

# Product Innovation Management Analysis Based on Supply Chain Management

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**Abstract** Product innovation is a most challenging job. How the new products of an enterprise come into the market at the quickest speed, how to reduce the development cost and how to meet customer's demands furthest directly relate to innovation condition of the product, and then relate to existing and development of an enterprise. The thesis comprehensively adopts system theory, flexibility theory, virtual enterprise theory, enterprise reorganization and other theoretical methods to establish a supply chain platform with the product innovation as the center, which changes the traditional product innovation method and puts the product innovation into the supply chain platform. The systematicness, integration and compatibility are taken as the main study line to solve some problems in product innovation based on supply chain, obtain new model for product innovation and integration based on multi-level coordination mechanism of CORBA and WEB, put forward prompt to product development, virtual product development, modular design and other product innovation method and execution frame.

**Key words** Supply chain management; Product innovation; Mode; Innovation method

## 1 Introduction

Supply Chain Management is a management logos developing based on modern science and technology condition and profuse product condition. It refers to every aspect of various enterprises and enterprise managements, is a multi-industry management. As trade partners, enterprises make associated efforts to pursue maximize collective economy and benefit. Commercial flow, physical distribution, information flow, fund flow and more in the supply chain are fully planned with the computer network technology, planning organization; coordination and control are performed at the same time. The concept of modern new product is from market or customer demands, but not from the producer angle.

Product innovation is the most challenging job. How the new products of an enterprise come onto the market at the quickest speed, how to reduce the development cost and how to meet customer demands furthers directly relate to innovation condition of the product, and then relate to existing and development of an enterprise. It is observed that each enterprise try its best in increasing development speed and level of new product. They think that they have already used up interior methods and measures and nearly have no potential to be evacuated, whereas, supply chain management mode diverts people's attention out of the enterprise. The thesis takes product innovation study based on supply chain management as the subject. The main meaning of the study work is represented on the following two aspects:

Firstly, supply chain management and product innovation are two subjects with very abundant connotation, relating to a great many of change factors. Secondly, it is well known that product innovation has become the first great event of enterprise's daily activity, and management of this part is the most complicated part.

At present, the major study emphasis on product innovation both here and abroad is mainly focused on the following aspects:

(1) Connotation study of product innovation: The study is performed mainly around the problem - what is product innovation. Although product innovation has become the focus in development of modern enterprises, there are different opinions in concept of product innovation. There is no a strictly uniform definition at present. Organization for Economic Cooperation and Development (OECD) defines the product innovation from market angle: the product technology change<sup>①</sup> generated to provide new or better service for product users. From technical angle, Professor Xu Qingrui thinks that all activities from technical innovation activity to development of new product are called product innovation<sup>②</sup>.

<sup>①</sup> Organization for Economic Cooperation and Development. Innovation Survey Manual. Xinhua Publishing House, 1997

<sup>②</sup> Xu Qingrui. Technology Innovation Management (M). Zhejiang University Press, 1990

(2) Research of product innovation influencing factors: The analysis & research concerning the key factors for production innovation are mainly conducted through investigation and statistical analysis methods. In this aspect, the research of Prof. Copper is the most representative and through the analysis for the key factors of 102 successful new products and 103 failed new products in 103 companies. It is found that the key factors for the success of new products are: the advantages of the product itself, marketing and collaboration of technology and production; the key factors for the failed new products are: over-high price, market changes and intense competition, etc.

Since supply chain management and product innovation management are two disciplines of great profoundness, a large amount of variables are involved. Therefore, it is a great challenge to conduct seamless connection and fusing research for the two disciplines. At present, there is basically no related domestic research and the foreign research on this subject is also at the opening and tentative stage; most researches are concentrated upon the generalization and summarization of enterprise practice, without forming systematic theory and methods yet.

## **2 Analysis of Product Innovation Method under Supply Chain Management Environment**

### **2.1 Collaborative product innovation based on supply chain**

The ideal of collaborative product innovation is to expand the traditional internal product data management function to build a platform which integrates all the information, process and management of product supply chain so as to realize the collaborative development and sharing for the product knowledge asset within the so-called “expanded enterprise”. The authorized customer of the collaborative product innovation can access and operate any distributed and heterogeneous product innovation resources in the “expanded enterprise” information system within the whole life cycle from concept design, manufacture, sales, service and discard & reclamation. One of the important features of collaborative product innovation system is the unified data model which integrates the data and application function in a loosed coupled manner and ensures the inter-collaboration among the individuals without relying on data interoperability and this facilitates the integration of application software among the enterprises. The collaborative production innovation which depends on Internet connect the interest of supply chain and customers closely to form a global product knowledge network; any tools or services to add value to the product during the whole life cycle of the product will be based on this basic structure. Generally speaking, the main functions realized by the collaborative product innovation include: document management, version management, process management, product structure management, technical form management technology, component management, requirement management and research program management, etc. Refer to Figure 1 for specific structure.

