Introduction of Japanese Manufacturing System and its Limitations in the Hyundai Motor Company, mimeo, 1999, p.8

95% of scheduled batch delivery plan and synchronized production process.

Synchronized sequential delivery is conducted in three different methods. One is called MIP (Manufacture in Plant) sequencing, where components are produced in plant and then sequentially fed to assembly line according to the sequence of vehicles. The second way is sub-assembly sequencing. This is conducted by supplier, who assemble units of component in the near of assembly line and delivery by JIT. The last method is direct sequential delivery, where components are sequentially provided directly to assembly line from suppliers. Supplier get the information from Hyundai through the VAN network system, which indicates delivery volumes needed every day. For example cockpit module supplier get an order for assemble products in every day. The information is the assembling sequences finally determined just after vehicle came out PBS (Pained Body Storage) (see Figure 2). In fact, Company D is keeping just 10~20 unit inventories of finished module to sequence deliveries. If they have problem to parts supply from subcontractors, they have high risk to sequential delivery on Hyundai assembly line.

Module system and synchronized production on Hyundai has strong pressures for changes of supply chain. The supplier has polarization as a three types:

- Big mutli-technology supplier like Hyundai Mobis ,
- Medium-sized suppliers of modules in the pre-modularization and
- Small-size suppliers of components.

The first type is dominated by affiliated-firms and international suppliers like Bosch. Assembler has attempted to set up affiliated subsidiaries in order to secure a stable and adequate supply of parts. Otherwise, assembler has alleviated R&D responsibility on the parts and components. The majority of these firms is relatively big in size and has high technological capability and usually manufacture the core parts are complicated and capital-intensive. The portion of the parts supplied by these parts manufacturing companies is over 40% of all parts that are supplied to assembler. Firms work in close alliance to solve specific problems of design, manufacture and have long-lasting working relationships. In such cases we can find cooperation and co-existing relations.

The Second type is a sub-module supplier who was mostly Tier 1 suppliers. Most of these suppliers are small scale and lack R&D capability that inevitably leads to lower participation by suppliers in the design process and a longer time for new parts development. The last type is mostly common parts supplier who has direct business transaction with assembler. This pattern of closed transactions can provide monopoly

rents to the automobile manufacturing companies by weakening the parts manufacturers' bargaining power and setting monopoly prices. This hierarchical subcontracting network is advantageous to the assembler, who has the power to drive down cost.

MODULARIZATION AND WORK ORGANIZATION

Elimination of worker is one of the purposes for introduction of modularization. Even the diffusion of modularization on the shop floor is not characterized by new production concept. Taylorist-Fordist concept is still key elements of the production management on the Hyundai

Usually, the work organization is based on a high division of labor according to functions, tasks, and hierarchical level. This means that the division between worker and manager/engineer, blue collar and white collar, physical and metal work was crystal-clear. Employees were categorized into 4 different groups, each assigned to specific tasks; (1) Managers or engineers works in the office with degrees from universities, many rarely visiting the shop floors. (2) Clerical workers are engaged as assistants to the manager/engineer at the factory with degrees from high schools. (3) Skilled workers or technicians are professionals with degrees from technical high schools. They have the task of programming, program adjustment, presetting of tools, maintenance and repair, and quality assurance. (4) Production workers are unskilled and perform the tasks of loading and unloading the parts as well as simple assemblies on the production lines. The employees in each job categorization have their own carrier system.

The work organization at the plant level has a three hierarchical level [7]: Chochang (group leader) - Banchang (foreman) - Juim (section director). The key element of the work organization among the workers is "Cho" and "Ban". According to the data of the company, a "Chochang" directs an average of 8~10 general workers, a "Banchang" has around 60 subordinates including 2~3 "Chochang". Group leader and foreman have managerial responsibility for immediate production activities and play crucial roles in organization, design, and allocation of work on a daily basis. Their job is to supervise, or "boss", shop floor workers that are a differential feature in comparative team work in the Uddevalla system. They are selected by management, which has the right of personal assessment of workers. This dense managerial structure plays a critical

7 In the Ulsan Plant, the work organization has a five hierarchical level.

role both in mobilizing workers in rationalization activities and in controlling workers on the shop floor.

