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Product lifecycle management for automotive development focusing on supplier integration

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Abstract

The past years have seen growing investments in the area of product lifecycle management (PLM) by the automotive sector. Due to its complex development cycle, the automotive OEM has begun to adopt the supplier integration into its product development process. To respond to this new trend, the PLM system needs to evolve to support the collaboration and partnership management between the automotive OEM and associated suppliers. Regarding the depth of collaboration, the integration of supplier into OEM process chain has been defined in two ways, quasi-supplier integration and full supplier integration. To enable the success of supplier integration, one of the PLM tasks is to control the collaboration between the automotive OEM and its suppliers, through deciding on an appropriate supplier integration way. Meanwhile, aiming at reduction of the expenditure for partnership management and coordination, the automotive OEM tends to have direct connections with limited number of capable and effective suppliers, called system suppliers. Other suppliers, called sub-suppliers no longer directly communicate with the automotive OEM, but instead with a system supplier who works closer with the automotive OEM and deals with the task of sub-supplier management and coordination. To keep up with these tasks above, a PLM framework is established in a broader perspective in this paper, enabling supplier integration and partnership management in the automotive development process all along the life cycle. Finally, an automotive case study is presented to illustrate the PLM implementation procedure focusing on supplier integration.
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Keywords: Product lifecycle management; Automotive development; Supplier integration; Partnership; Collaboration

1. Introduction

The automotive industry is now under increasing pressure to maintain their places in the market. To improve their ability to innovate, get products to market faster, and reduce errors, the automotive manufacturers have been continuing to improve their development and management abilities through advances in computer-aided design (CAD), computer-aided process planning (CAPP), computer-assisted manufacturing (CAM), computer-aided engineering (CAE), concurrent engineering (CE), product data management (PDM), business process reengineering (BPR), etc. [1]. It is worthy of pointing out that the past years have seen growing investments in the area of product lifecycle management (PLM) by the automotive industries [2–5]. For example, companies from Boeing to GM to Proctor & Gamble are using PLM technology, making it a $16 billion industry in 2004. GM credits PLM initiatives with decreasing time to market from 48 to 18 months [6]. Automotive industry leaders such as Autoliv, Eaton, Honda, and Johnson Controls are driving success by using the MatrixONE solutions [7]. Regarding the importance of PLM to the automotive industry, Reale and Burkett make a conclusion which is "The Smarter the Car, the More Automakers Need PLM" [8].

PLM can be considered as a business strategy intended to link all information, people, and processes associated with a product from birth through end-of-life disposal [9]. Similar to other types of products, it is generally recognized that PLM for automotive development needs to span common product lifecycle phases from customer requirements definition, product design/simulation/analysis, production planning, manufacturing quality management, service and guaranty management, as well as recycling [10]. It is necessary to note that different PLM implementation patterns have been derived according to corresponding industry context and product characteristics [10]. The automotive industry tends to have structured process emphasizing configuration traceability and

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accountability persistence, and the automotive product development lifecycle is considered to follow the pattern of the stage-gate model [2,11]. Meanwhile, automotive suppliers are seeking new ways to strictly contain costs without sacrificing innovative, feature-rich products, and platforms. With the demands for faster innovation, higher quality, and increased regulation, it becomes apparent that the winning automotive suppliers will be those that leverage product innovations to rapidly develop new platforms and win new programmes. Therefore, for the automotive OEM industries, there is an important new trend of automotive development which is increasing supplier involvement or integration into the product development process chain.

To respond to the trend of supplier integration for automotive development, the evolution of PLM framework and tools is very important and critical. Focusing on the supplier integration and collaboration, the direction of PLM for automotive development is investigated in this paper. The paper is organized as follows. Section 2 explains the rational of supplier integration for automotive development. As PLM is the front of new challenges to enable successful supplier integration for automotive development, it needs to be responsible of controlling the collaboration between the automotive OEM and suppliers as well as managing the partnership between them. Therefore, Section 3 presents two types of supplier integration (quasi-supplier integration and full supplier integration) according to the collaboration depth; Section 4 discusses the partnership interface between the automotive OEM and suppliers. In Section 5, a PLM framework to enable supplier integration for automotive development is given. In Section 6, a case study is included. The last section concludes the paper.

