Research on the Application of IPD in Equipment Manufacturing Enterprises R&D Management

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ABSTRACT: This paper introduces the necessity of enterprise implementing of IPD, expounds the basic theory of IPD; summarizes the successful experience of equipment manufacturing enterprises. Finally, this paper summarizes attentions of implementing IPD by combining with the existing research results, and it has reference significance for other manufacturing enterprises to improve the level of R&D management and product market competitiveness.

1. INTRODUCTION

The competitive advantages of the enterprises depend largely on whether it can provide customers with the products that customers love quickly. It promotes the enterprises to improve the competitiveness of R&D. But the development process is facing many challenges. In the external: technology updates fast, increasingly fierce competition and customer need diversity. In the internal: market response slowly, bloated organizational structure, collaborative difficulties and high cost of R&D[1]. Hammer and Champy proposed business process reengineering to solve the R&D problems: Reconstructing the traditional R&D mode thoroughly and violently in order to replace the functional departments based on the division of labor with the overall performance oriented process. Integrated Product Development (shortened as IPD) is embodied of the idea in the field of product R&D management[2].

2. OVERVIEW OF IPD

<<Application of Product and Cycle Optimization in Product Development>> is a symbol which marks the perfection of IPD theory. It describes all aspects of the product R&D mode and provides a general framework and standard terminologies[3]. Business and academia set off a boom of researching IPD after the successful implementation of IBM. European scholars focus on product development cycle. American scholars focus on cross-sectoral collaboration. HUAWEI imports IPD earlier and summarizes the Chinese experience[4].

2.1 Definition

IPD is known as the theory of integrated product development. It is a humanized way of R&D management to develop competitive and high quality products or services in the right time[3].

2.2 Core Ideas of IPD

2.2.1 Product Development as Investment

IPD puts the resources in the most promising product portfolio by investment portfolio analysing new projects.

2.2.2 Market Driven R&D activities

IPD requires that R&D activities are based on customer needs. It integrates R&D process and market management. Market management ensures that people do the right thing. R&D process ensures that the way which people use is right.

2.2.3 Cross-sectoral Team Collaboration

IPD regards product R&D as cross-sectoral activities. Integrated product management teams ensure that the company has the right products in the market. Product R&D teams are responsible for business success of products.

2.2.4 Structured Process

IPD is clearly divided R&D activities into six stages which includes concept, planning, development, verification, release and life cycle. It tries to find a balance between unstructured and over structured processes.
2.2.5 Business Layer and Asynchronous Development

IPD divides R&D activities into different layers of tasks including final product, platform, subsystem and technology. Project teams develop all layers of the tasks asynchronously. Low layers support high layers. Coupling degree is low between different layers, and cohesion degree is high in the same layer.

2.2.6 Reusability

IPD emphasizes reusability in the condition of preserving the product personality. Reusability is conducive to develop asynchronously.

2.3 Framework and Key Elements of IPD

IPD is a complete product development mode. It is a set of methods including seven elements which is divided into three aspects of market management, process recombination and product recombination[2]. Framework of IPD is shown in figure 1.

![Figure 1. Framework of IPD.](image)

2.4 Advantages of IPD

The traditional development mode (structured mode, contingency mode and information mode) has many disadvantages. The structured mode can't develop asynchronously, and R&D activities like "pass the parcel". Contingency mode can't take people as dynamic variables which restricts the development and innovation of management theory. There are not clear steps in the information mode. Senior leadership can't control the development process, and the different departments cooperates difficulty[5].

IPD inherits the advantages of the traditional product development mode. It takes "produce competitive products" as the goal, and restructures the processes of marketing, finance, development and manufacturing. It is a humanized and team-based mode. This mode is able to respond to market changes quickly, meet consumer's express and implied needs in time. It is conducive to shorten the R&D cycle, reduce the cost of R&D and maintenance, improve the per capita output rate and improve the quality of products.

3. RESEARCH ON EQUIPMENT MANUFACTURING ENTERPRISES IMPLEMENTING IPD

3.1 Company profile

H enterprise was founded in 1996 in Jiangsu Province which is a listing Corporation. After 20 years of development, it has become multi categories of the industrial manufacturing center based on the high-end equipment manufacturing and auto parts industry. It has 9 subsidiaries. The enterprise focus on R&D since it was founded. It is devoted to becoming a world-class metal recycling equipment manufacturer. After the financial crisis, it faced a severe business environment and competitiveness.

3.2 Processes of Implementing IPD

3.2.1 Market Management

The enterprise takes market management as the driver of the developing activities, standardizes operation steps of market management scientifically for ensuring the correctness of decision. The market management processes include four steps: understanding market, market segments, combination analysis and make plans. The market management process is shown in Figure 2.

![Figure 2. Marketing Management Process.](image)

(1) Managing Customer Needs Scientifically

The need management of the enterprise is strengthened from four aspects including need collection, need analysis and classification, need realization and need verification, and ensures that make the activities of collecting customer needs routine and standardized. In the process of contacting with customers, the enterprise records the real needs detailedly, and carries on need analysis from eight angles of price, availability, packaging, performance, ease of use, assurance, life cycle costs and social acceptance. The need management divides needs into long-term needs, medium-term needs, short-term needs, express needs, implicit needs, specific needs and
value-added needs, meet the high layers needs prior by ranking needs. R&D teams make R&D plans according to the needs analysis report and realizes relevant needs in new products

(2) Optimize Investment Portfolio

The enterprise takes needs to drive product development and takes product development as an investment according to IPD. It considers factors including the competitors, market needs, the enterprise advantages and revenue targets fully in the investment portfolio analysis. The enterprise makes corresponding business plans from the three aspects of the understanding market, market segments and the combination of the analysis.

