User roles and contributions during the new product development process in collaborative innovation communities

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ABSTRACT

Collaborative innovation (co-innovation) community emerges as a new product design platform where companies involve users in the new product development (NPD) process. Large numbers of users participate and contribute to the process voluntarily. This exploratory study investigates the heterogeneous roles of users based on a global co-innovation project in online community. Content analysis, social network analysis and cluster method are employed to measure user behaviors, distinguish user roles, and analyze user contributions. The study identifies six user roles that emerge during the NPD process in co-innovation community: project leader, active designer, generalist, communicator, passive designer, and observer. The six user roles differ in their contribution forms and quality. This paper contributes to research on co-innovation in online communities, including design team structure, user roles and their contribution to design task and solution, as well as user value along the process. In addition, the study provides practices guidance on implementing project, attracting users, and designing platform for co-innovation community practitioners.

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1. Introduction

Co-innovation is a new innovation paradigm where various internal and external sources are integrated to generate new organizational and shared values (Lee et al., 2012). With the rapid development of Internet technology, online community has become one of the main methods that help companies to involve customers in new product development (NPD) process (von Hippel and Katz, 2002; Sawhney et al., 2005; Romero and Molina, 2011). The concept of co-innovation community is an Internet platform where new ideas or approaches from various sources are applied to create new product for all stakeholders, including consumers (von Hippel et al., 2011; Lee et al., 2012). Many firms actively develop co-innovation communities to manage users as well as facilitate them to generate ideas about a new product or service (Bugshan, 2015), for example Dell IdeaStorm, Local Motors, etc.

In co-innovation communities, large numbers of members from decentralized places participate and contribute to the NPD process without meeting each other. They behave freely and voluntarily. They development the product through submitting designs,

offering solutions, discussing ideas, further elaborating and testing them, meanwhile they communicate and build relationships (Füller et al., 2007). The co-innovation process is outlined as: With the product ideas being revealed through internet platform, great number of voluntary designers participate in the design, communicate and cooperate with other designers, as well as share ideas and results to accomplish the product (Zhang et al., 2014). The operation and success of NPD process depend on the users' participation, solutions, and communication (Sawhney and Prandelli, 2000; Füller, 2010). To understand how they lead to product innovation, a better understanding of user behaviors, roles, and contributions in the NPD process is necessary.

Participants display different characters and make different contributions in collaboration design process inside or among firms. The design team consists of individuals from different domains and they act as different roles, such as organizational boundary spanning roles, task boundary spanning roles, discipline boundary spanning roles, and personal boundary spanning roles, as well as roles that span multiple boundaries (Sonnenwald, 1996). In user participatory design, participants have various roles: interactive role, group-oriented role, task-oriented role or production role (Barcellini et al., 2015). Similarly, users act as distinct roles during the NPD process in co-innovation communities (Romero and

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Molina, 2011). In addition, user roles vary at different stages of product lifecycles. The roles vary from trendsetters in idea generation stage to innovation facilitators in product development and testing stage, and information disseminators in market launch and profit management stage (Kim et al., 2008). Related researches mainly focus on the entire community (e.g. open source software communities, open-content communities, innovation-contest communities) (David and Shapiro, 2008; Barcellini et al., 2014; Arazy and Nov 2010; Füller et al., 2014), but seldom look into the product development process in the community. And little is known concerning participants' roles and contributions in the NPD process.

Participatory ergonomics focusing on design activities have emphasized the need to involve the potential users of the product under design in the design processes (Vink et al., 2008; Rocha et al., 2015). Participatory ergonomics employs tools (paper prototyping, work groups, and simulations) for people to articulate their tacit knowledge (Hall-Andersen and Broberg, 2014). Recently, some digital technologies are also included, such as digital kiosk (Mackrill et al., 2017), augmented reality and virtual environment prototypes (Aromaa and Väänänen, 2016), and online communities (Lockton et al., 2010). To analyze user behaviors in co-innovation process is particularly relevant in participatory forms of design. The objective of this paper is to identify user roles and contributions during the NPD process in open environment. The question in focus is: what users do during the process and how do they contribute to the project. This objective requires us to develop multiunit methodologies to analyze user roles and contributions based on their behaviors. In this analysis, content analysis, social network analysis (SNA), and cluster method are employed. First, user relationship is measured and user social network attributes are defined with SNA. Second, combined with user's creation number and social network attributes, cluster method is used to classify user roles. Third, we employ content analysis to explain the contribution quality of different user roles and identify the contribution form and quality to the product process.

