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Procedia Manufacturing 3 (2015) 3391 – 3398

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Beyond the innovation: An exploratory study of designing web-based self-services

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Abstract

Customized web-based self-services play an important role in today's product/service innovation. Compared to traditional tangible services, helpful web-based self-services and off-line services may better facilitate creativity, accelerate value co-creation, and reduce the costs and risks of development and commercialization. Therefore, in order to offer a conceptual framework for a web-based self-service system that enhances the fuzzy-front end (FFE) of new product/service development, this study analyzed the needs and challenges found during the transition of the Dechnology (Design Thinking plus Technology Innovation) project at the Industrial Technology Research Institute (ITRI), the largest R&D organization in Taiwan. Through literature review, in-depth interviews, and participatory action research, we formalized five core system modules, including: 1) user behavior and lifestyle, 2) thematic trend analysis, 3) technology screening and translation, 4) idea visualization, and 5) O2O service connection, with corresponding design principles for supporting user creativity in a web-based self-services environment. Finally, this study proposes a conceptual framework integrated with service design to serve as an important reference for enterprises that undergo similar innovation projects in the future.

Peer-review under responsibility of AHFE Conference

Keywords: Self-service; Web-based system; Innovation; Service design; Co-creation

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Peer-review under responsibility of AHFE Conference
doi:10.1016/j.promfg.2015.07.529

1. Background

For the enterprises of today, innovation is an important part of raising competitiveness and responding to rapidly changing markets [17]. However, when engaging in innovation, many enterprises may encounter issues in pursuing breakthrough while being constrained by manpower and resources. For example, maximizing the effect of innovation is a key area of interest in business management [4]. Moreover, as enterprises begin to embrace co-creation and open innovation, they are often required to integrate internal and external knowledge and resources. The research [26] pointed out that in trying to raise the efficiency of idea genesis and accelerate commercialization, the enterprises might also be increasing the costs of integration and communication.

Fortunately, with the emergence of new technology and web applications, web-based self-services now have significant roles in the development of products and services. Basically, a web-based innovation platform can overcome the limitations of space and time while offering greater autonomy and options to the co-creation participants [10]. In addition, a well-connected network of web-based self-services and off-line services can motivate a user's creativity in the front end of development, accelerate co-creation and commercialization, and minimize the innovation costs and risks [10]. However, during the fuzzy-front end (FFE) of new product/service development, how to apply a user-oriented web-based self-service platform to enhance the effectiveness of innovation and connect well with off-line services is a crucial challenge for many R&D enterprises [9, 10, 11, 13].

This study discusses the three transitions of the Dechnology project at the Industrial Technology Research Institute (hereinafter referred to as ITRI). This study aims to propose a conceptual framework for a web-based self-service system that enhances the effectiveness of the FFE phase of new product/service development.

2. Literature review

2.1. The fuzzy front end of new product/service development

The process of new product development (NPD) is the series of activities and steps performed between idea genesis and commercialization [22]. The research emphasized that the NPD is a common model of long-term profitability, but the model also inherits high risks of causing huge losses [1]. In particular, FFE is considered as the make-or-break phase of NPD [7, 16]. And, the study [21] divided the process of NPD into three major stages: 1) FFE; 2) product/service development; and 3) commercialization, where FFE consists of opportunity identification, opportunity analysis, idea genesis, idea selection, and product concept development. The paper [2] defined FFE as: 1) market and technology assessment, opportunity identification, 2) concept generation, and 3) product definition and planning. Moreover, past research [3] suggested that NPD is composed of: 1) idea generation and assessment; 2) concept development and planning; 3) product development; 4) prototype development and testing; and 5) production and market introduction and diffusion, where phases 1 and 2 are defined as the FFE. Based on the above literature, this study defined the FFE phase of new product/service development as: 1) opportunity analysis and identification, 2) product concept development, and 3) product definition and planning.