It understands the market by the consulting company report, the government work report and other ways for conducting market segmentation seriously. It conducts combined analysis to quantitate market attractiveness and company competitiveness by GE matrix, and abandons the technology oriented R&D mode, gives priority to the new product project to ensure that limited resources are invested in the core areas and the correctness of investment decisions.

3.2.2 Business Process Reengineering

(1) Build Cross-sectoral Teams

H enterprise sets up two types of cross-sectoral teams: One kind is integrated product management teams (shortened as IPMT), they belong to the senior management decision-making layers, ensure that the company has the right product positioning in the market, providing project development resources and control investment. These teams are similar to the venture capital firms. The other kind is product development teams (shortened as PDT), they belong to the implementing layers of the project, ensure that the company launches new products successfully, similar to the venture capital projects. Both IPMT and PDT are made up of cross-sectoral staff including marketing representatives, finance representatives and technical representatives. IPMT controls PDT. IPMT checks whether the projects are profitable which are responsible by PDT from business points. Other departments are equivalent to the "ponds" which provides talents and information[2].

The relationships between PMT, PDT and functional departments is shown in Figure 3.

Marketing management processes issue project Charter, IPMT will appoint the PDT managers and the PDT core teams. PDT develops detailed product strategy and business plans according to the project Charter which are sent to IPMT for decision making. If the evaluation is passed, PDT starts product specific development. Other departments provides talents for PDT in the course of R&D. When the R&D activities are over, R&D members back to their original departments.

(2) Structured Process

The enterprise clears definition of work according to the rules of structured processes, so that R&D activities conform to the following six points: ① clear hierarchy—manage, ② clear phases—control, ③ clear delivery procedures—measure, ④ uniform and professional terminology—communicate, ⑤ clear division of responsibilities—division of labor, ⑥ clear performance indicators—evaluate.

In the implementation of IPD, the new product development processes are divided into six stages including concept, plan, develop, test, launch and life cycle. After the end of each stage, IPMT carries out stage evaluation including technical evaluation and deciding evaluation[3]. The stage evaluation process is shown in figure 4.

The process of stage evaluation is similar to the funnel. At the beginning, there will be lots of creative ideals. In the developing process, the commercially successful product projects are retained by all stage evaluations at the end. They will be properly invested, the product will be developed.

In order to implement the stage process, the R&D activities are classified by structure layers, and decomposed by roles. Each layer has a specific guide books and templates to regulate the behavior of employees, guide the staff to complete their work. Seeing figure 5.
In practice, PDT starts the project according to the project charter which is output by the marketing management processes. The project charter is send to IPMT for evaluating, IPMT evaluates projects from business perspectives. If the evaluation is passed, PDT manager and PDT core members will be appointed and the cross-sectoral teams are formed.

3) Strengthen Project Management and Pipeline Management

The enterprise strengthens the project management by comparing project implementation with plans constantly. At the same time, it trains project managers so that project managers have general management terminologies and basic management knowledge.

H enterprise strengthens the pipeline management from two aspects: One is to strengthen the pipeline management in the market management. In the constraints of the internal resources, it sorts multiple projects in order to balance the resources. Two is balance project resources in a single project. According to the H enterprise internal practice, the pipeline management is mainly used in multi projects so that the enterprise ensure that business plans are matched with the enterprise resources by the pipeline management.

3.2.3 Product restructuring

(1) Asynchronous Development

In order to shorten the product cycle, the enterprise actively explores the mode of asynchronous development. The product developments are divided into different layers in the vertical. That is high polymerization at all layers of internal and low coupling between layers. Different teams complete different layers of work asynchronously which shorten the development cycle greatly. Business stratification is shown in Figure 6.

(2) Common Building Blocks

In order to reduce costs, improve quality and shorten the time to market, H enterprise enhances designing capabilities, constantly deepens the accumulation of technology and actively builds Common Building Blocks (shorted as CBB) which have strong independence. Using mature CBB structures products which integrates personalized needs. It is conducive to seize the market rapidly. CCB is shown in Figure 7.

3.2.4 Using IT auxiliary tools

H enterprise uses a variety of IT auxiliary tools to accelerate the implementation of IPD which enabled R&D activities to be standardized, efficient operation, low cost and shorten the development cycle. It enables to produce marketable products of high quality to participate in market competition. And using IT auxiliary tools ensures excellent experience and method to be solidified into the management processes, which improves the management level of the whole enterprise at last.

4. SUMMARY

IPD has been highly respected since its generation. In practice, many enterprises shorten the development cycle, reduce the cost and enhance the competitiveness of the market by implementing IPD. At the same time, theory of IPD has been continuously enriched and perfected. However, enterprises should consider the impact of related factors when they implement IPD. (1)Senior Management's Support: Senior Manager's Support is the premise of the successfully implementing IPD. It can provides power for implementing IPD. (2)Corporate Strategy: Corporate Strategy decides the design of operational layers, the set of operational layers and monitoring targets. The changes of strategy has directional effects on R&D. (3)Organizational Structure: The standard degree of organizational structure and operation control process affects the possibility of R&D improving activities, the effectiveness of innovative projects and the speed of R&D. (4)Staff
Participation: Implementing IPD involves all staff. The inertia of the staff will make them horrible and will negate IPD’s progressiveness and the necessity of implementing IPD.

The enterprises will get a great success only by grasping the essence of IPD, eliminating all kinds of interference factors and exploring a way with its own practice step by step in the fierce market competition.

REFERENCES