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Open Design Pattern, Method, and its Self-organization Mechanism

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**Abstract**

As the consumer individualization is becoming stronger and the customer demand is changing more frequently, the traditional manufacture-active design pattern cannot meet the demands of the present age. It is widely acknowledged by experts that the individualization can be really realized if the consumer could participate in the product design process. At present, the consumer participation in product design process through Internet is quite prevalent, but the design methodology and theoretical foundation have never been concerned by previous studies. This paper proposes the concept of Open Design and then investigates related design pattern, method and self-organization mechanism to enable efficient implementation of consumer participation. Aiming at the increasingly complexity and variety with random consumer participation, a reference framework of Internet Open Design which based on social network is established to realize self-organization. Meanwhile, a dynamic function model tool and a knowledge fusion method are proposed to enable efficient and effective consumer participation online. The effectiveness of proposed model, theory and method are validated by simulation. This research on the Internet Open Design Pattern, Method and its Self-organization Mechanism extends the current product design methodology.

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**Keywords:** Design Requirement; Internet; Function Modelling; Knowledge Fusion; Consumer Participation

**1 Introduction**

Product design method is extremely important for manufactory. Companies seek competitive design method in product development process in terms of speed to market and cost reduction. Nevins and Whitney [1] discovered that early design is the most important in whole design process. Some researchers provide general principle-based methods to support early design decision, such as TRIZ [2], F-B-S [3] and C-K [4]. These methods are helpful for comparatively optimized decision rapidly. But the mapping, from specific case to general theory, is various from person to person. So the design decision is individualized.

In order to design the product accepted by users, the influence of designer's personal preference should be avoided. A good solution brings user's need in design

process [5]. User-centered design, also commonly referred to as human-centered design and customer-centered design, represents a general philosophy toward design that brings the users or consumers into the design process [6]. User's experience design extends the traditional boundaries of human-object (product) interactions to encompass the notion of the ambience where human-object (product) interactions are operating [7].

In the internet environment, the quantity of users participating is huge, and the procedure of participation is complex. Collective innovation process is expected to solve the problem, which is based on connected, open, and collaborative processes to generate, develop, prioritize, and execute new ideas [8]. The conceptual framework and the agent-based model are used to derive insights for designing novel coordination

mechanisms.

Despite the encouraging success of various projects listed above, the utilization of large-scale participation in product development is still in its infancy. This paper proposes the concept of open design, and the related design pattern, method and self-organization mechanism are investigated.

## 2 The Pattern of Open Design

The traditional or collaborative innovation design processes are described as top-down processes, where the information flows logically from the desired functionality of a product to a design that satisfies the functionality. These processes are based on the assumption that the overall function of the product can be decomposed into many sub-functions, and these sub-functions can be satisfied through the specification of subsystems. The subsystems are designed by teams through well-defined tasks. The requirements flow from the highest level system to the lower level components and the design information systematically flows from the lower level components to the higher level systems. After all the subsystems and the components are specified, integration and verification are carried out to ensure that the system level requirements are satisfied, and that there are no undesired interactions between the subsystems. The open design process is different from traditional product development processes and collaborative innovation processes in a variety of ways. The organizational structure in traditional or collaborative

innovation product development is hierarchical. Whereas in the open design, the organizational structure is unorganized and flat, and it is not well defined. The participation of product development project is carried out by internet open design environment, and is based on individual interest. The organizational structure in Open Design projects consists of independent participants who work on different aspects of the project.

The design organization, normally a company, provides a platform for the participants to contribute their product design schemes. Compared with the traditional product development environment that participants' tasks are assigned, tasks are not allocated in open design projects.

The key problem of open design is the mapping unprofessional participant's design idea to professional design function and structure model orderly. Therefore, it is the first function of open design platform, as shown in figure 1. The professional participants who complete clear function model, structure model and their interrelations present a tiny fraction of whole participants. Most of the schemes of participants refer to one or several branches of whole tree function or structure model. The platform transforms these information fragments to knowledge points which supporting decision. Some of these knowledge points have effects on product function, some of these have effects on product structure, and some of these have effects on both of them. In summary, the open design platform provides a path from participant's proposal to solution.

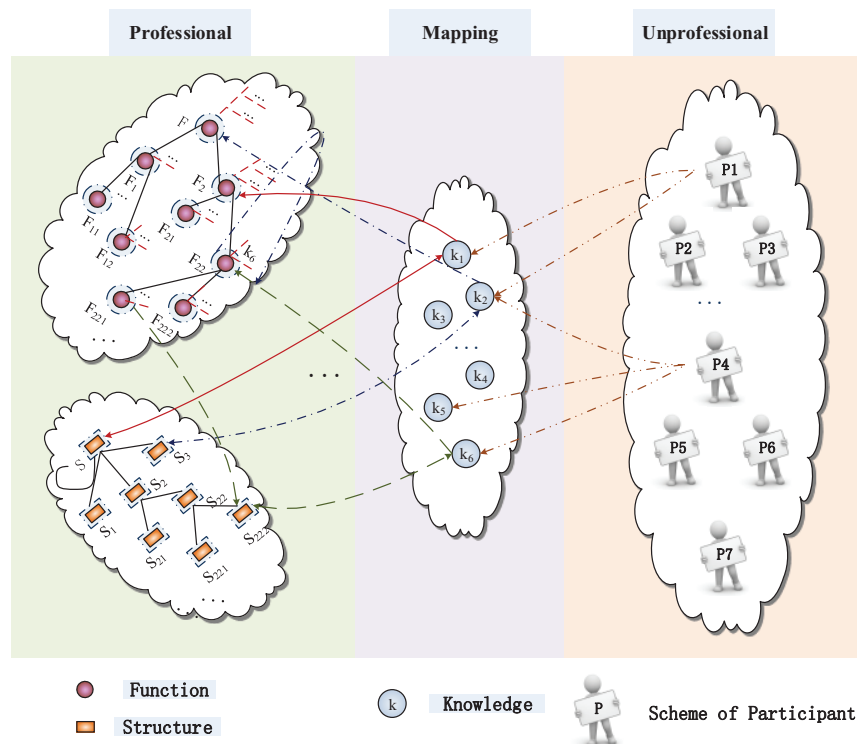


Fig. 1. The Pattern of Open Design

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