2.2. The challenges of radical innovation

Past research [15] pointed out that innovative design ideas originate from sources of inspiration, which include prior experiences and knowledge [23, 25]. Past studies have suggested that when innovation are based purely on either technology, market information, or customer needs, oftentimes such efforts may only result in incremental improvements instead of radical innovation [12, 27]. Therefore, for radical innovation, the research [27] proposed a design-driven model of innovation. It emphasizes the long-term grasp of user behavior and lifestyles, market trends, and technology trends. The model can enable the powerful redefinition of a product or service to create high barriers to entry for the competitors. This process is also referred to as technology epiphany.

In order to gather information and convert them into inspirational stimuli, enterprises would need to devote considerable amounts of resources, manpower, and time; furthermore, doing so can also have negative effects on NPD, such as reduced efficiency and indirect increases in costs and risks [8, 14]. As such, for radical innovation, it

is important for enterprises to find ways to gather and convert information efficiently and identify opportunities effectively in the FFE phase of new product/service development.

2.3. The rise of web-based self-services in aiding development

As early as the 1990s, software companies have been allowing clients to customize system pages. Later, many hardware companies also joined the trend and gave users more options to participate in product customization [28]. After the prevalence of the Internet, ATM applications paved the way for web-based self-services to become a mainstream technology, which enabled the customers to serve themselves through connected system platforms [23]. Today, instead of just product customization or self-service applications for the "end product," web-based self-services play active roles in the front end of new product/service development [19]. In particular, in the information aspect, many web-based platforms aim to assist project members in linking up and compiling market trends (e.g. Trend Hunter), technical information (e.g. Material ConneXion), and new ideas (e.g. Open IDEO). Such platforms can reduce risks and promote the effect of innovation.

In addition to information, efforts also need to be made to ensure a good user experience for a system to be effective in aiding NPD [10, 11]. The research [9] argued that the designs of many web-based self-service platforms lacked basic human-computer interaction (HCI) principles, which led to poor usability and experience. For the design of self-service systems, past research [10] proposed nine major principles, which are: 1) providing an optimal challenge, 2) supplying autonomy, 3) offering a community, 4) giving permission to take risks, 5) facilitating goal setting, 6) supporting positive affect, 7) encouraging mastery experiences, 8) supporting resources, and 9) proposing encouragement mechanisms. However, further studies are required on planning the various functions and modules of web-based self-service platforms and developing concrete design principles in order to meet the needs of the FFE phase of new product/service development.

3. Dechnology and the issues after the transition

As the largest R&D organization in Taiwan, the ITRI has been trying to cross the technology "Valley of Death" in recent year. A major part of ITRI's efforts has been the implementation of the Dechnology project, which was launched in 2010 to introduce design thinking into the organization's existing R&D process. In the past four years, the Dechnology project has enabled ITRI to undergo two transitions. The first transition introduced design thinking into the organization through product appearance design and user interface design. The second transition introduced "service design" and gave rise to the Dechnology innovation consulting services, which are: 1) customer experience optimization for private brands and channel operators through total solutions development; and 2) exploration of multidisciplinary technology applications and commercialization [5]. Although the project achieved impressive results in small-scale trials, problems were also encountered in the areas of long-term service expansion and sustainability.

Firstly, through the Dechnology project, this study found that in the FFE phase of new product/service development, enterprises that pursue radical innovation would need to spend large amounts of time and resources on gathering and sorting multidisciplinary information (sometimes done hastily as a result). This often led to difficulties in completing full and in-depth market and technology analysis on time, or finding opportunities with potential. Secondly, when enterprises are unable to efficiently grasp the related inspirational stimuli such as market trends, the Dechnology team needs to spend extra time and cost on helping them complete the FFE tasks in order to move on to concept development and commercialization. However, it was found that multidisciplinary projects actually shared different degrees of association. When knowledge management and cross applications are done systematically, previously processed information may well become excellent sources of inspirational stimuli for new idea generation. However, the increasing bulk of information and fixed manpower made it difficult to transfer knowledge between projects.

