Winter 12-5-2004

Design of an E-SCM System for an Auto-parts Companies

Junsu Lee

Jaebyung Rhu

Kiseong Kim

Myunghyun Oh

Jongyeong Lee

See next page for additional authors

Authors

Junsu Lee, Jaebyung Rhu, Kiseong Kim, Myunghyun Oh, Jongyeong Lee, and Byungho Jeong

Design of an E-SCM system for Auto-Parts Companies

Junsu Lee, Jaebyung Rhu, Kiseong Kim, Myunghyun Oh, Jongyeong Lee, Byungho Jeong
Dept. of I&IS Eng., Chonbuk University, Chonju, Chonbuk, 561-756, Korea

ABSTRACTS

This paper deals with the design of e-SCM for a supply chain of a commercial vehicle company. Two first vendors and two second vendors of the company are included in the objects of developing e-SCM system. We analyzed the information flow and business process between 1st vendor and 2nd vendors. The database (DB) has to be designed for contents of easy access, correction and update, because DB is indispensable for developing the new system. A relational database concept was used to design tables which maintain data needed in the system. The paper uses data flow diagram to describe TO-BE model of the e-SCM system.

Keywords: e-SCM, SCM, VMI

1. INTRODUCTION

Intensive competition in recent global markets, the introduction of products with short life cycles and the heightened expectations of customers have forced business companies to focus their attention on their supply chain. In a typical supply chain, raw materials are purchased, items are produced at one or more factories, shipped to warehouses for intermediate storage, and then shipped to retailers or customers. In this context, supply chain management(SCM) is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that an end item is produced and distributed at the right quantities, to the right location, at the right time, in order to minimize system wide costs while satisfying service level requirements [1, 5]. The supply chain of a commercial vehicle company has more complex procurement chain. It is most important to manage the procurement process of auto

parts in the supply chain of a commercial vehicle company. Thus this paper deals with the design of en e-SCM system for small and medium size auto-part companies that are the first and second vendors of a commercial vehicle company.

The SCM system has to be designed in integrated point of view to be used successfully [2, 3]. Even though every researcher defines the integration differently, in general, supplier integration, alignment of purchaser and supplier, coalition between suppliers, and supply chain synchronization are included in the concept of integration [4]. In those senses, the supply chain of a commercial vehicle industry is more complex than those of other industries and especially, a procurement supply chain is relatively important in the industry. However, from the characteristics of domestic industrial environment, the relations with a vehicle company and it's vendors forms a hierarchical supply chain structure with dependency rather than cooperative independency. Since the competitive power of a vehicle industry depends on the competitive power of whole supply chain rather than that of the industry itself, we need the effective methods to manage the whole supply chain

including the procurement supply chain reasonably. Thus, this paper dealt with analysis of business process and information flow, system design for developing e-SCM system of some auto-part companies. Section 2 provides a brief overview of sample supply chain. Section 3 describes the results of AS-IS analysis to understand intra-company business process and inter-company data flows. The TO-BE model is given for design of e-SCM system based on previous results in section 4.

2. SELECTED PROCUREMENT SUPPLY CHAIN FOR DEVELOPMENT OF AN e-SCM SYSTEM

Four auto part companies are selected to develop the e-SCM system in this study. Two of them are the first vendors and others are the second vendors of company 'AAA' which assembles trucks and buses. A company 'UUU' is the first vendor and has about 50 employees.
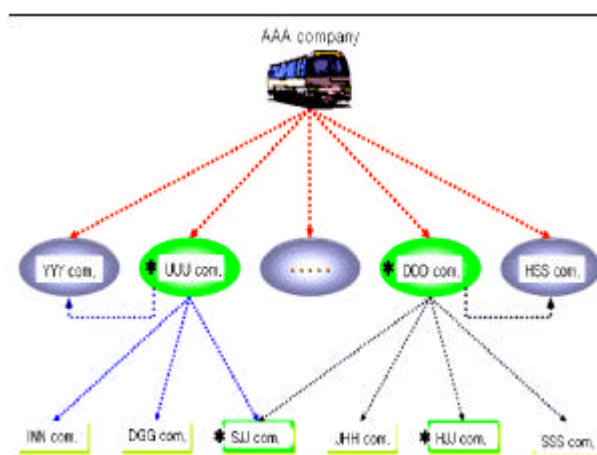
*: companies to be considered in this research
< Figure 1> A sample supply chain for procurement of the vehicle company

