

Agile industrial design management based on Scrum

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Abstract—While the business of Yangtze River and Pearl River delta in China is booming, most OEM enterprises attempt to maintain or exploit market through rapid development or innovation in the form of customized design. With the design period is cut down greatly, in order to improve design quality on the current situation of industrial design in China, this paper proposes the method of agile industrial design, and builds the agility model with three major factors of dynamic team, lightweight process, and flexible methods. The method is adapted to the conceptual design process filled with uncertainty, especially in creativity and demand. Based on it, the paper introduces Scrum used in software development and analyzes its usability in the industrial design. Finally, agile industrial design management mode based on Scrum is constructed. It has solved the problem of rapid response ability in meeting the quality requirements of customers. This mode helps enterprises improve the scientific management in agile design environment.

Keywords *Scrum; industrial design; agile design; design management*

I. INTRODUCTION

The conception stage in industrial design is full of creativity, which contains a lot of uncertain factors. In general, clients are not familiar with desired products and the design process originally. With development of products, the design concept gradually becomes clear, and the cognition and expectation of clients for products are improved. According to the Kano model [1], three levels of customer expectations for product and service quality are defined - (1) Expected, (2) Normal, and (3) Exciting. Consumer satisfaction for the product and services depends on the contrast with the expectations before design. If these expectation requirements are fulfilled, the customer will be satisfied. If the actual effects are prior to expectations the customer will feel very satisfied. If these expectation requirements are not fulfilled, the customer will be dissatisfied or extremely dissatisfied. Therefore, the uncertainty of customer demands is inevitable and objective. It is important to timely obtain customer demands and manage them appropriately.

Compared with the countries with long design history, the design education and practice in China pay more

attention to design sketching and less to design analysis. The market demands are the major cause. While the business of Yangtze River and Pearl River delta is booming, most OEM enterprises attempt to maintain or exploit market through rapid development or innovation in the form of customized design. The real requirements for original design are scarce. As a result, the soil for multidisciplinary team innovative design does not exist. Facing the current situation in China, design industry has not formed the corresponding design management mode.

There are striking resemblances between agile software development and industrial design. The common target for design is invisible information products, the customer demands are of large uncertainty [2], iteration program is adopted in the design stage, and teamwork mode are almost the same. In software development industry, Scrum is a kind of popular agile development and management method in recent years [3]. Scrum asks for the ability of fast incremental delivery, and building up efficient and collaborative team during product design. Based on Scrum, the paper puts forward the management mode for agile industrial design, and expects it will promote the scientific management of industrial design in China.

II. SCRUM

The core of agility is rapid response [4]. Ivar Jacobson [5] pointed out the main characteristics of agility. First, agility belongs to social science which pays attention to the effective teamwork. Second, agility is lightweight which depends on more implicit knowledge, besides explicit knowledge. Agile methods emphasize continuous delivery of products, embrace changes, and pay attention to team communication and immediate feedback to users. So, it is a "lightweight" process.

Originally, Scrum is proposed for software development. Currently, it is one of most popular and effective ideas and methods for agile project management. It is a kind of iterative and incremental development method, at the same time is the adaptive development process [6-7]. The target of Scrum is to deliver software products with as well as high quality after series of defined periods. Here a "defined period" is called a Sprint. The whole development cycle includes demand, analysis, design, iteration and production.

The stages of need, analysis and design need respectively a sprint. However, iteration and production need respectively 3-5 sprints. Every sprint is mission-oriented, which has not been determined beforehand. Four elements of Scrum include task library, team, sprint and Scrum meeting. The development process is shown in Fig.1. Firstly, the priority of initial demands is determined, and will be defined as work items, and be enrolled in task library. At the initial stage of every sprint, work items are selected from task library and assigned to team members through the Scrum meeting. Later, team members agreed with the quality about the task assigned at the end of the sprint. Every weekday, team members notice and update the work schedule through the Scrum meeting. At the end of sprint, team will exhibit work progress for customers and collect the new demands from customers for next sprint.

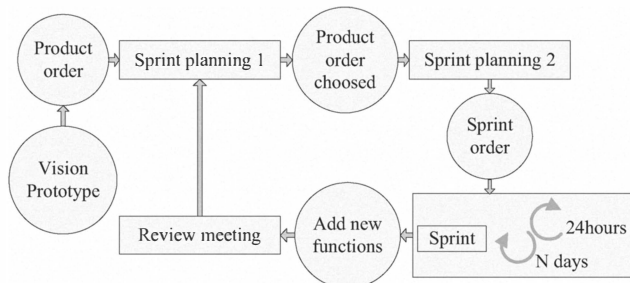


Figure 1. Process of Scrum

III. MANAGEMENT MODE OF AGILE INDUSTRIAL DESIGN

Agility of industrial design is mainly represented on dynamic team, lightweight process, and flexible methods. Along with the development of society, design becomes more and more complex and diverse. Design factors have involved more areas, including aesthetics, humanities, anthropology, sociology, and engineering science. It has become the inevitable tendency that multidisciplinary teams of collaboration ability substitute for individual designers. "Dynamic" is represented on inter-organizational or inter-area team, organizations with loose organizational structure,

variable management process, and responsibility for providing members with free work space.

