

Study on PLM-based Industrial Design Processes

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Abstract: Industrial design plays a greater role in product innovation, product lifecycle management is based on the impact of industrial design processes, this paper uses qualitative analysis and case study method to study the process of industrial design. The traditional industrial design is no longer suitable to the serial process of intense market competition, concurrent engineering, product innovation tool software, product innovation management software, and other advanced concepts and techniques must be adopted to reconstruct the industrial design process, to shorten the product life cycle time and improve the market competitiveness of the goal.

Key words: PLM; Industrial design processes; Concurrent engineering; Mobile design

1 Introduction

With the computer technology and innovative management development, industrial design flow past the sequential engineering far can not deal with the fierce market competition, how to make industrial design in product innovation play a greater role becomes very important. Since the 1990s, it is significant for industrial design of concurrent engineering design and PLM product concepts such as the development proposed. The development of domestic and foreign experts believe that the PLM information to promote industrial design, but the majority of research and application of concurrent engineering in product development, product development, industrial design as a separate part, but also participate in the development process, so also with the industrial design process changes in the development of PLM. It is necessary to PLM-based industrial design all aspects of the operation to do in-depth study. Mobile as their main communication tool, how the context of PLM to shorten product life cycles, respond to unpredictable changes in the market is necessary.

U.S. consulting firm CIM data 2002 PLM from the three meanings of to explain its importance in promoting information technology. That PLM is a strategy, a philosophy and a range of software^[1]. PLM of the United States earlier and more in-depth, SAP launched the SAP PLM system to achieve a number of departments also collaborate to provide end to end solution. PLMIG (PLM INTEREST GROUP) is an international trans-regional, cross-enterprise PLM interest organizations, since in 2005 PLMIG proposed to develop a generic reference model of PLM benefits, this model will be able to global PLM evaluation, either from the economic point of view, the management point of view, or from the enterprise resource planning, supply chain management. Customer relationship management and other systems integration point of view, it requires a clear definition of the concept of PLM. Domestic scholars CaoYang puts forward the comprehensive use of concurrent engineering and industrial design can make technology, industrial design integration process, reconstruction industrial design serial parallel process of new ideas. Liu GuoHao^[2] believed that strengthening the industrial design into the advanced management technology system of thorough research, optimization and reconstruction process, be helpful for industrial design into full play in industrial design product integration development in the role. Lin JiaLiang and Li BinBin believed will put the goods into concurrent engineering to design the psychological effect evaluation as the guidance, product design, engineering design synchronism to greatly shorten the product manufacturing cycle.

2 Product Lifecycle Management the Influence of the Industrial Design

2.1 The meaning of product life cycle management and positioning

With the development of information technology, product life cycle management business has gradually been accepted and flourish.. Product lifecycle management (PLM) is a kind of technology which supports the whole life cycle of the products information to create, management and application . It emphasizes the life cycle of products across the supply chain management and utilization of all

Henan province government decision-making research topic bidding: Based on the design innovation of Henan province regional culture industry development strategy research (NO.2011B834) information. Product life cycle management is a developed rapidly and relatively new area, it also has a different understanding of the definition. American consulting firm in. Defined by CIM data, PLM

including CAX software (product innovation tools software), CPDM software (product innovation management software), including PDM and the sharing of product model information in the online collaborative software and related consulting services. PLM software is the core PDM software, before the birth of the PLM, PDM product development process is mainly directed against the data and process management. PDM be extended meaning in the PLM, it can achieve a number of departments and even between enterprises of product data collaboration applications.

2.2 The meaning of concurrent engineering and the situation of development of domestic and abroad

As the product life cycle management emphasis on product life cycle management ,all department of the docking become very important, So the concurrent engineering become the development direction of modern industrial design. Analysis of the 1988 U.S. National Defense Research Institute made a complete concurrent engineering (CE-Concurrent Engineering) of the notion that "the concurrent engineering is integrated, the parallel design of products and related processes (including manufacturing and support processes) of systems approach. Requirements of product development from the outset, taking into account the product life cycle (from concept to product obsolescence) of each phase of the factors (such as function, manufacture, assembly, job scheduling, quality, cost, maintenance and user needs, etc.) and emphasized the work of various departments, the decision makers through the establishment of effective mechanisms for information exchange and communication, considering all relevant factors, so that part of the follow-up problems that may occur in the early stages of design to be found, and resolved at the design stage so that the product will have good manufacturability, can be assembled, maintainability, and the characteristics of recycling, etc to minimize design iterations, shorten the design, production preparation and manufacturing time.

