

Parts supply management system for automobile part's manufacturing companies

Gil-Sang Jang*, Jung-Sang Choi**

* Dept. of Management Information Systems, University of Ulsan, Ulsan 680-749, Korea

** Dept. of Industrial Engineering, Kangnam University, Kyeonggi 449-702, Korea

Abstract

This paper proposes an efficient and effective BOM management scheme for small and medium manufacturing (SME) companies that produce automobile parts. Automobile part's manufacturers produce very various products due to various automobile characteristics such as types, colors, and options of cars. These products are classified into product groups with common parts and like this product groups with commonality are regarded as product family. This paper proposes a BOM data model for product family structures and implements the practical EXCEL-based BOM management system for real small and medium manufacturing (SME) companies that produces automobile parts.

1. Introduction

BOM (Bill of Materials) is a description or listing of raw materials, parts, and assemblies that define a product. BOM (Bill of Materials) is an important basic data that defines a product structure in manufacturing company. BOM provides information that is needed from product definition, operation instructions, engineering change order, order entry, accounting, quotation, etc. Also, BOM is an important input data for a purchase of components that consist of a product, and for master production scheduling and material requirement planning that determine the points of time of purchasing order and production instructions [1]. Accordingly, efficient BOM management is very important for improvement of productivity in a manufacturing company.

The following many researches have been studied for design and implementation on BOM management systems. Nandakumar[2] designed and implemented BOM processor using RDBMS(Relational Database Management System). Chung et al.[3] proposed BOM data model using an object-oriented technique and implemented a prototype of object-oriented BOM management system with simple functions using C++ programming language. Oh et al.[4] designed traditional BOM management systems using an object-oriented technique. Kim et al.[5]

proposed a method of implementing Web-based generic BOM management system, but proposed a conceptual data model of generic BOM using an object-oriented technique. Lee et al.[6] studied on design and implementation of generic BOM management system using OMT(Object Modeling Technique) under a traditional client/server environment. Jang et al.[7] proposed a object-oriented methodology of implementing Web-based information system, designed and implemented a prototype of Web-based generic BOM management system. But, above studies are theoretical and prototyping. Accordingly, they are not practical in real company environments.

This paper is concerned with a BOM of automobile part's manufacturing companies. At present, the difficulties of automobile part's manufacturers can be mentioned with frequent changes of product specification, very various kinds of parts, and few staff and lack of their specialty. Under coarse surroundings of small and medium enterprises (SME), automobile part's manufacturers need an easy and efficient BOM management with small efforts such as manpower, time.

This paper proposes a BOM data model for product family structure and implements the practical EXCEL-based BOM management system for small and medium manufacturing (SME) companies that produce many variants of product families. This study is performed and used currently in a real automobile part's manufacturing company that produce various product families with many common parts.

2. EXCEL Form and Process for Generating BOM Information

BOM is critical information for a production management and material management system in manufacturing companies. The following [Figure 1] shows business functions that related to BOM information in automobile part's manufacturing companies. To support business functions effectively, it is important to manage BOM easily and efficiently. EXCEL has advantages such as calculation, presentation, macro function, DB connection capabilities. Also, in order to process various business works, EXCEL is widely utilized by staffs in automobile part's manufacturing companies. In this paper, for easy and efficient BOM management, EXCEL spreadsheet is used.

2.1 An EXCEL Form for Product Specification

The following [Figure 2] is a EXCEL form that describes product specification for 22 kinds of door modules. Here, 22 kinds of door modules is regarded as a product family. Thus, this form shows EXCEL-based product specification for product family structures that represent 22 kinds of door modules. This form consists of three areas that management number information, product structure information, and exceptional usage information.

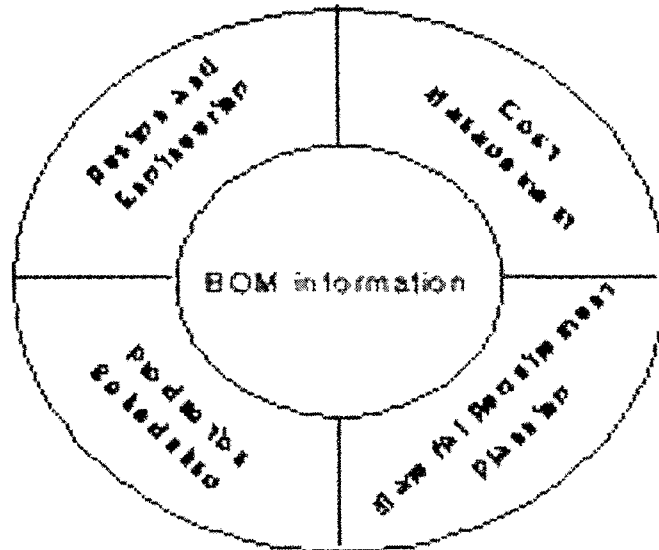


Figure 1. Business Functions related with BOM Information

The image shows a screenshot of an Excel spreadsheet used for product family structures. The spreadsheet has multiple columns and rows of data. Two callout boxes are present:

