

New Trend of Parts Supply System in Korean Automobile Industry; The Case of the Modular Production System at Hyundai Motor Company

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An automobile is said to be composed of about 20,000 components or parts (hereafter parts). Korean or Japanese automobile companies are outsourcing up to 70% of these parts on the basis of production cost from their outside parts suppliers. Therefore it is essential for an automobile company to establish an effective and efficient supply chain of materials in order to be competitive.

Regarding the supply chain in the automobile industry, an issue which attracts our attention recently is the modular production system. It is a parts supply system where a small number of first tier suppliers (module suppliers) located at the same or very close site as the automobile assembly plant assemble modules of automobile and supply them on the same sequence in the final assembly line of the automobile assembly plant.

Recently growing number of world automobile companies is adopting this system to enhance their competitive edge. It was also introduced in Korea late in 1990's by Hyundai Motor Company.

In this paper the concept and the meaning of the modular production system is briefly introduced, and the case of Hyundai Motor Company and its two module suppliers, Hyundai MOBIS and Duckyang is analyzed in terms of the problems they encountered as they practiced the modular production system. The paper also presents with some useful lessons which HMC got through the experience of practicing the system so far.

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I. Introduction

In today's competitive environment, automobile firms require the dynamic ability to respond rapidly and flexibly to meet the diverse needs and demands of their customers. Even though there are over 20,000 parts or components in an average automobile, only a few are actually manufactured by the final assemblers, the majority being supplied by a network of specialist component manufacturers. In this regard the efficiency of the supply chain is very important for the competitive advantage of an automobile assembler. It has been demonstrated that by working closely together, automobile companies and their suppliers can create highly competitive supply chains [2].

Regarding the supply chain in the automobile industry, an issue which attracts our attention recently is the modular production system. It is a parts supply system where a small number of first tier suppliers (module suppliers) located at the same or very close site as the automobile assembly plant assembles modules of automobile and supplies them on the same sequence in the final assembly line of automobile assembly plant.

It is true that the growing number of world automobile companies is adopting this system recently to enhance their competitive edge, but they also experience some difficulties during the introduction of the system. For an automobile company to introduce this system, it will have to investigate the problems which might occur practicing this system.

The purpose of this paper is to introduce the concept of modular production system and analyze the decision problems that may occur when a company adopts this production system by the case study of a Korean automobile company, Hyundai Motor Company and its two module suppliers, Hyundai Mobis and Duckyang, which have been practicing the system since 1999.

The structure of the paper is as follows: Section 2 provides a short review on the concept and type of modular production system. Section 3 will provide the case study of Hyundai Motor Company and its two module suppliers, Hyundai Mobis and Duckyang. The case is analyzed in terms of the problems they encountered as they practiced the modular

production system. The paper also presents with some useful lessons HMC got through the experience of practicing the system so far. In Section 4, the conclusion is presented.

II. Modular production system

1. Supply chain before modular production in the automobile industry; bulk delivery

Bulk delivery refers to the shipment of parts from the supplier to the automobile assembly plant. In this scenario, the majority of the assembly of components is completed in the OEM's plant. This requires large amounts of work space and line length within the automotive assembly plant. This type of delivery is consistent with the OEM supplying the product design and the supplier delivering the material as required.

2. Concept and types of modular production system

Module refers to the integration of multiple parts or components. Modular production refers to the shipment of modules from the module supplier to the automobile assembly plant. In this scenario, assembly of components into modules is completed in the module supplier's plant and the shipment of modules is from the module supplier to the OEM plant.

By modular production, the OEM expects to get dynamic ability to respond rapidly and flexibly to handle the complex model mix from the diverse needs and demands of their customers maintaining its cost and quality level. Why is it possible? Because the diversity of automobiles comes from diverse modules assembled by the module supplier. In addition, the OEM expects not only less investments in facilities and slimmer organization structure but also improvement in manufacturability and quality by simplification of assembly line.