Flexible production systems require flexible work practices and worker commitment to quality control and maintenance. Hence the organizational hierarchy may shift from inflexible to flexible, which generally contributes to cooperation and horizontal communication. The most fundamental issue in Asan is an introduction of a new form of work and production organization that is closely related to human resource management. There is considerable pressure to change the traditional work organization such as the Ulsan plant. The capacity to mobilize workers in order to increase productivity is closely linked to a career system and individualized personnel assessment. For this reason, management intended introduction of a qualification system that would stimulate promotion of an employee's status. This means that the work organization is divided by position and job classification. This system could solve the bottleneck of promotion of workers [8]. This system also is characterized by the integration of the differential status system between white-collar workers and blue-collar workers. This differential status system is one of the dissatisfactions among blue-collar workers now facing personnel management. Hyundai has ten different grades.

Furthermore, working hours are a critical issue for labor-management relations on the shop floor. Plant management has tried to shorten the cycle-time of production processes as a means of increasing the UPH (unit per hour) of production lines. Usually, cycle time is dependent on the market situation. Given production worker's growing concerns over the shortening of cycle-times, union leaders have tried to exert leverage on man-hour management on the shop floor. The Plant management, pressured by day-to-day production targets, is simultaneously facing the need to prevent union leaders from wildcat actions. So, management needs to maintain a cooperative relationship with union representatives and senior workers who can influence production workers. In this context, management ought to informally persuade those people when implementing man-hour adjustments. A plant manager said:

“Due to increased domestic and export demands we need more produce the cars at plant. Our employees are satisfied because of job is guaranteed and we plan to hire

8 In fact, the promotion of employees in the company is very important for their working life. Koreans also have a strong sense of status or position. The span of promotion from general worker to "Chochang" was limited. According to this new system, a general worker can be entitled "Chochang" without specific responsibility. A "Chochang" will be rotated among the members of the same qualification range. The new organizational innovation can boost voluntaristic behavior in the production process. Obviously, the improved quality and elimination of waste requires the voluntarism of employees.

370 workers who was layoff from the Ulsan plant. Therefore we need to increase UPH from 47 to 60 since third quarter 1999. For this purpose, we try to persuade the workers informally. I am very optimistic because of the high unemployment and recession help to cooperative relationship between labor and management [9]."

Despite this, man-hour adjustments will be negotiated at the regular monthly meeting between union representatives and management. Throughout the informal connection between managers and workers, management has made great efforts to avoid union representatives' opposition in man-hour resettlement [10]. It is noteworthy that management has used formal [11] and/or informal meetings as an extension of collective bargaining. In this context, the management relies on personal relations with workers in order to produce cooperative labor-management relations.

The Asan Plant uses ongoing training and socialization programs to acclimate workers to new production practices. Most employees begin with a six- to eight-week introductory session that includes an overview of automotive assembly and fairly rigorous socialization in the new production system. After this, workers are inserted into teams where they continue to learn by doing from more senior employees. The average line candidate is given a minimum of 21 hours of training and then up to an additional 20 hours for a specific job, such as trim work, body and chassis assembly, or working in the stamping plant. Career development policies seek to create broad levels of capability with respect to new technologies. The aim of these policies is to avoid creating unacceptable employees. Hyundai also offers several training programs to upgrade the skills of workers.

Parallel with create 'familyism', the management stresses higher skill formation. That is a pre-condition of automation at the shop floor. The basic approach to acquisition of skills of shop floor workers is on-the-job training. Until recently most skills were still acquired by experience on the job, with a planned program of skills training and development. In general, however, the companies were demanding higher levels of education and skill before a job was offered. All new employees have been required to undertake formal training on the job to acquire necessary competencies.

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9 Interview at plant in June 2, 1999

10 The Labor union has proposed of bargaining demand for UPH co-determination at collective bargaining in 1999. The management basically accepts this proposal. However, it remains to be seen how UPH can be setup and controlled.

11 According to the labor-management council act in 1997, all firms with more than 30 workers should form a council and hold meetings regularly every quarter. This council is composed of the same number of representatives from employees and management.

Promotion is increasingly based on skills acquired and demonstrated levels of competencies. Award restructuring has fostered this trend, which placed greater emphasis on skill-related wage systems.