- 'Management NO Information' points to a column in the upper part of the table.
- 'Exceptional Usage Information' points to a column in the upper right part of the table.
- 'Product Structure Information' points to a large section of the table below the first two callouts.

 The spreadsheet contains various alphanumeric codes and numerical values, typical of a technical or manufacturing data file.

Figure 2. An EXCEL form for Product Family Structures

2.2 A Process of Generating EXCEL- based BOM Information

The following [Figure 3] is a process that generate BOM information from customer order and design information to EXCEL-based product specification and BOM data.

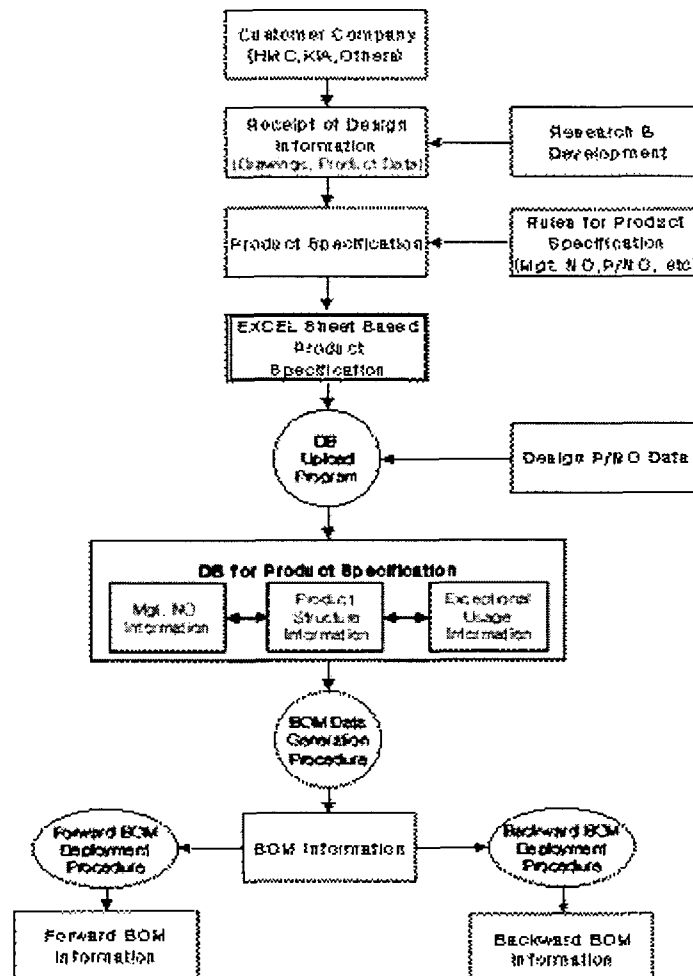


Figure 3. A Generation Process of EXCEL-based BOM Information

3. Data Model for Product Family Structure

Automobile part's manufacturers produce very various products due to various automobile characteristics such as types, colors, and options of cars. These products are classified into

product groups with common parts, and like this product group with commonality is regarded as product family. The following [Figure 4] is data model for product family structures that support multiple views of variants of the product family. Two typical views which occur in product families are the customer's view and the manufacturer's view. The customer's view is defined in terms of product features such as the colour of an door module, whilst the manufacturer's view is given in terms of a BOM which can be used during the assembly process. Both of these views can be supported for any variant of product family by making the product family structure the central design P/NO master. Product P/NO master and component P/NO master support the customer's view, and design P/NO master supports the manufacturer's view.