Modular production has usually two types; simple assembly (SA) type modular production and integrated development (ID) type modular production. In SA type modular production, the module supplier just makes the modules and ships them to the OEM plant. The module

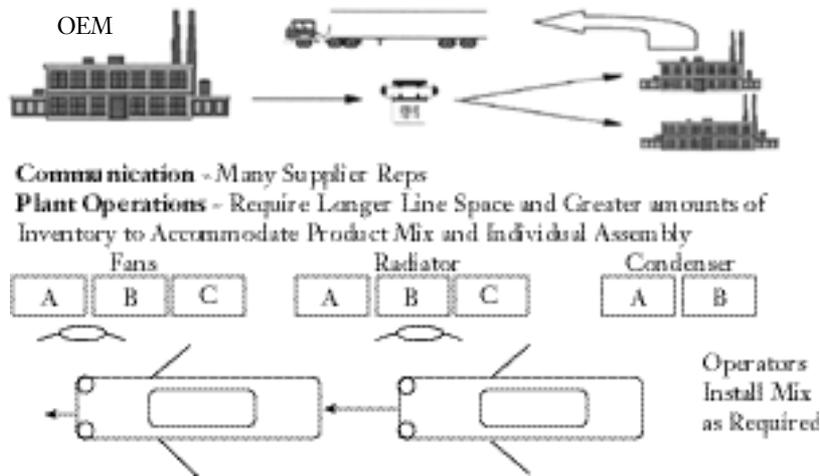


Figure 1. Bulk delivery system

Hamid Noori and W. B. Lee(2000), p. 302.

supplier simply assembles the parts or components into module and supplies them to OEM plant, whereas in ID type modular production, module supplier does design, development, test of modules as well as assembly and shipment of modules to the OEM plant.

In SA type modular production, the OEM expects cost savings mainly by the difference of wage rate between the OEM and the module supplier whereas in ID type modular production, there is broader possibility of cost savings and quality improvement by way of diverse module design and development.

3. Practice of modular production system

In practicing modular production, there are three styles of it; Modular sequencing, supplier parks, and assembly within assembly.

1) Modular sequencing

In modular sequencing, the supplier maintains real time information on scheduling

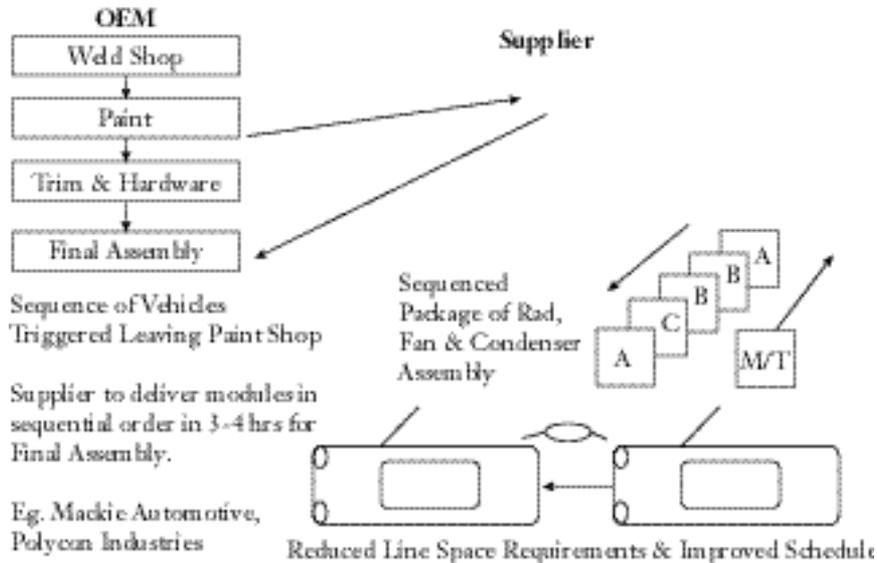


Figure 2. Modular sequencing

Hamid Noori and W. B. Lee(2000), p. 303.

activities in the plant. The supplier transports modules to the OEM plant by trucks with the information. This results in improved communication and accuracy and ultimately fewer inventories on the assembly line as sequenced modules take up less storage and assembly line space in the plant [1].

2) Supplier parks

The supplier park is a closer version of modular sequencing. The suppliers deliver components to the OEM through the use of automated conveyor systems. For example, Ford (Spain) developed a supplier park adjacent to its car assembly plant where many dedicated suppliers are located. In this case, the benefits include reduced material handling, the elimination of truck transportation and a further reduction in WIP. Communication and flexibility in scheduling is improved further as lead times from the supplier to the OEM are reduced [3].