The roof of buses is main item which the company 'UUU' produces and supply for the company 'AAA'. Some of other first and second vendors of the company 'AAA' furnish the company 'UUU' sub-parts that are

required to make the roof of buses. A company 'DDD' is also one of the first vendors of the commercial vehicle company 'AAA' and about 60 employees work for this company. The main products are a frame of buses and bumpers of trucks. The sub-parts for frames and bumpers are made for itself or are supplied from other first and second vendors of 'AAA'. The second vendors 'SJJ' and 'HJJ' are included in the procurement supply chain of this study. <Figure 1> shows the part of the supply chain for this study.
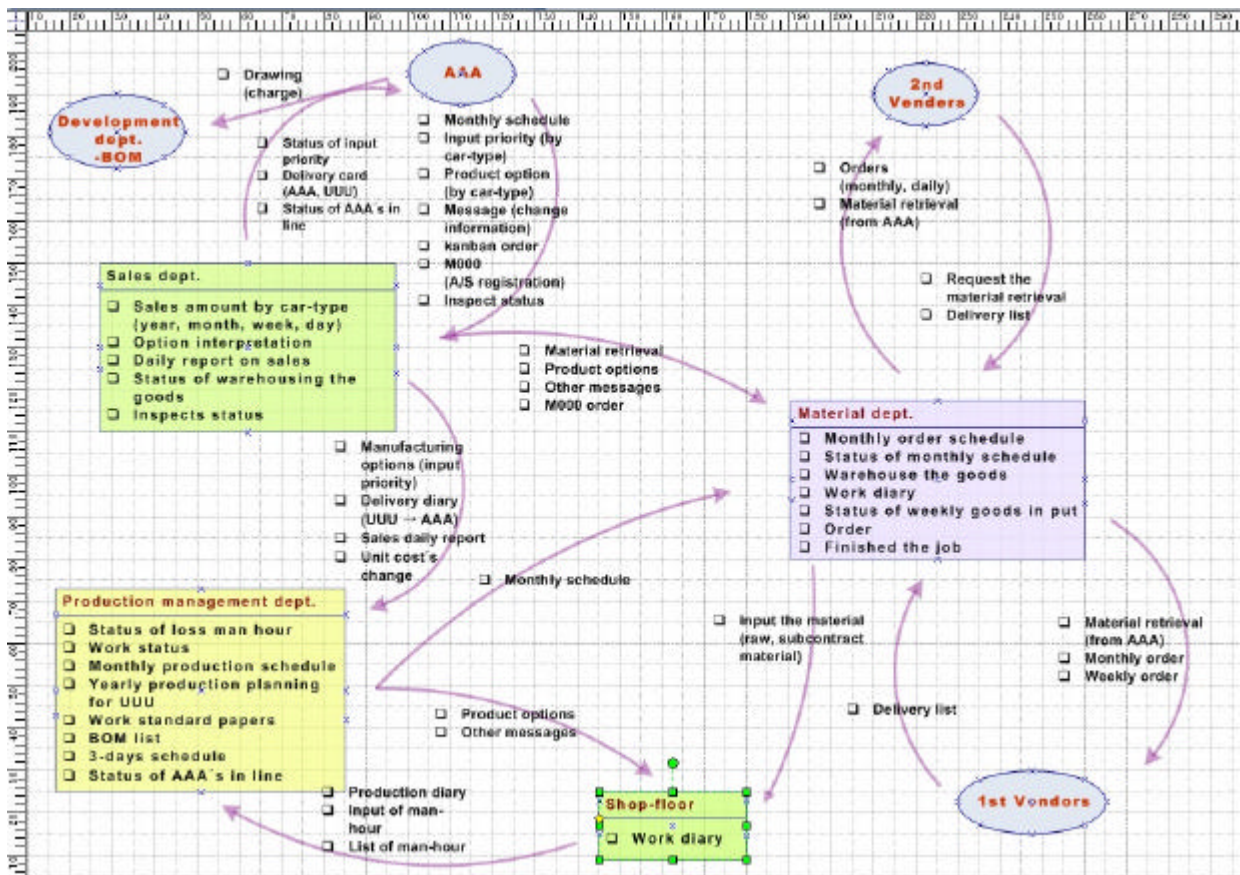
3. SYSTEM ANALYSIS

3.1 Information flow within procurement process

We analyzed a delivery process that the company AAA transmits to the 1st vendors' monthly production plan, the input sequence of the final assembly line and specification reports. The sales part of the 1st vendor gets these order information through a VAN system and passes those information on the other part, such as production control and procurement department of the company. The operation manager makes a monthly production plan from AAA's monthly plan and a 3-days production schedule on the basis of AAA's sequence

information and specification report. Currently, the monthly plan and 3-days schedule made by the operation manager are notified to related divisions (purchase section, production section, and sales section) and related 2nd vendors in a document. The purchasing manager calculates net requirement of each part on the basis of BOM (Bill of Material) and inventory records of the parts. And then purchasing orders are delivered to related 2nd vendors.