Concurrent engineering of the foreign country more deeply than earlier also, At present, concurrent engineering has been widely used in foreign countries, such as aircraft, computers, machinery and electronic products. University of Virginia research center using concurrent engineering developed new model aircraft, the wing of the development time by 60% (from the previous 18 months, reduced to 7 months). Relative to other countries, in the 1990s the development of concurrent engineering in China, concurrent engineering was caused great attention by government and academia. CIMS in the implementation of the new generation of projects, 863 subject matter experts to organize relevant experts to conduct research and technology development, so that the theory of the concurrent engineering research, technological development to catch up with the world advanced level.

Industrial design of concurrent engineering emphasized in cross-parallel and start work as soon as possible to shorten the product life cycle time. Industrial design throughout the whole product life cycle, both pre-user research and concept design, modeling, and other new products, industrial design play an important role. Industrial design of concurrent engineering can not only to shorten the product life cycle time, but also minimizes waste of resources. Industrial design and production occurs link cooperation. For example, industrial design and product modeling team's cooperation, the structural design of the cooperation and so on.

2.3 Under the background of PLM industrial design innovation function

Modern industrial design processes need to adapt to new management and new technology requirements. Therefore, industrial design is an important part of new product development. There are several factors that are mainly composed of advanced technology in development; changes in customer demand; shortened product life cycle, studies show that ^[3], in the past 50 years, the product life cycle, students have been reduced to a quarter of the original one of the new product was no longer life-cycle five to ten years, there have even listed this generation, the development trend of generation; there is intense competition from domestic and foreign. PLM is product lifecycle management, for the introduction, growth, maturity, decline of the characteristics of the four stages of management and docking. Each stages of both features for the management, but also to the four stages of successful docking. As the each stages and sectors of the parallel, so that products may amend the error as soon as possible to avoid late stage in the product life cycle that lack of cost, manpower, so that shorter product life cycle. Regardless of PLM as a technology or a concept will help to shorten the product life cycle time.

Industrial design information from the development of PLM. PLM system designer team will through exchange and share product data and ideas, to finish the design work. PLM concept in before an enterprise just concerned about, the management of production process, including product data management (PDM) applications are just the production process of data and information management, not the industrial design on enterprise innovation of the management system. The study reveals that the

technology of evolution of industrial design innovation function stable increasing, to the market orientation effect is more and more big.

3 Modern Industrial Design Process

3.1 The traditional industrial design of sequential engineering

Sequential engineering is the whole product development process subdivided into many steps, each department and individual are only part of that work, but is relatively independent work finished, the results pass to the next department. From the requirements analysis, product structure design, process design until processing and assembly is step between departments. The traditional sequential engineering method is based on two hundred years ago the British political economist Adam Smith's theory of labor division. The theory believed that the finer division of labor, the higher the efficiency. The traditional industrial design sequential process the user survey, concept design, model design, production process, manufacturing, products listed into the market (figure 1), and each link has almost no docking. Industrial design sequential process cannot adapt to raise the current market of new products, consumer demand more and more strong, increase production strength competitors. Product innovation is vital to the development of enterprise and survival, therefore, the speed of change and become important factors enterprise foothold. Robert cooper think speed produces competitive advantages and higher profit ability, and speed means smaller accident. And sequential process obviously can't satisfy speed bring far advantage on product development basic according to order, and in different departments, this not only make the product update slow, but also may cause material force, financial and human waste. Cause the user survey and design link disconnect.

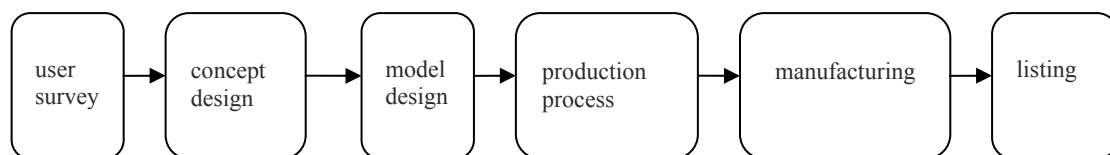


Figure 1 The Traditional Industrial Design Sequential Engineering Process

3.2 The industrial design of concurrent engineering

Industrial design process can be divided into the following several parts: user survey, concept design, detailed design, model of modeling, design, manufacturing. For each link PLM have different influences, PDM is the core of PLM.