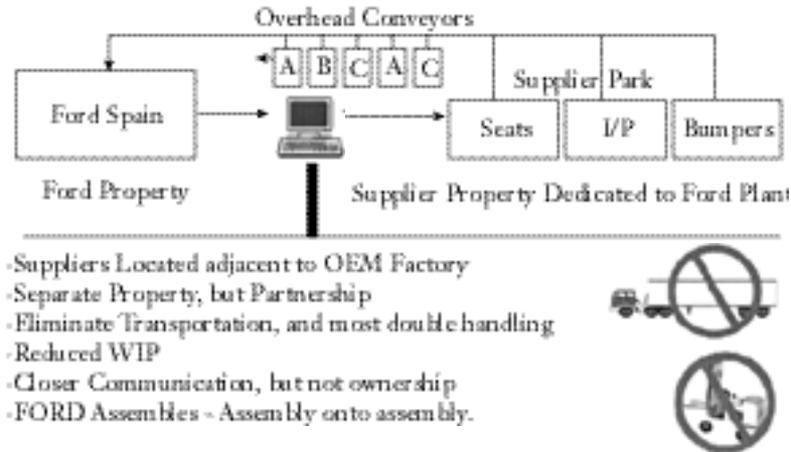


Figure 3. Supplier parks-Ford Spain

Hamid Noori and W. B. Lee(2000), p. 303.

3) Assembly within assembly

In this case the suppliers rent (or co-own) space in the OEMs plant, and assemble the products directly to the vehicle. This promotes the organizational structure based on a series of production silos that are arranged side-by-side and highly coordinated with each other. This approach involves a high degree of cooperation, communication, and integration of operational and managerial activities. The benefits include a further reduction in WIP inventory and instantaneous communication between the OEM and the participating suppliers [7].

III. The case study-modular production at Hyundai Motor Company

At Hyundai Motor Company (HMC) modular production started from 1999 when it started the production of newly developed car model, Avante XD. HMC wanted to have the

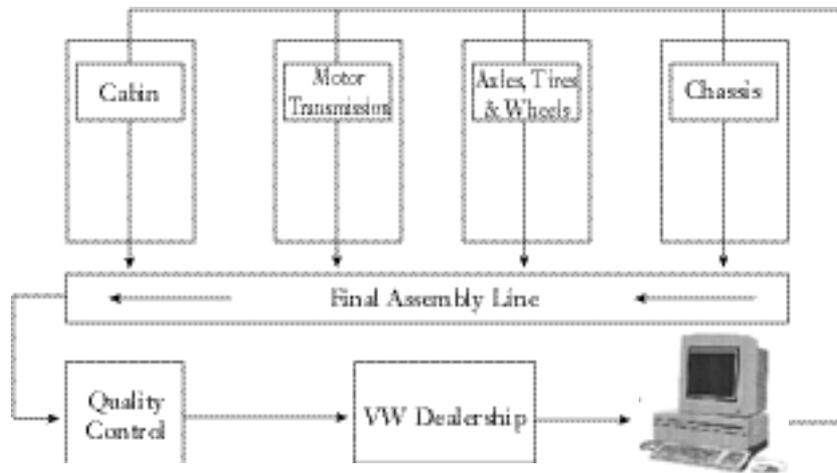


Figure 4. Assembly within assembly system

Hamid Noori and W. B. Lee(2000), p. 304.

dynamic ability to respond rapidly and flexibly to handle the complex model mix from the diverse needs and demands of their customers maintaining its cost and quality level. The model mix had been being more and more complicated as HMC exported cars to more and more countries in the world.

In this case study we will analyze a case of two module suppliers, Hyundai Mobis and Duckyang, which supply chassis modules and cockpit modules respectively. We will provide some discussions after analyzing them. Finally, we will provide future plan of HMC regarding the policy of modular production and we will also provide some lessons HMC got through the experience of practicing the modular production so far at the end of this case study.

1. Hyundai Mobis

Hyundai Mobis supplies front suspension, rear suspension, front axle and front strut modules of car and UV models such as Trajet, Avante XD, and Santafe to the HMC plant.

Hyundai Mobis just assembles these modules of automobile components from about 50 component suppliers. Hyundai Mobis manages delivery, QC, and payment for the modules, while HMC executes the design and development of module, the selection of component suppliers.

As vehicles leave the HMC PBS (painted body storage), the sequential order is electronically transmitted to Hyundai Mobis's plant 1 kilometer away (actually the same plant area as HMC). Hyundai Mobis has 60 to 90 minutes (depending on the product) to assemble and deliver the sequenced modules to the plant. HMC operators remove the parts from the shipping racks and assemble them to the vehicles. In this case Hyundai Mobis needs precision of its plant operation because there is not enough time to recover when there occurs some trouble at Hyundai Mobis's plant.