As shown in Figure 1, the overall framework is divided into three levels: mission level, CPC platform and tool level. CPC platform acts as a bridge, one end of which is mission level, that is, the main content of CPC solutions of enterprise. the other end is CPC platform based tool level, such as enterprise resource planning software, customer relation management software and supply chain management software, etc. It is obvious that under CPC environment, all the customer orders are completed on the CPC platform.

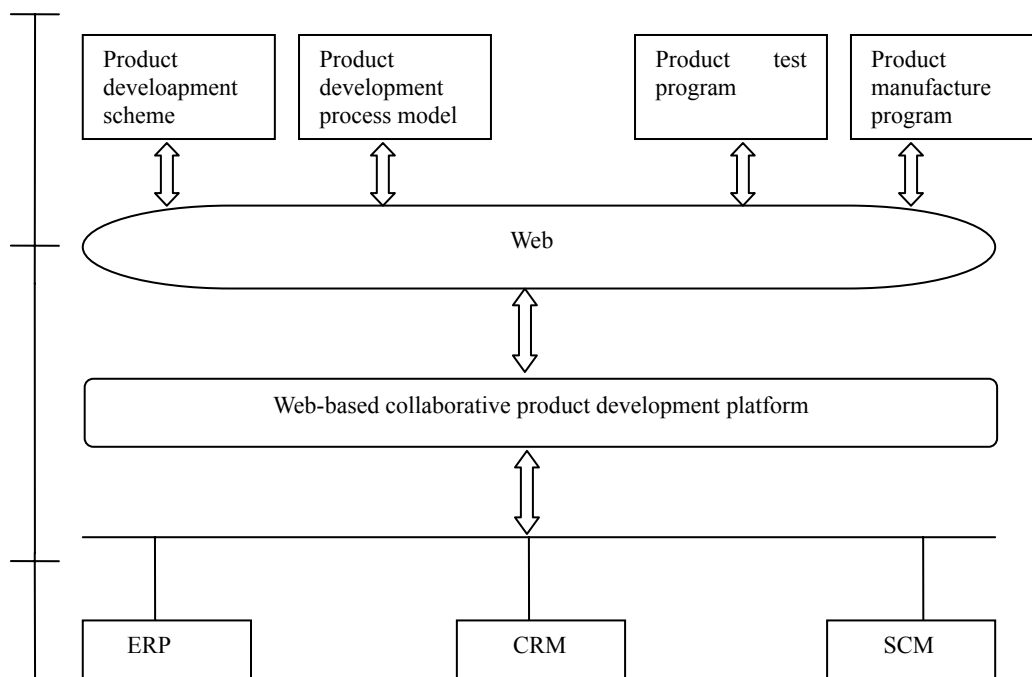
### **2.2 Virtual product innovation based on supply chain**

The supply chain-based virtual product innovation system is a layer structure composed of interface layer, control layer, application layer, active layer and data layer, the information operation of each layer is conducted on the basis of unified protocol via a “virtual bus” and refer to Figure 2. The system provides a logically tight and structurally compact substrate for the follow-up development of VM, supplies open-type technological frame and associated mechanisms of cell technology and supports distribution-type environmental control mechanisms to realize multi-layer integration and “plug and play” tool dynamic integration as well as the interaction between the real world and virtual world.

### **2.3 Modularized product innovation based on supply chain**

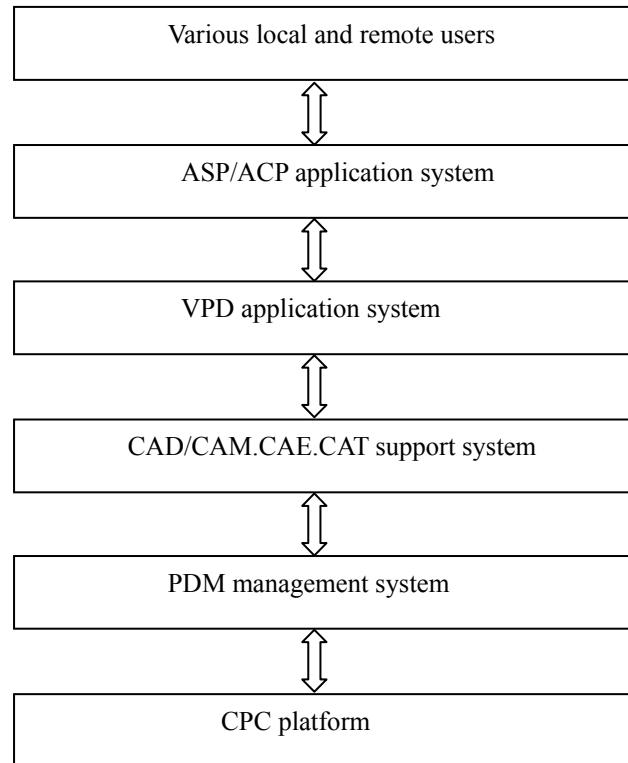
Modularized system comprises several modules which are independently designed but operate as a whole; the designers divide the information into standardized design rules and non-standardized design parameters to realize modularization. Standardized design rules are the rules that exert influence on the follow-up design, which are divided into three parts: the first is structure, which defines the modules that constitute the system as well as the functions to be realized by each function; the second is interface, which describes the interaction among the modules, including how the modules are installed, connected and communicate with one another; the third is standard, which test whether the module is consistent