User survey should throughout the entire product life cycle, each stage show different characteristics and work out the demand analysis report, compiled by the PDM software to the virtual data sharing of product master model, through the product data management (PDM) to provide the data and other departments to parallel, shorten the product life cycle time and improve efficiency. The conceptual design communication with customers, according to the results and data user survey for conceptual design, including new product feasibility, use environment, material qualitative, cost control and so on can product main model with the relevant departments, formulate feasible analysis report communicate as early as possible, and the quality supervision, shorten the product life cycle time. 3D modeling stage need to use professional industrial design software, such as 3DMAX, PRO/E, RHINO, ALIAS, CAD, etc. Formulate 3D model assessment report and structure design progress schedule. Meanwhile, industrial design software needs PLM, PDM and PMM work together. The detailed design, 3D modeling by design review after feedback to the modeling, modeling and structural design review and hardware design review timely communication, consider operability and aesthetic factors for structure design review records and hardware design review records. Through 3D model and structure design of revisions and hardware design, software design communication implementation model design. Model design needs through structure design of the review and mold production verification to modify the structure design, formulate external and internal records and mold production schedule. Manufacturing is supervised by quality and controlled by cost, post-market sales direct feedback to manufacturing.

The industrial design process and structural design, hardware design and software design of parallel, and with PLM, PDM and PMM as the foundation. Industrial designer, engineering designers, software engineers, advertising designers can in a foreign land space end-to-end model technology product main sharing. Staff of different departments parallel, through the data parallel information management as

early as possible to shorten the correct mistakes, the purpose of the product life cycle, also beneficial to the cost control of enterprise. As shown in figure 2 below.