Lightweight process is mainly manifested in iterative design and implicit knowledge transmission. Industrial design activity of uncertainty is a tentative solution to design problems. Professor Liang Guiming [8] argued that the solution space of industrial design is of plasticity, and the plasticity is reflected in renewability, rearrangement, and agreeableness. The tentative solution to design problems can be looked as a search process in cognitive space [9]. The search scope depends on knowledge of designers. These factors determine industrial design is a kind of iterative process (Fig.2). Transmission of implicit knowledge relies mainly on direct acceptance by subjects, which is directly or indirectly interpersonal communication. Conceptual design is a kind of non-linear creative activities, which relies mainly on design experience and creative thinking such as reverse, parallel, associative, divergent thinking. The specific transmission methods for implicit knowledge include exchange between team, informal communication, design brainstorm, and knowledge map.

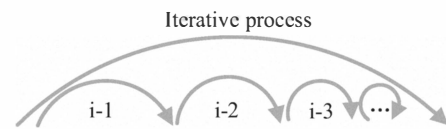


Figure 2. Iterative process of industrial design

Flexibly combination of design methods is one of effective tools for rapid design. During the stage of concept design, different design methods are selected to use for different products. Design efficiency and quality are closely related to combination of selected methods. Scrum is the agile method driven by demand, which is suitable for industrial design practice of creativity. Considering agility of industrial design, the paper constructs the agile industrial design process based on Scrum (Fig. 3).

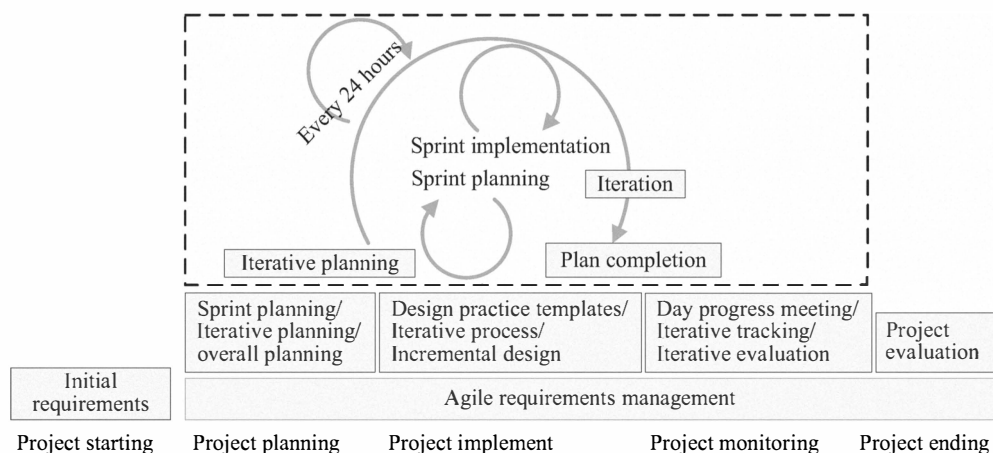


Figure 3. Scrum process in the stage of conceptual design

A. Demand management

Demand management should run through the whole cycle of industrial design. The management of demand changes and renewal plays a vital role. Agility emphasizes the active development and response to demands. In the management process, agility requirements are defined by index cards, story cards, feature description and customer language, and the priority of requirements can be determined through customers.

B. Iterative process

Iterative process includes iterative planning, iterative evaluation, iterative tracking and so on. Iterative planning works around commercial value, and emphasizes the response to business needs. Other iterative processes track and evaluate the realization of function and quality according to sprint unit.

C. Practice templates

Practice templates (as shown in Fig.4) define the design problem solving methods which can be tested. These templates involve all kinds of relative independent methods about design and design management. They are survey questionnaire template, trial and error with templates, behavior image templates, user experience design templates, situation template, brainstorming template, team templates, etc. Practice templates provide design managers with adaptive mode of method combination. Fig.5 illustrates the interface design of scene of situation template.

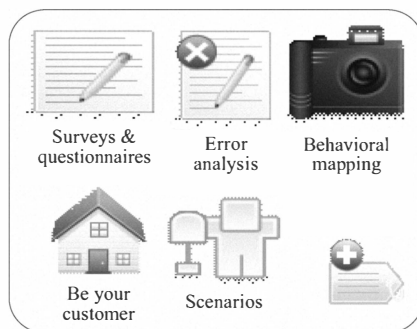


Figure 4. Design practice templates

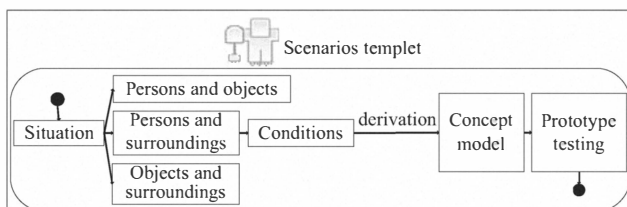


Figure 5. Situational design template

Agile method and management mode based Scrum is put forward on the foundation of industrial design. It has solved

the problem of rapid response ability in meeting the quality requirements of customers. Due to agile method emphasizes the communication of implicit knowledge and application of flexible method, the controllability and stability of teamwork design appears poor. The rapid design reconstruction and robustness of agile industrial design is the further study task.

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