To address this issue, in 2014, the Dechnology project initiated an exploratory study for its third transition (see Fig. 1). The purpose is to find a conceptual framework for a web-based self-service system that enhances the efficiency of the FFE. The framework is to facilitate enterprises in efficient multidisciplinary information and trend

gathering, linking, and compilation. Also, it serves as a mechanism to guide the connection of the related commercialization services during the new product/service development process. Most importantly, the framework can assist the transition of Dechnology from a mainly off-line innovation consulting service to a web-based self-service system with enhanced service quality and user experience.

4. Methods and procedures

A three-stage participatory action research was conducted in this study, as described below:

1) Designing the stimuli for the platform: Prior to system design, two internal expert meetings were held to discuss the design directions for the stimuli. To verify the preliminary hypothesis, past longitudinal thematic trend studies were converted into the required stimuli for new product/service development. The stimuli were presented as three types of cards. There were persona cards, market trend cards, and technology trend cards. Finally, two design workshops titled “Future Travel” and “Future Stores” were held (see Fig. 2). In each workshop, there were ten enterprise managers, five R&D representatives, and five designers. Together, they participated in the co-creation process.

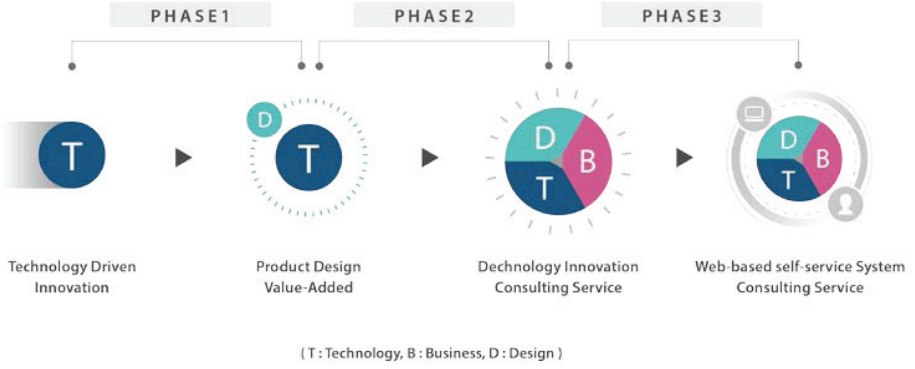

Fig. 1. The three transitions of the Dechnology project.

Fig. 2. The stimuli cards were tested through workshops.

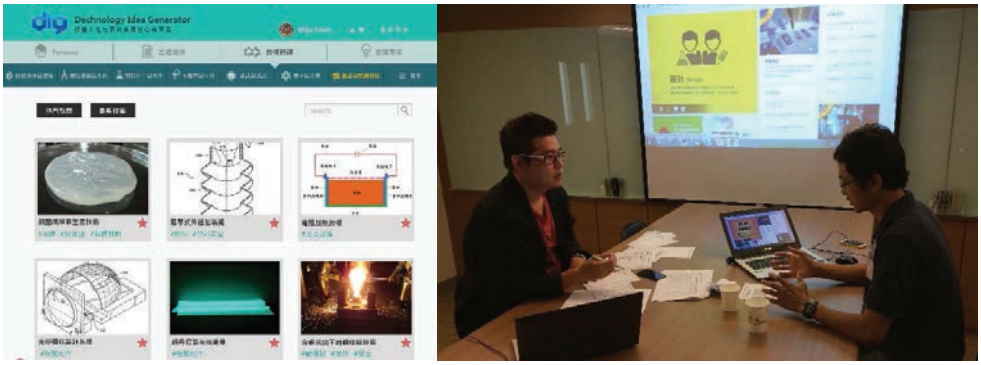

Fig. 3. System prototyping, user interviews, and testing.