Some parts are assembled based on HMC's 2-hours schedule and delivered to HMC plant in lot. In case there is difference between the planned model mix and actual model mix, Hyundai Mobis has to rush to deliver the required parts to HMC plant.

Hyundai Mobis establishes module production plan based on HMC one-day production plan. Parts requirement by each parts supplier is calculated by MRP program, and this information is sent to parts supplier through LAN (Local Area Network). Parts suppliers manufacture parts based on this information and deliver parts to Hyundai Mobis plant every two hours according to delivery instructions of Hyundai Mobis.

2. Duckyang

Duckyang supplies cockpit modules of car and UV models such as Equus, Trajet, Avante XD, and Santafe to the HMC plant. Duckyang designs and develops some parts of the cockpit module and produces a portion of them by itself. It assembles the modules of the components of its own and from the suppliers selected by Duckyang.

As vehicles leave HMC PBS, the sequential order is electronically transmitted to Duckyang's plant about 10 kilometers away. Duckyang has 70 to 100 minutes (depending on the product) to assemble and deliver the sequenced modules to the plant. As Duckyang needs

20 minutes for model assembly and 50 minutes for the transportation, it has very tight time allowances. At first Duckyang started model assembly based on HMC's paint-out information and shipped modules based on HMC's PBS-out information in order to have enough time allowances, now it starts model assembly based on HMC's PBS-out information because there occurred inventory increase and rush order on account of the difference between the paint-out information and PBS-out information.

In order to solve these problems, first, Duckyang needs to reduce transportation time and second, HMC should make its production schedule more stable.

3. Discussion

Of the two cases we examined, Hyundai Mobis is thought to do an SA type modular production and is also has the characteristic of supply park. Duckyang is thought to do a kind of ID type modular production partly and has the characteristics of modular sequencing. From the cases we examined, we can present some guidelines for practicing modular production as follows.

First, as the dimension of modules increases and the weight of modules increases accordingly, ways for more safe handling of modules such as using racks during assembly and delivery of modules.

Second, as the time allowances between the reception of sequence information and delivery of modules to the assembler's plant is very tight, module assembly plants need to be located close to assembler's plant. As the length of car assembly line at automobile plant gets shorter and shorter, the time allowance for the production and delivery of modules is expected to be tighter. In this regard a supply park seems to be more desirable form.

Third, the production plan of assembler has to be with more uniform load and more stable to allow upstream suppliers (module suppliers and parts suppliers to module suppliers) less disorder such as rush order, inventory increase, etc.

Fourth, the possibility of making mistakes in assembling to the specification is expected to increase as the model mix increases. Model suppliers have to prepare for the quality control

and inventory management, which is expected to be more difficult in the future.

4. HMC's lessons and future plan

HMC evaluates its modular production system as an SA type modular production system. It thinks it is simply the expansion of simple assembly of parts previously done at the HMC plant. HMC doesn't feel it has achieved enough performance by the SA type modular production system in terms of cost savings or weight reduction, or quality improvement. HMC thinks that it doesn't enjoy the full advantage of modular production system by present SA type modular production. So HMC plans to extend to ID type modular production in the near future.

For modular production to be more effective, HMC thinks, it should be through functional integration of parts assembled into the module. HMC expects to reduce such things as the number of parts assembled into the module, the man-hours needed to assemble them, the cost and the weight of modules, and to improve the quality of product by ID type modular production. To extend to ID type modular production, HMC thinks that it will have to identify and bring up the module suppliers who have the capability of design and development of modules.

Besides, HMC got following lessons practicing the modular production so far.

First, the close collaboration between relevant departments (department of product design and development, process design, supply) is very important for smooth introduction of this system.

Second, precise cost/benefit analysis of modular production in advance is necessary.

Third, selecting capable and dependable suppliers and bringing them up is very important for the ID type modular production.

Fourth, it is desirable to build a supplier park near the car assembly plant to save material handling cost.

Fifth, allow module suppliers to participate in the product design process of HMC as early as possible.

Sixth, authority and responsibility of each participant (HMC, module supplier, and parts supplier to module supplier) for the quality and after service etc. should be clearly established.