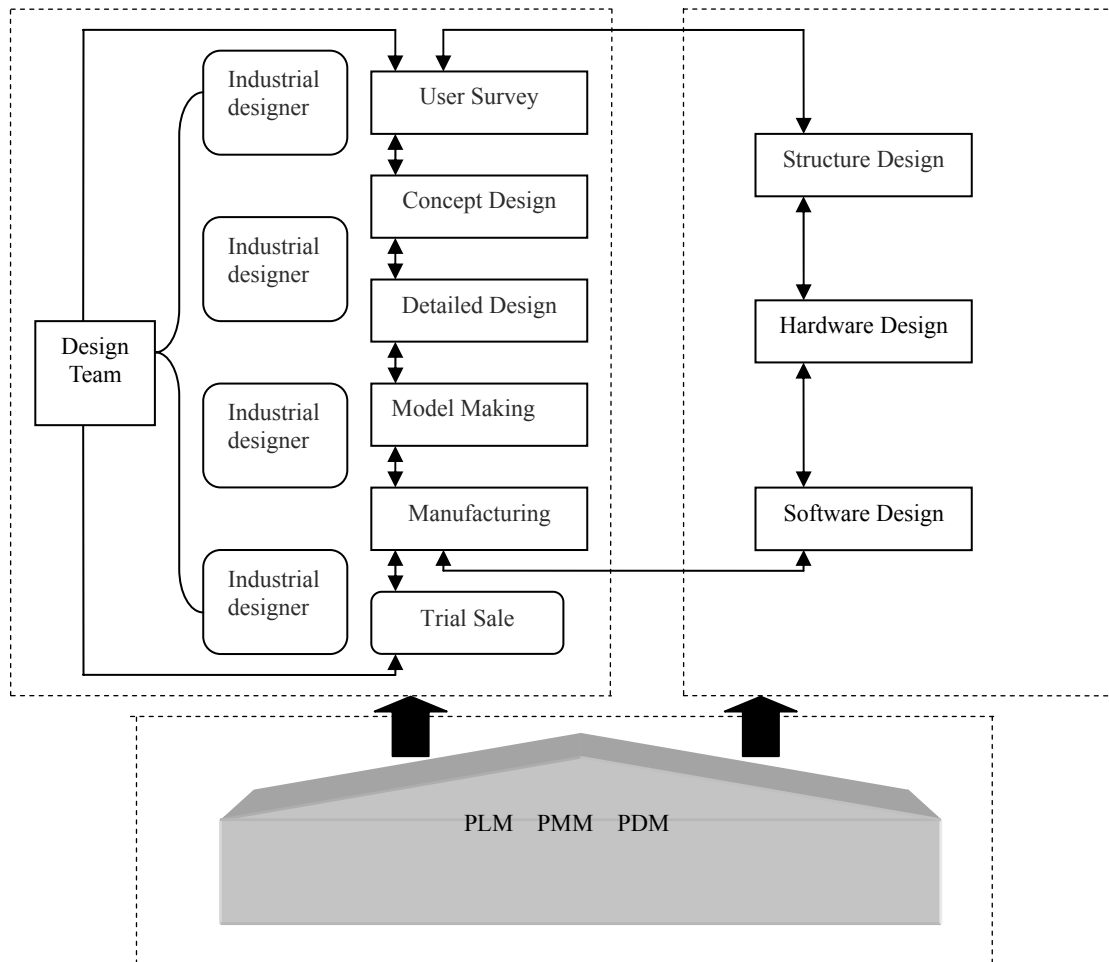


Figure 2 Under the Background of PLM Industrial Design

4 Under the Background of PLM Mobile Designs Development Research

With the information technology, computer technology and network technology development, the development trend of mobile performance for the product life cycle is shortened, and the renewal speed generation speed, customer needs diversification and individuation. Due to technology restricted, sequential engineering phone design extended the life cycle time before, as a result of each department no docking and parallel, caused a waste of resources, In the beginning there is no market research to consider the entire product life cycle, so that the program may be the last link in the design found. In this sequential engineering put each department staff, technology, the design and the management work, but couldn't get separated process integration. As the previous contradictions between industrial design and structural design, resulting in longer development time and cost increases. This sequential process against the development of mobile phone design, it is necessary to strengthen the docking, including two departments and other departments have parallel work. Nokia research and development team common feature is "simultaneous engineering"^[4], namely before the concurrent engineering, referred to this first is Japan's practice, the purpose is to consider the life-cycle of all elements. Nokia through the core work flow across the organization and inter-departmental mode of operation, will research and development innovation effectively integrate up. Domestic phone design also gradually towards the concurrent design.

Industrial design as mobile phones design process of research direction, it is very important of long-term development of enterprises and design company. Therefore, the research on its practical significance. Phone design by many departments and personnel structure. And related technical support,

including product lifecycle management (PLM), product data management (PDM), product main model (PMM), as shown in Figure 3. Mobile design manufacturing process can be roughly divided into industrial design, structural design, hardware design, software design, project management, resources development, quality supervision. Industrial design of a few parts (market research, concept design, model design, process design, trial-produce preparation, products listed) and structure design, hardware design and software design of parallel. Project management, resources development and quality supervision throughout the whole design process. Project management task is to manage the project's progress and coordination of all departments, resources development of new material, ensure excavated material enough, mobile development processes which must be a quality assurance. As possible parallel between departments to achieve maximum limit the time shortened product life cycle. The product development mode, method and process play an important role in Mobile phone industry competition.

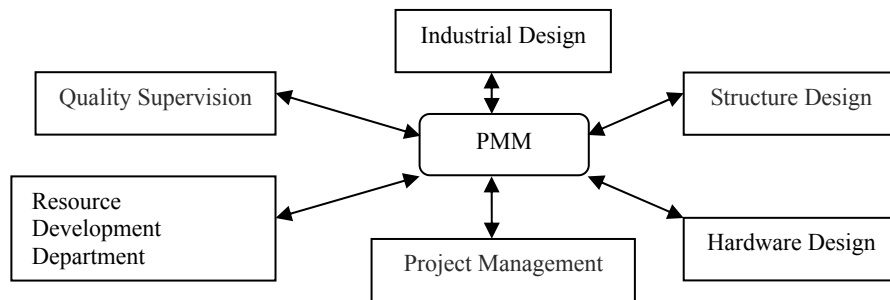


Figure 3 Mobile Product Main Model Train Diagram

5 Conclusion

Along with the traditional industrial design sequential engineering mode the malpractice of exposure and information technology, computer technology and network technology development, PLM based on the context of concurrent engineering and other advanced technologies and concepts will inevitably replace the industrial design sequential engineering before. Under the influence of PLM of industrial design process has not only need design team docking, the more to adapt to the demand of the market; PLM is not only a kind of technology, is also a kind of idea, it is benefit for industrial design innovation status. Based on the study of industrial design process for PLM shorten product life cycle time, realize industrial design process departments docking, in order to improve the market competitiveness.

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