2) Defining the role, framework, and core modules for the platform: Following on from the results of the previous stage, three focus groups were organized for this stage. Five multidisciplinary experts joined each session to discuss and define the role of a web-based self-service system in new product/service development. Storyboards were used to describe the user procedures and the holistic experience in connecting to commercialization services. Finally, the framework and core modules of the system were defined.
3) Rapid prototyping and verification: In this stage, the researchers of this study worked with the designers of the system and user interface to design the prototype web page for the system core functions. In-depth interviews were conducted with four enterprise representatives, three R&D representatives, and four designers to discuss the initial verification tests (see Fig. 3).

5. Findings

5.1. Platform stimuli design

Every stimulus was given a name and a description, and was also accompanied by a real-life case and a photo that best illustrated the content. Next, the cards were designed in the same size as regular board game cards for convenience and ease of use during discussions. In the two workshops, it was found that in general the participants highly approved of the customer cards, market trend cards, and technology trend cards. The participants reckoned that the cards were effective in aiding the development team to grasp customer needs and important trends during the FFE phase. Moreover, the stimuli enabled interdisciplinary interaction and enhanced the efficiency of communication among the multidisciplinary team members. This led to the generation of many more good ideas.

However, past research [18] found that stimuli in the form of paper cards were labor intensive, lacking in long-term efficiency, and unable to meet sustainable operational goals. To address these issues, further studies are required in converting large volumes of stimuli into web-based self-service systems, and associating the stimuli with each other effectively. And, it is a research worthy of big data analysis which can enable active adjustments of algorithms and automated user experience optimization.

5.2. System role, framework, and core modules

From the expert meetings, the analyses on resource and time input in past Dechnology cases showed that information gathering and compilation during the FFE phase did in fact cost enterprises the most amounts of time and resources. It was also found that the output of the FFE phase indeed influenced the success rates of commercialization [16, 7]. This suggests a strong need for a supporting web-based self-service system [19]. Moreover, it was found that in-person services are irreplaceable in the development process. This is because a major part of development requires professional knowhow and assessment derived from tacit knowledge, which

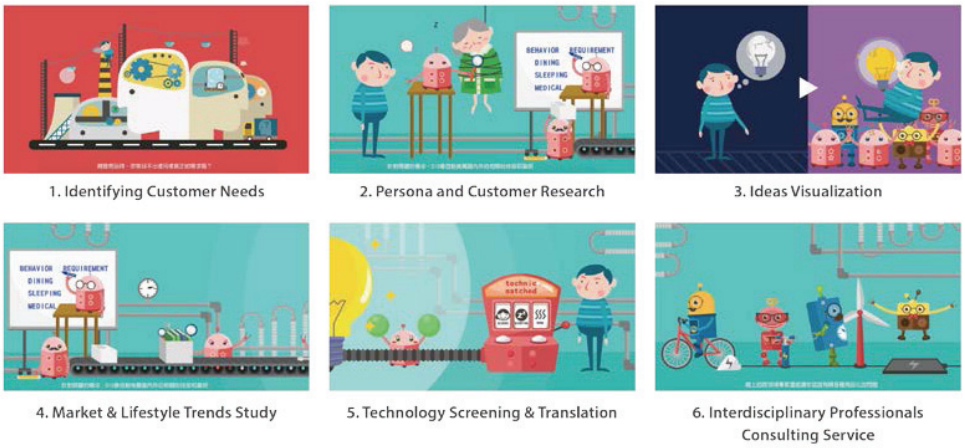

Fig. 4. Using storyboards to illustrate system scenarios.

are difficult to convert into text information. Based on these findings, it is recommended that future systems enable the users to connect stimuli with off-line services in the FFE phase through: 1) self-services or with 2) in-person assistance.