2. Supplier integration for automotive development

Due to its complex development cycle, the automotive industry is seen to adopt the supplier integration into the development process or outsource a higher percentage of the product development to suppliers, such as Magna's involvement in Citreon, BMW, and DCX, Valeo and ArvinMeteritor in BMW [2]. Actually, it has been found from contemporary research in the fields of concurrent engineering and supply chain management that significant benefits can be achieved if suppliers are integrated/involved in new product development processes as early as possible, which is called Early Supplier Involvement (ESI) [12–15]. The rational is that suppliers frequently possess the greater depth of domain expertise that can lead to improvements in product design. The traditional OEM–supplier relationship is characterized by a sequential, two-step interaction. In the first step, the OEM gives clear product and production requirements to the supplier. In the second step, the supplier delivers the product or service to the OEM. Both parties tend to optimize their own position instead of looking at the cooperative gain, and this behaviour is not based on complementary strengths. Supplier integration/involvement is a new method for integrating supplier creativity and innovativeness in the new product development process. Supplier integration/involvement strives to create synergy through mutually interacting deliverables and decisions between OEM and supplier. Both sides take advantages of each other's capability to develop the product as well as to obtain feedback from the other party to improve the product development.

To decrease development cycle as possible, the automotive industry, acting as OEM, tries to focus its time and cost on core competency areas such as styling, Body of White (BIW), engine, and transmission, while shifts other portions of auxiliary system development to suppliers, which can lead to a win–win situation to both the automotive OEM and suppliers.

Furthermore, it has to be considered, that on the one hand the more active the involvement of supplier into the automotive development process chain is supposed to happen, the more complex the coordination process will be. The early integration of suppliers into the automotive development process chain does not only lead to an earlier start of the supplier's usual activities but also to a shift in the focus on activities to be processed. This will cause new challenges for the collaboration between the automotive OEM and the supplier. In the current global manufacturing context, the automotive OEM and associated suppliers may be geographically separated. Each geographical location focusing on certain area of the automotive product lifecycle based on resource strengths and cost effectiveness [2]. For example, as the auto market is expanding very fast in current China, some big automotive companies (such as VW, Ford, and GM) put the final assembly in China where manpower is cost-effective, while keep the design and research residing with the automotive OEMs. To facilitate supplier integration/involvement in the automotive product development, not only technology integration but also process and organization integration are needed to be considered. The automotive OEM needs to make the evolving product definition and development process available to their suppliers, while protecting everyone's private data and private process and managing everyone's role. The collaboration between the automotive OEM and the integrated supplier can be defined at different levels according to the collaboration depth and different types of partnership. To practically manage the automotive product lifecycle, PLM is in front of new challenges to meet the requirements above.

3. Collaboration between automotive OEM and suppliers

As illustrated in Section 2, to realize supplier integration/involvement, it is important for PLM to provide a collaboration tool to enable appropriate collaboration between the automotive OEM and its suppliers. Using the collaboration tool, the supplier can conduct product design for OEM as an appropriate role (see Fig. 1).

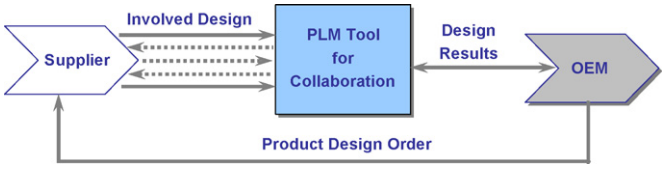

Fig. 1. PLM tool enabling the supplier integration.

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