By the early 1990s job rotation to train polyvalent workers was a prominent theme in the work organization. However, the Ulsan plant could not introduce job rotation programs because the workers still viewed it negatively as a cause of work intensification. Nevertheless, rotation took place frequently on the factory floor, essentially organized by work groups, and not designed to create polyvalent workers so much as to compensate for work-related stress and strain among group members. However, the plant management in Asan has introduced a special policy for job rotation on the shop floor that is directly and/or indirectly linked with personal promotion and increased wages.

Modularizing production involves considerable change in the organization of work. In comparison to Fordist work organization, modules production system is characterized by simply small sets of integrated production tasks. It is mean job descriptions are larger than Fordism and job hierarchies are simple than traditional one in more generally. In this context, modularizing work organization allows production workers to broad on-the-job training that promotes continuous improvement throughout the system. However the introduction of modularizing production is not lead to elimination of work intensity at shop floor. According to a 1999 company survey, 40 per cent of respondents (sample size: 200) reported their physical workload was too heavy [12].

Neither does modularization imply a decentralization of authority or a diminution in the division of labor. Production decisions are still coordinated centrally by a core group of managers. Design of new products and production techniques remains the province of specialized engineers. Individual production units remain highly specialized (although the change from batch to modular production changes the nature of the specialization marginally). Consequently, there is no need to amend the view that production workers are merely a variable expense, not assets worthy of investment.

In Hyundai, modularization neither improves the status of production workers nor narrows the status gap between management and worker. The close connection between modularization and work relocation leads to an asymmetry in labor-

12 Hyundai Asan Plant, Quality of Working Life Survey, 1999

management relations in which collective bargaining becomes a battle over the right to perform work. The Union pays attention about work organization based on work relocation by the modularization, because they mostly concern about job security and wage. Cockpits Module of B Model at Hyundai eliminates 30 workers at assemble line. Now modularization is hot issues on the collective bargain. In 2002 collective bargaining, union and management has agreed to co-determination of job security based on the adopted new technology. Union had required reduce modularization at Factory 3 in Usan Plant. Management plans to massive induced to modularizing production, when the new model begins production.

Amazingly, modularizing production and work reorganization at Asan plant still supports high levels of productivity and quality. In sum, modularization allows mass producers to regain competitiveness without any comprehensive reconstruction of the Taylorist-Fordist concept.

CONCLUSION

This paper has two major aims: a new feature of supply chain and work organization through discussion of the introduction of modular product architecture. In relation first aim, the supply chain has polarization between modular suppliers and traditional suppliers. The first tier supplier in the traditional supplier chain has become the second tier supplier in modular system, because Hyundai does not select them as modular supplier. It means that the supplier will increase its position as key suppliers of high-tech components to the OEMs and also to the big module integrators. It seems that attention is shifting to emergence of large-suppliers. In this trend, the affiliated-firm has play most important role in the supply chain and the buyer-supplier relationship should be changed into a more meaningful partnership based on product and technology development. Another option is that parts suppliers – they are a relatively weak horizontal network and creates a lower level of control – should be integrate vertically into supplier chain as second tier suppliers. Even these firms are bigger and have a higher-averaged technical capability than the modular suppliers.

With respect to supply chain aspect, Hyundai has attempted to develop new delivery system at shop floor. Synchronized sequential delivery is flexible to market fluctuation and led to reduced inventory cost. However modular supplier has high risk to synchronized sequential delivery and takes response for quality of products, because they have not enough inventories. It means that inventory cost and quality control for parts and components has been passed on to the modular suppliers.

The paper also discussed the changed work organization through modularization. Introduction of modularization is purpose to increased productivities, elimination of workers and reduced logistic cost, not a new orientation of work organization. Even the introduction of modularization on the shop floor has brought to the doubtless high-performance, it is not characterized by new production concept. Taylorist-Fordist concept at Hyundai is still key elements of the production management. It means reforms at the margins of the mass-production system.

Lastly, it is deemed necessary to focus future research on Networking. The implementations of modularization require an optimization of just in time and in-sequence delivery and material handling. It is bring new cluster of second tiers parts suppliers in the near by large module supplier like Hyunai Mobis. Also first tier suppliers move their plant into new industrial districts like Asan. Assembler promotes the integrated production-site concepts, which is supported by the central and regional government. Assembler is looking forward an optimization of logistical management with Supplier Park. It seems also necessary to explore quality of working life that has caused modularization.

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