The raw materials are requested and released to produce bus roof by 3-days production schedule. The released materials are transmitted to the process line, and then the results of production are recorded in job card and work diary to the end of manufacturing. A delivery man of company UUU or DDD distributes completed parts with delivery card to the assembly line of company AAA according to a daily delivery schedule. The sales manager checks the daily delivery results from AAA's VAN system. Even though business processes of two companies UUU and DDD are slightly different each other, the principal business processes of two companies are almost same. <Figure 2> shows the work flow of two companies.

3.2 Analysis of the work flow

The sales department receives the monthly production plan, the input sequence of each assembly line, manufacturing specification and the other special

messages from AAA's VAN system and distributes to the department of production management and purchasing department. The AS-IS analysis about information flow between departments of the 1st venders was accomplished for main four departments(sales, production, purchasing

materials and production management). The sales department supplies materials, which are received from AAA, to the production department. The department delivers the completed parts into the corresponding assembly line of company AAA and checks the production line stands of AAA and delivery status etc. The department of production management makes each production plan(monthly and 3 daily. The purchasing department calculates the material requirements by a monthly and 3-days schedule and makes an order to the 1st and 2nd vendors. <Figure 3> summarizes the work flow related with production management and material management. The whole business flows including the 2nd vendors are shown in <Figure 4>.
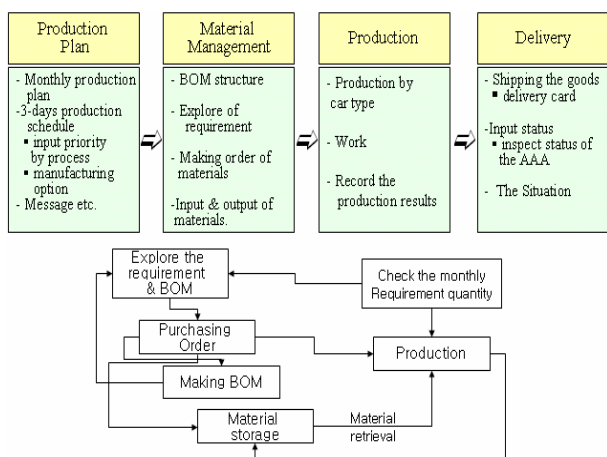
<Figure 3> Work flow of production management and material handling
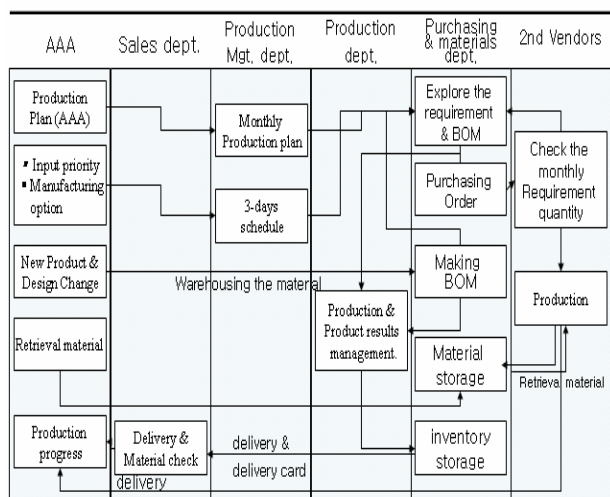
<Figure 4> Work flow for 1st vendors and their divisions, AAA company and 2nd vendors.

4. SYSTEM DESIGN

4.1 Conceptual Design of an e-SCM [7]

The system was designed based on client/server structure which is a typical structure of a web-based system. The conceptual framework of the system is shown in <Figure 5>. The figure shows that the system consists of a web

server, a DB server, and three functional modules such as production controller, sales manager, and purchasing & material manager. The users of the 1st and 2nd vendors access to web-server through Internet and the web-server makes connection to an appropriate module.

