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PLM education in production design and engineering by e-Learning

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ABSTRACT

These days more attention is being paid to Product Lifecycle Management (PLM) using a technique for managing total product planning, design, manufacturing, sales, and disposal. We researched business processes and education curriculum of the PLM system in manufacturing businesses. We designed the curriculum of PLM education and developed part of a lesson. Most importantly, e-Learning is shown to be an effective tool for achieving educational objectives. We found that not only knowledge and theory but also practical education methods using case studies in an e-Learning environment are necessary for human resources to develop effective PLM.

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1. Introduction

In manufacturing enterprises, managerial techniques meant to efficiently manage human resources, materials/machines, money, and information, such as Enterprise Resource Planning (ERP) and Supply Chain Management (SCM), have been widely introduced. Recently, Product Lifecycle Management (PLM) (Chiang and Trappey, 2007), a managerial technique focusing on the product, has been noted. In other words, PLM is a managerial technique used to pay close attention to material and information flow for the product, and managing product planning and design, procurement, production, sales, maintenance, reuse, and recycling, as shown in Fig. 1.

Because all business processes from the supplier to the consumer relate mutually, not only the manager but also the mainstay executive job should understand PLM.

Haapasalo and Hyvonen (2001) developed an educational curriculum for use in an electronics factory (Haapasalo and Hyvonen, 2001), and Holweg and Bicheno

developed educational tools for SCM (Holweg and Bicheno, 2002). However, there is no educational curriculum for PLM that has examined integrated engineering processes.

Conventionally, the Research Center for e-Learning Professional Competency (eLPCO) at the Research Institute of Aoyama Gakuin University in Japan has been researching human resources development intended for employees of the middle management class in manufacturing enterprises, and this center has developed effective educational curriculum. e-Learning is widespread in a number of fields as an education method of using Information and Communication Technology (ICT) based on information technology and network technology. Since e-Learning can be experienced as virtual business; it is a suitable kind of education for the businessman (Kakehi et al., 2005).

The goal of this lesson is an understanding of effective PLM when a new product is developed using e-Learning as the educational tool. In addition, students learn how to strategize and make decisions in this e-Learning course (Kakehi et al., 2005).

This paper focuses on the business processes in PLM, designs the curriculum of the PLM education by e-Learning and actually develops part of the lessons. The outline of this paper is as follows.

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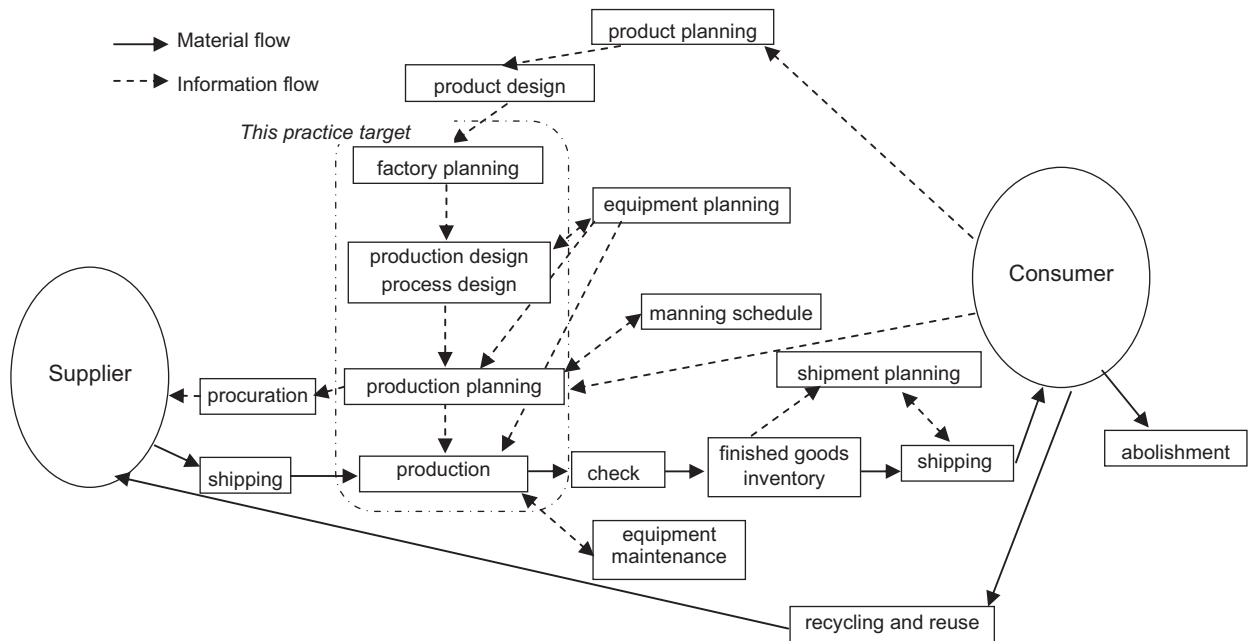


Fig. 1. Production lifecycle management in production activity.

Section 2 explains the idea and the effect of PLM in the production field. Also, it examines the Bill of Materials (BOM) necessary to achieve PLM. Section 3 describes an important ability for employees in PLM education, and it also explains the BOM, which is the core of PLM.

Section 4 describes the executive summary of the lesson. Section 5 explains the lesson scenario and discusses the implementation and evaluation of part of the lesson. Finally, Section 6 proposes the conclusion of this research and the future issue of PLM education. This paper discusses the syllabus and design for teaching PLM in the production area.

2. PLM in the production field

2.1. Effect of PLM in production field

Information systems such as Enterprise Resource Planning and Supply Chain Management have now been widely implemented in manufacturing enterprises. Also, environmental concerns in manufacturing (Haapasalo and Hyvonen, 2001) have become a very important theme. This is because Product Lifecycle Management deals with all business processes such as the product project, the design, manufacturing, sales, and disposal, it has been paid attention as a key technique to solve the environmental issues in manufacturing (Seliger, 2007).

The management of PLM in the production field has some advantages due to intelligence sharing in all business processes (Chiang and Trappey, 2007):

(1) It is possible to shorten the development period because PLM applies the concurrent development between the product and production designs.

- (2) Information can be shared in the business process among the upstreams and downstreams by BOM mutually. The problem and trouble had been found by the business process in the downstream so far. Since business information can be shared by the BOM, the problem can be found by the business process of the upstream as a front loading.
- (3) The enterprise can develop efficient communication with its clients. Moreover, it is possible to develop this communication efficiently by recycling information designed in the past.

2.2. BOM for PLM

To achieve the effective PLM, it is essential to share information gathered over the entire product lifecycle in multiple departments. Therefore, it is necessary to construct a multiple database Bill of Material in each case for effective knowledge sharing. Fig. 2 shows the PLM practice in production area. The multiple BOM consists of Engineering (E-BOM), Manufacturing (M-BOM), Process and Workstation BOM (W-BOM), and are related to each other.

In the product design process, the composition and CAD data for parts are stored in the E-BOM, and the assembly sequences are examined. In the production design process, parts are managed by a production technique that considers the process plan, and part information is stored in the M-BOM.

In the process planning process, information on the process planning that is based on the production plan is stored in the process BOM. In the task design process, the task is designed, and information on the processing procedure and the workstation layout is stored in the W-BOM.

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