Moreover, user interviews and initial tests were conducted with the use of storyboards (see Fig. 4) and system page prototypes. Corresponding to the tasks in the FFE phase, this study defines five core system modules: 1) user behavior and lifestyle - to illustrate the trends in user behavior and lifestyles, 2) thematic trend analysis - to compile future theme and field trends, as well as benchmark cases, 3) technology screening and translation - to present different technology in the context of their fields, features, and applied cases, 4) idea visualization - to enable the users to edit ideas and visualized presentations with ease, and 5) O2O service connection - to use the on-line medium and match the needs of different new product/service development projects with the relevant multidisciplinary experts or commercialization consulting services.

5.3. Design principles

Finally, beside the nine major design principles for self-services proposed by Gerber and Martin [10], through the in-depth user interviews, and the initial testing results, this study formalized a set of platform design principle for five core system modules:

Table 1. Design principles for the five core system modules.

FFE task	Core system module	Design principle
Opportunity analysis and identification	User behavior and lifestyle	• Use of interrogative sentences to outline the user • Enable the adding, subtracting, and editing of user conditions • Visualized presentation of user behavior and lifestyle
	Thematic trend analysis	• Categorization according to themes and fields • Presentation of market trends and benchmark cases • Use of tags to link to “User behavior and lifestyle” and “Technology screening and translation”
	Technology screening and translation	• Categorization according to technology fields and features • Presentation of technology name, uniqueness, and function • Technical details can remain hidden for initial searches • Use of the system to link to “User behavior and lifestyle” and “Thematic trend analysis”

FFE task	Core system module	Design principle
Concept development	Idea visualization	• Interface designs that enable easy sorting and editing of information • Enable visual linking of "User behavior and lifestyle", "Thematic trend analysis", and "Technology screening and translation" • Enable each project to add its own visual creative board • Enable the importing of information from external search engines to the creative board
Product definition and planning	On-line to off-line service connection	• Provide connections to experts in different fields • Provide Dechnology-related off-line consulting services • Enable direct session bookings or online consulting services

6. Conclusion and future research recommendations

When pursuing radical innovation, enterprises would often pour considerable resource and manpower into gathering and compiling multidisciplinary information in the hope of finding new opportunities; however, in fact, such efforts may also significantly increase the costs and risks of development. Meanwhile, new solutions to address such issues are awaiting exploration in the information age of today. Building on ITRI's Dechnology project, this study conducted a three-stage participatory action research to explore a conceptual framework for a web-based self-service system platform that enhances the benefits of the FFE phase. Firstly, two workshops were conducted using customer cards, market trend cards, and technology trend cards to identify the design direction for the stimuli on the system platform. Next, through expert meetings, the role of the system platform was defined to support FFE tasks, including the gathering and compilation of stimuli, as well as providing connections to commercialization services. Finally, through in-depth user interviews and verification testing, this study defines five core system modules that correspond to the tasks in the FFE phase, and formalizes their design principles. The modules include: 1) user behavior and lifestyle, 2) thematic trend analysis, 3) technology screening and translation, 4) idea visualization, and 5) O2O service connection.

In terms of recommendations and suggestions for future research, firstly, this study was conducted using small-scale rapid prototyping and testing without going into the tangible designs for the database system, so while the data types and their presentation methods have been defined, there can be further research into the mechanisms for the linking and association between different categories of the stimuli. Secondly, this study was focused on a single case study. This warrants future qualitative and quantitative studies in order to reveal any necessary modifications to the current conclusion and hypothesis when they are applied to different types of new product/service development projects. Lastly, this study did not investigate the technologies necessary for the automated optimization of user experience or the periodic compilation of useful information on the proposed system platform. In this regard, it may be beneficial for future studies to investigate the potentials of artificial intelligence and big data algorithms.

Acknowledgements

The ITRI would like to thank the Department of Industrial Technology of the Ministry of Economic Affairs for its support and the staff of the ITRI Commercialization and Industry Service Center for their efforts.

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