with the design rules (the role played by the module in the system) and evaluated the performance of one module relative to another module. However, the non-standardized design parameters are the design rules that will not influence the modules themselves. The non-standardized design parameters can be selected at a latter stage and can be changed when necessary without having to communicate with any people outside the design team. Under the combined effect of standardized design rules and non-standardized design parameters, the modularization can effectively solve the increasingly complex requirement.



**Figure 1 Overall Framework of Supply Chain Collaborative Product Innovation**

Modularized design is an important means for product innovation. Under traditional mode, since most product development is independently completed by an enterprise, the modularized design is generally carried out within the enterprise; that is to say, when the product innovation teams within the company are undertaking product innovation, in most cases, the optional sophisticated technological modules come from the internal of the company; under this condition, the selection range of the technical module is very narrow. With modularized design, the suppliers at the upper reach, middle reach and lower reach can collaborate closely with frequent technical communication; the companies can build their respective sophisticated technologies into platforms and make corresponding packages for the convenient selection of other companies. This kind of technical module package involves a wide range of industries with high applicability; in this way, the simple repetitive inefficient labor and input of each company can be greatly reduced, a higher technical platform can be provided for the product innovation at the very beginning and the investment and cost can be significantly saved; most importantly, the development speed of the product is sped up, which can enable the product to gain the initiative and expand market share. Under mode of the supply chain management, the modularized design is more easy and convenient and the advantages and effectiveness of modularized design can be given full play; when a technical module is widely applied, this technical module will possibly become a kind of industrial standard and once a kind of technology becomes an industrial standard and the enterprise who firstly grasp this kind of technology will gain significant market advantage.



**Figure 2 Virtual Product Innovation System Based on Structure of Supply Chain**

### 3 Case Study

In 1985, Hewlett Packard formally entered into China and established China Hewlett-Packard Co., Ltd., which is the first high-tech joint venture in China. HP carries out operation in 178 countries and regions concurrently, using multiple working languages and possessing 1 billion customers, 150000 staff and 70000 service partners and 210000 sales partners; on average 71 patents come into being everyday. After being merged with Compaq in 2001, HP has become a super-large enterprise with the sales turnover reaching 90 billion US dollars in 2005; the global market share of HP laser printers has exceeded 50% and the market share of inkjet printers has reached 40%. HP has three main subsidiary business departments: personal system division, imaging and printing division and technological solution division and the sales turnover of the three divisions has exceeded 26.7 billion US dollars, 25.2 US dollars and 33.3 US dollars respectively; the technological solution division is the most profitable and this division has its own IT services, such as software and storage as well as its own global supply chain. The super-large enterprise scale has brought great challenge to HP and it is not a simple thing to handle so intricate relations.

#### 3.1 Customer satisfaction management

Today's customers are more and more sophisticated and they put more and more emphasis on the product values but not price; thereby, HP gives consideration to the requirement of the customers and strives to provide the customers with assured solutions, which is the greatest need of the customers. Printers are bulk-sales IT product and its product design and operation mode influence the whole development process of the product and thus the two aspects are considered as the most important factors for the success of HP business printers. Since the entry of HP laser printers into China's market, a lot of money has been input into the product localization and product design; in order to speed up the Chinese printing speed, HP took the initiative to provide Chinese word stock for the users and developed HpLaserJet6L series products to meet the demand of Chinese consumers, which greatly satisfy the actual demand of office printing market in China<sup>①</sup>.

The HP printers are positioned as "I trust, I choose"; in order to satisfy the actual demand of Chinese consumers, HP maintenance is changed into "HP golden service", which not only changes the

<sup>①</sup> Xu Xiaoqing. Global supply chain analysis of HP. Market Weekly, 2006(2)

image of HP service but also comprehensively promotes the HP service capacity. HP establishes new industrial service standards and, meanwhile, in order to satisfy the different requirements of customers, various personalized service programs are established, in the hope of driving the product innovation via service standardization and individualization. During this period, HP also carries out free printer training in such places as exclusive shops and computer cities to teach the customers to use and maintain the computers. To satisfy the customer requirements at any time and place by providing proper products, service and solutions is the unremitting goal of HP.