IV. Conclusion

This paper presents the concept and meaning of modular production system as an efficient form of supply chain to handle increasing model mix of automobile assemblers, maintaining their cost, quality, and delivery levels. It also presents the case study on a modular production system practiced by a Korean automobile assembler, Hyundai Motor Company, and its two module suppliers, Hyundai Mobis and Duckyang, which have been practicing modular production since 1999.

It is true that the modular production system has many advantages in theory. Especially it can allow automobile assemblers the dynamic ability to respond rapidly and flexibly to handle the complex model mix from the diverse needs and demands of their customers, maintaining their cost and quality levels.

But according to our case study, the system may cause much complexity and disorder to the module suppliers without exhaustive preliminary investigation and arrangements. The most important preliminary arrangement seems to be that the production schedule of the assembler should be stable and of uniform load and the plant operation of the module supplier should be precise. It seems that more cases are to be studied for the generalization of these results in the near future.

References

- [1] Dinsdale, J.(1996), "Car parts supplier delivers the goods quickly", *Plant, Canada's Industrial Newspaper*, (27 May): 14-15.
- [2] Dyer, J.(1996), "Specialized supplier networks as a source of competitive advantage.

- Evidence from the auto industry”, *Strategic Management Journal*, 17: 271-91.
- [3] Feast, R.(1997), “A walk in the park”, *Automotive Industries*, (February): 109.
- [4] Hoek, Remko I van and Harm A M Weken(1998), “The impact of modular production on the dynamics of supply chain”, *International Journal of Logistics Management*, 9(2): 35-50.
- [5] Kinutani, H.(1997), “Modular assembly in mixed-model production at Mazda” in K. Shimokawa, U. Jürgens and T. Fujimoto(Eds.), *Transforming Automobile Assembly*, Springer: 94-108.
- [6] Max, Robert, Mauro Zilbivicius and Mario Sergio Salerno(1997), “The modular consortium in a new VW truck plant in Brazil: new forms of assembler and supplier relationship”, *Integrated Manufacturing Systems*, 8(2): 292-98.
- [7] Noori, Hamid and W. B. Lee(2000), “Fractal manufacturing partnership: exploring a new form of strategic alliance between OEMs and suppliers”, *Logistics Information Management*, 13(5): 301-11.
- [8] Wilhelm, B.(1997), “Platform and modular concepts at Volkswagen-Their effects on the assembly process”, in K. Shimokawa, U. Jürgens and T. Fujimoto(Eds.), *Transforming Automobile Assembly*, Springer: 146-156.

韓國 自動車産業에서 部品調達方式의 새로운 傾向; 現代自動車の 모듈生産方式 事例

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국문초록

자동차는 약 20,000개의 부품으로 조립되고 있다. 일본이나 한국의 자동차 제조업체들은 이들 중 제조원가 기준으로 약 70% 이상을 외부의 협력업체로부터 공급받고 있다. 따라서 자동차 제조업체가 경쟁력을 향상시키기 위해서는 이들 부품을 공급받을 수 있는 효율적이고 효과적인 부품공급체인을 구축할 필요가 있다.

자동차산업의 부품조달체계와 관련하여 최근 관심을 끌고 있는 이슈가 모듈생산방식이다. 이것은 자동차 조립업체의 공장 내 또는 공장 인근에 소재하는 자동차 모듈 조립업체가 자동차의 모듈을 조립하여 자동차 조립공장에 납품하는 시스템이다. 여기서 모듈이란 자동차 조립업체가 여러 가지 부품을 부위별로 나누고 종래에 비하여 보다 큰 단위로 묶어서 부품개발과 조립을 하는 단위이다.

최근 세계적인 자동차 조립기업들은 그들의 경쟁력을 향상시키기 위해 이러한 모듈생산방식을 도입하고 있으며 한국의 현대자동차도 1990년대 후반 이 시스템을 도입하였다.

본 논문에서는 모듈생산방식의 개념과 의의를 간략하게 소개하고 현대자동차에서의 모듈생산방식 도입사례를 고찰하여 모듈생산방식 도입 및 운영과정에서 제기되는 문제점들을 분석하였다. 이를 위해 현대자동차와 2개의 모듈업체, 즉 현대모비스와 덕양산업에서 이루어지고 있는 모듈생산과정을 살펴보았다. 아울러 현대자동차가 지

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금까지 모듈생산방식을 운영하면서 습득한 모듈생산과 관련된 유용한 지식을 소개하였다.

주요어: modular production system, parts supply system, automobile industry 모듈생산 방식, 부품조달체계, 자동차산업