This paper is structured as follows. In the next section, we introduce the technical approaches used in this study. In the following section, we give a brief overview of the research material and methods, after which we describe the analysis process and the results. In the section thereafter, the findings of the study are discussed, and finally we finish this study by presenting the conclusions.

2. Techniques and measurements for user analysis

2.1. Multiunit methodologies

The main methodologies used for identifying user roles in community include content analysis and SNA. Content analysis emphasizes user behaviors to the product. This method distinguishes user roles based on user action features, such as participation volume and frequency (Füller et al., 2007), behaviors and advancement (Jensen and Scacchi, 2007), decision-making power and technical capabilities (Hedberg and Iivari, 2009; Bach and Twidale, 2010), action forms (Liao et al., 2008), action temporal duration (Bayus, 2013), user interests and inclination (Nakakoji et al., 2002; Arazy and Nov 2010), as well as user actions at different stages of product innovation process (Kim et al., 2008; Romero and Molina, 2011). SNA is a common method used in sociological research to distinguish positions and roles based on ties and relationships (Borgatti et al., 2009). In user community analysis, SNA focuses on user statuses in user network and their interaction relationships (Cross et al., 2006; Fuge et al., 2014). Number of relationships, user involvement level, and user ties are

the basis to distinguish user types (Tang and Yang, 2005; Toral et al., 2010).

During the NPD process in co-innovation community, users design the product together by submitting solutions, discussing ideas, and testing them. On the other hand, they communicate and build social relations. In this study, we stress that the way how design solutions are collaboratively developed and the way how users communicate are with same importance. Content analysis and SNA are combined to identify user roles. The content analysis is used to measure user efforts to the product design and the SNA is used to locate their position in the social network structured by users involved in the project.

2.2. User characterizing profiles

The profiles are captured to describe a participant in terms of his/her behavior (Barcellini et al., 2014). Content-related measurements (e.g., behavior, ideas number, and comment) and relational measurements (e.g., centrality, in-degree, out-degree, and structure) are both needed in the complementary methods (Füller et al., 2014; Barcellini et al., 2014). In this study, we take creation number, population degree, and influence degree as user behaviors measurements. The former represents one's actions on product design and the latter two represent one's social property. By using these particular criteria, we could character user's efforts to the product and status in the user relation network. In order to evaluate how the users differ in contributions, we capture the contribution forms and contribution quality.

3. Material and methods

3.1. Research setting

Case study enables researcher to investigate causes and relationships in greater details and over a longer period time, as well as integrate different viewpoints and explanations (Eisenhardt, 1989). In this paper, the case study helps to analyze user roles and contributions with large number of data from particular co-innovation community and get an intuitive conclusion.

The research setting of this study is a co-innovation project in Local Motors community,[1] an international and highly successful community adopting co-creation to bring hardware innovations to market. All businesses of Local Motors are promoted online and open to users who are interested in vehicles creation. The community gathers over 52.2 k community members, collaborating on 6.1 k designs and 2.1 k ideas across 87 projects. LM SF-01,[2] one of the most popular projects in the community, is chosen as the research object because: 1) large numbers of users from all over the word participate in the project; 2) user behaviors during the project process are recorded. The project starts on July 1, 2014 and aims at building a vehicle platform under requirements of users.

3.2. Data collection

In Local Motors community, the web page of a project lists all the actions users did in a chronological order. The contents of an action contain who, when, did what, in which activity and the detail. We have been following the project from the beginning and directly copy all the necessary data by web mining. Local Motors is a public community. The data we collect is open to all users and doesn't contain personal information. So there is no research ethics

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[1] https://localmotors.com/.

[2] https://launchforth.io/localmotors/lm-sf-01/latest/.