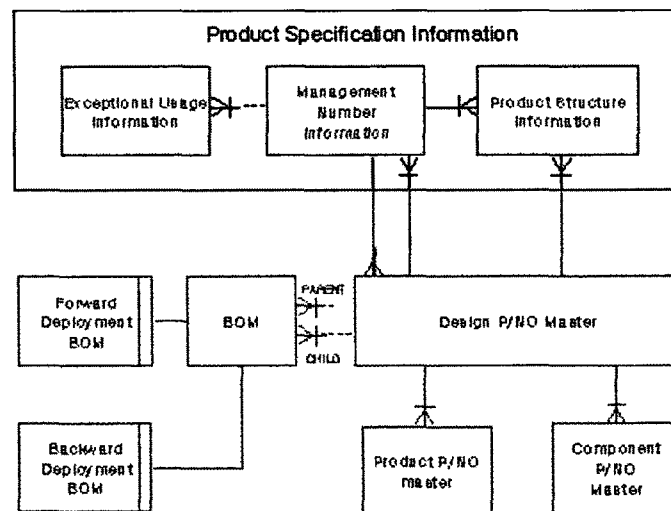


Figure 4. Data Model for Product Family Structures

4. Implementation of EXCEL-based BOM Management System

EXCEL-based BOM Management System is implemented using EXCEL, Visual Basic 6.0, ORACLE8i and PL/SQL. The major functions of system implemented are composed of the basic information management such as parts and product specification, batch processing for product specification(assembly, sub-assembly, part, and raw materials), query for product specification, update for BOM(parts list) information, query for forward deployment BOM[Figure 5] and backward deployment BOM information[Figure 6], calculation of item requirement quantity, etc.

The screenshot shows an Excel spreadsheet with a tree view on the left and a data table on the right. The tree view shows a hierarchy of parts, with the top-level part selected. The data table has columns for part numbers, descriptions, and other attributes. The data is organized in a way that shows the forward deployment of a BOM, meaning it lists the components and their quantities for a specific part.

Figure 5. Query for forward deployment BOM

The screenshot shows an Excel spreadsheet with a tree view on the left and a data table on the right. The tree view shows a hierarchy of parts, with a lower-level part selected. The data table has columns for part numbers, descriptions, and other attributes. The data is organized in a way that shows the backward deployment of a BOM, meaning it lists the parent parts and their quantities for a specific part.

Figure 6. Query for backward deployment BOM

5. Conclusions

In this paper, we proposed a BOM data model for product family structures and implemented the practical EXCEL-based BOM management system for real small and medium manufacturing (SME) companies that produces automobile parts. EXCEL-based BOM management system has some advantages. First, a traditional code-based BOM management has many difficulties in content understandings and management, but EXCEL-based BOM

management is very easy to manage product data due to a visualization of product specification using EXCEL spreadsheet. Second, because design information is transported through EXCEL forms to automobile part's manufacturers, this information can utilize in the proposed BOM system immediately. Also, an automobile part's company with R &D center is easy to draw up design information using the EXCEL spreadsheet. Third, as utilizing strong EXCEL functions such as presentation and DB connection, the proposed system can save manpower and time to draw up product specifications. Fourth, if a staff draw up a product specification using EXCEL only, the remaining processes are automatically performed in the proposed system. Accordingly, BOM management is very easy with small efforts and thus a staff can directly perform BOM management if he learn basic education during two or three hours. Expectations of the proposed data model and implemented system are an exact product version management, an effective BOM configuration and management with small efforts, and an efficient management of engineering order (EO) and engineering change order (ECO) with easiness.

References

1. Clement, J., Coldrick, a., and Sari, J., Manufacturing Data Structures, Oliver Wight Publications, 1992
 2. Nandakumar, G., The Design of a Bills of Material Processor Using a Relational Database, *Computers in Industry*, Vol.6, pp.15-21, 1991.
 3. Chung, Y., and Fischer, G. W., A Conceptual Structure and Issues for an Object-Oriented Bill of Materials (BOM) Data Model, *Production Planning & Control*, Vol.3, No.3, pp.314-326, 1992.
 4. Oh, T. H. and Kim, S. H. and Park, J. S., The Development of the Object-Oriented Technological Document Management System (OOTDMS), *IE Interfaces*, Vol. 11, No. 2, pp.49-64, 1998.
 5. Kim, J. K., Kim. Y. H. and Kang S. H, Web-based BOM, 1997 IE/MS Spring Conference, pp.401-404, 1997
 6. Lee, D. G. and Kim, J. G. and Jang, G.S., Design an Implementation for Generic BOM Management System (GBMS) Using Object-Oriented Technique, *IE Interfaces*, Vol. 12, No. 1, pp.102-113, 1999.
 7. Jang, G.S and Kim, J. G. and Lee, C. H., Modeling and Implementation for Web- based Generic BOM Management System, *Journal of the Society of Korea Industrial and Systems Engineering*, Vol. 23, No. 57, pp.21-39, 2000
-