### 3.2 Product development management

At the end of 2000, HP successfully starts enterprise product innovation management plan and the goal is to halve the product time-to-market as well as the after-service cost of the product (this goal is hopefully to be realized through improvement of design quality, rapid implementation of engineering alteration and timely correction of design deviation on the basis of collaborative product innovation). This plan comprises three parts: the first is to integrate previous different kinds of PDM systems inside HP to establish a unified product design platform; the second is to implement technological configuration management criteria among all the enterprises and cooperation partners; the third is to establish the cross-enterprise collaborative environment guided by the thought of collaborative production innovation. The design and manufacture of printers involve ASIC (Application Specific Integrated Circuit), software, hardware, firm ware, mechanical design and appearance design, etc., belong to a relatively complicated high-tech manufacture. The main management center for HP laser printer is established at the capital city of Idaho, Boise, the network card is in Roseville of California and the accessories are in Mexico; the three locations are respectively provided with several software, hardware, ASICS laboratories as well as product innovation centers and the production is outsourced to a factory in Japan. In the past, the management have conducted preferable integration, for example, the product life cycle, engineering alteration and new product introduction have made database butt-level contact with the factory system; the management of inkjet printer is relatively more complicated, there are different production, research & development and sales systems & processes in Canada, Asia-Pacific regions and Ireland, therefore, the collaborative production innovation for inkjet printers is the both the important and difficult and HP is striving to integrate the R & D resources and development platforms of the two product lines through the establishment of collaborative product innovation system.

**Table 1 Income Measurement Index of HP Company**

Time index	Product innovation cycle
	Engineering alteration implementation date
	Percentage of new product sales
	Percentage of standard component adoption
	Re-use degree of other R&D development programs
Quality index	Times of design iteration
	Capacity of design process
	Times of alteration of the engineering drawings after being issued to manufacturing division
	Maintenance cost
	Rework and scrap costs
	Quantity of product data sources
Efficiency indicators	Accuracy of bill of materials
	Unit project cost
	Unit alteration cost
	Outsourcing dependence of the project
	Quantity of manual input and checking points

To better implement the collaborative product innovation system, the product range shall be well-controlled and the inventory shall be continuously reduced. On one hand, the product commonality shall be identified so as to realize the re-use of components in the new products; since the electronic industry is relatively greatly restricted by environment, the products shall be designed strict in conformity with various regulations and environmental conditions and the time-to-market of new products shall be minimized. In this way, HP Company receives tangible benefits and the specific income is measured on the basis of the three indexing systems as Table 1 shows:

## 4 Results

As the leading enterprise within the industry, HP has made impressive achievements; through the above-analysis, we can produce the following results:

(1) Most companies follow such a common law: the market performance of business-focused companies significantly overwhelms those competitors without clearly-defined core businesses. Each enterprise shall only focus on the most adept and sophisticated business and outsource the non-core businesses; this can facilitate the enterprises to focus the limited resources on the main business so as to form core competitiveness of the products or services and can also boost the efficiency of auxiliary businesses, reduce the operation cost and create high service value for the customers.

(2) Through the imperfection of e-business platform, the unnecessary intermediary links in the production innovation management are eliminated, the information timeliness and accuracy are improved, the integrations of business flows and the inter-connection & communication of information systems among enterprises are realized. In this way, the enterprise can reduce cost, reinforce responsiveness, better internal procedures and enhance customer service so as to form effective product innovation cooperation and communication.

## 5 Conclusions

The main content of the paper is to establish a supply chain platform centered on product innovation. Different from the traditional product innovation methods, this paper places product innovation on the platform of supply chain and strives to solve the problems emerging in the supply chain-based product innovation by taking the systematicness, integration and coordination as the main research line; supply chain-based product innovation methods are brought forward to realize the integration supply chain and product innovation management. Through the research for the integration of supply chain and product innovation, new product innovation integration mode based on CORBA & WEB-based multi-level coordination mechanism is put forward as well as such product innovation methods and implementation frameworks as agile product development, virtual product development and modularized design, etc.

Supply chain and product innovation management research is a hot research issue both home and abroad since supply chain management and product innovation management can bring magnificent potential benefits for enterprises. In addition, with the rapid development of information technology, the supply chain management and product innovation management also gain great development and continuous enrichment of content; the applied research means, tools and methods are also increasingly diversified. Meanwhile, people's minds are also advancing with the times and their knowledge to the supply chain and product innovation integration are ever-deepening; especially, with the wide participation of some large enterprises in Western countries and the continuous accumulation of experience, the research for this subject will be continuously perfected and enriched.

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