The second vendors can check out the net requirement and current inventory records from the web page of the 1st vendor any time, and decide how many or what items they should deliver. To do this, the 1st and 2nd vendors must agree with the proper inventory level or average inventory level for each part. That is, vendor managed of the 1st vendors.

<Figure 5> A Conceptual framework of the e-SCM system.

4.2 Design of Database

As DB is indispensable for developing the e-SCM system, it has to be designed for contents of easy access, correction and update[6]. DB includes valuable and various data about primary data of manufacturing item, parts, sub vendors, drawing data, inventory records, production schedule, bill of material information and production or delivery data. DB takes different effect for performance by times of access. Therefore, DB, in this study is designed with divided table by size of data and times of access to table with planning system. A relational database concept was used to design the DB which maintains data needed in the system.

<Figure 6> shows the relations with some tables and the table ASSY which stores primary data about finished goods. ASSY table includes basic information about finished part such as product ID code, price, car-type etc. ASSY_INV maintains product ID code and on-hand inventory of finished item at company AAA and the 1st vendor. ASSY_SKETCH table consists of the name and code of drawing, the version of drawing and the file name of drawing etc.

Part DB includes various kinds of primary information such as drawing data, inventory information and manufacturing style etc. Since the frequency of access varies according to kinds of data, DB table was partitioned by the frequency and size of data. PART DB

stores basic information about each part including part ID code, part name, packaging unit, order method, type of classification, and the average monthly requirement etc. PRAT_INV has on-hand inventory, amount of anticipated requirement at 1, 2 and 3 days after. The PART tables and their relation are shown in <Figure 7>.

<Figure 6> Relation Diagram of tables related with finished item of the 1st vendor

<Figure 7> Relation Diagram related with PART DB

4.3 Data Flow Diagram

This section describes data flow for some fundamental functions using data flow diagram (DFD). <Figure 8> summarizes data flow between DB tables when the system makes a 3 days schedule. The system has to reference the input sequence of company AAA, car type information, monthly production plan, BOM data, and inventory data for materials etc. Whenever a 3 days schedule is made, part quantity, which is required at 1 ,2 and 3 days after, is revised based on the updated 3 days input sequence. Workers put parts or material into the appropriate line as the input sequence of 3-days schedule. After completion of production, the quantity of completed production is recorded for later use. When the completed jobs are input into the system, inventory level

of parts, which are used to produce them, is reduced by BOM propagation. <Figure 9> shows a DFD to do this. A data flow diagram for stocking purchased parts or material is shown in <Figure 10>.

<Figure 8> Data Flow Diagram for 3-days schedule

<Figure 9> DFD for recording completed production

<Figure 10> DFD of warehousing registration

5. CONCLUSION

This paper is a case study to develop an e-SCM system to control a part of procurement supply chain of a commercial vehicle company. To do this, we analyzed the business process, information flow, and material flow among companies in the selected chain. And then, we designed the e-SCM system based on the results of the analysis. We designed the system to be developed based on web technology. The monthly plan and 3-days schedule of the 1st vendor will be made using monthly plan and input sequence of AAA. The second vendors can check out the net requirement and current inventory records of parts through the web page of the 1st vendor any time, and decide how many or what items they have to deliver. That is, vendor managed inventory(VMI) concept was applied to control inventory between the 1st and 2nd vendors.

ACKOWLEDGEMENT

REFRENCES

[1] Hukusima Yoshiyaki, SCM management revolution, 21st century books, 1998

[2] Johnson, R. & Lawernce, P., "Beyond vertical integration-the rise of value adding partnership", Harvard Business Review, pp. 94-101, July-August, 1998

[3] Walton, S. V. & Gupta, N.D., "Electronic data interchange for process change in an integrated supply chain", International Journal of Operations & Production Management, Vol. 19, pp. 45-73, 1999

[4] Korea Management Association consulting, Production system innovation, Synchronization production system, 1990

[5] Mentzer, J.T., W. DeWIT t., J.S. Keebler, S.H. Min, N.W. Nix, SmlT h and Z.G. Zacharia, "Defining Supply Chain Management", Journal of Business Logistics, Vol.22, No.2, pp. 4~6, 2001

[6] Cho, DongIl, Database Programming for Web applications, Samyang media, 2003

[7] Gary, P. Schneider, Electronic Commerce, Thomson, 2003