Collective Innovation: The Known and the Unknown

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1. INTRODUCTION

Open innovation, the innovation model characterized by permeable firm boundary for innovations is gaining popularity [Chesbrough 2003]. In this model, a company commercializes both its own ideas and outside ideas. The accessibility to a larger pool of sources of innovations increases the chance of successful innovations. Within open innovation paradigm, a company can obtain innovative ideas either from other firms, or from a crowd. The latter approach is here referred to as collective innovation [Kozinets et al. 2008]. Collective innovation is at the intersection of open innovation and collective intelligence. With the increasing adoption of information and communications technology (ICT), collective innovation becomes increasingly popular. However, there are few reviews for this topic ([Majchrzak and Malhotra 2013] is an exception which takes an information systems perspective). This abstract summarizes a revised version of a literature review on collective innovation [Wang 2013].

2. THE KNOWN

Different aspects of collective innovation are reviewed, including its typology, mechanisms, tools, motivation of the crowd, and the performance.

2.1. Typology

There are five types of collective innovation that can be found from the literature: contests, collaborative communities, complementors, labor markets, and games [Boudreau and Lakhani 2013, Yu et al. 2012]. Contests are very useful for defined open-ended problems and therefore a popular way for innovation. Collaborative communities, exemplified by open source software communities, provide access to a large number of diverse contributors and allow rich collaboration. Complementors, such as app developers, provide innovations that complement a firm’s products [Boudreau and Lakhani 2013]. Labor markets can be used for human computation and potentially innovative work. There are also games designed to facilitate scientific discovery. For example, an online game, Foldit, was developed to help generating candidate protein folding structures [Cooper et al. 2010]. It is possible that games are designed for helping firms to innovate.

2.2. Mechanisms

One common application of collective innovation is product innovation. Sawhney et al. [2005] identified different collaborative mechanisms for customer engagement in product innovation. Product innovation is usually conceptualized as a five-stage process: ideation, concept development, product design, product testing and production introduction [Sawhney et al. 2005]. The first two stages are considered as front-end, while product design and testing are considered as back-end. The other dimension is about the trade-off between reach and richness in the interactions. Four types of mechanisms are consequently identified. Specifically, mechanisms for front-end stages with high richness in interactions include suggestion box, advisory panels, virtual communities and web-based idea markets. Approaches to have input from broad audiences in front-end stages are online survey, market intelligence services, web-based conjoint analysis. Online environment can also allow customers to be deeply involved in later stages of product innovation (back-end). For example, there are toolkits for customers to design circuits and games. There are also open-source mechanisms allowing many participants to collaboratively develop new products. Mechanisms for back-end stages with high customer reach include mass customization of the product, web-based prototyping, virtual product testing and virtual market testing. Clearly the Internet provides various ways to involve the collective wisdom of customers and multiple mechanisms can be adopted in a synergistic way [Sawhney et al. 2005].

Another mechanism for collective innovation is idea competition. Ebner et al. [2009] studied an idea competition for an ERP software company and found that the key success factor is to involve all the
stakeholders at a very early stage of the development of the competition. The stakeholders in the study include the organizer, its R&D department, Human Resource department, and competition participants etc. Involving these stakeholders in the early stage of competition development helps ensure that these stakeholders are adequately motivated. The authors further suggest that targeting an already existing virtual community is very helpful for idea competition.

It is also possible to get creative ideas from labor markets such as Amazon Mechanical Turk. Some mechanisms have been developed to facilitate collaborative creation, such as CrowdForge [Kittur et al. 2011] and evolutionary collective design [Yu and Nickerson 2011]. These approaches show the promise of completing complex creative tasks by crowd.

2.3. Motivation of the Crowd
Various intrinsic and extrinsic motivations are behind crowd’s participation in collective innovation. According to self-determination theory, intrinsic motivation is affected by the degree to which the basic needs for autonomy, competence and relatedness are supported [Deci and Ryan 2008]. Based on this categorization, a set of motivating factors are collected in Table 1. In designing a collective innovation project, these motivations need to be considered and addressed to promote wide participation.

<table>
<thead>
<tr>
<th>Motivation Type</th>
<th>Motivation to Participate</th>
<th>References</th>
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<tbody>
<tr>
<td>Extrinsic</td>
<td>Payment</td>
<td>Frey et al. 2011</td>
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<td></td>
<td>Recognition from peers and firms</td>
<td>Leimeister et al. 2009</td>
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<td></td>
<td>Career potential</td>
<td>Frey et al. 2011</td>
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<tr>
<td></td>
<td>Increase one’s status within a community</td>
<td>Frey et al. 2011</td>
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<tr>
<td>Autonomy-related</td>
<td>Enjoyment</td>
<td>Frey et al. 2011</td>
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<tr>
<td></td>
<td>Sense of ownership and control over work</td>
<td>Von Hippel and von Krogh 2003</td>
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<td></td>
<td>Opportunity to express individual creativity</td>
<td>Roberts et al. 2006</td>
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<td>Benefit from using the innovation</td>
<td>Frey et al. 2011</td>
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<tr>
<td>Competence-related</td>
<td>Learning</td>
<td>Leimeister et al. 2009</td>
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<tr>
<td>Relatedness-related</td>
<td>Sense of efficacy</td>
<td>Antikainen et al. 2010</td>
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<td></td>
<td>Altruism</td>
<td>Frey et al. 2011</td>
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<td></td>
<td>Desire to find friends with similar interest</td>
<td>Frey et al. 2011</td>
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<td></td>
<td>Desire to feel affiliated with a community</td>
<td>Frey et al. 2011</td>
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<tr>
<td></td>
<td>Reciprocity</td>
<td>Antikainen et al. 2010</td>
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2.4. Tools for Collective Innovation
A variety of software tools have been developed to support innovation from the crowd, including the tools for user innovation [von Hippel 2001], a tool for improving design creativity by using associations of words and images [Nakakoji et al. 2000], a tool using information aggregation markets for generating and evaluating new ideas [Bothos et al. 2009] and a tool, called InnoTube, for connecting people through social network ties and showcasing ideas for collaborative innovation[Angehrn et al. 2009]. Among these tools, the most studied are those for user innovation, which are often adopted to address complex, diverse customer needs and to promote customization. In user innovation, manufacturers can provide "user toolkits for innovation" and outsource need-related innovation tasks to users [von Hippel 2001]. An example of such an approach is in integrated circuit (IC) design and manufacturing industry where firms provide design software to customers so that customers design their own IC.

2.5. Performance of Collective Innovation
The performance of collective innovation is gaining attention from management researchers. Research on performance of collective innovation as a whole focuses on company sponsored ones and typically measures
There are also studies focused on individual performances in collective innovation. Frey et al. [2011] found that in crowdsourcing innovation tasks extrinsic motivation for monetary rewards is positively related to non-substantial contributions and intrinsic enjoyment is positively related to more substantial contributions. In addition, the most valuable contributions are from those who have high level of intrinsic enjoyment and knowledge in diverse domains [Frey et al. 2011]. These results suggest that attracting knowledgeable people and appealing to intrinsic interest are important in designing collective innovation platform. Bayus [2013] studied Dell’s IdeaStorm online community and found that serial ideators are more likely to contribute ideas worth implementing than customers with only one idea. However, once their ideas are implemented, these serial ideators tend to fixate, which reduces the chance of further success. This negative effect of past success is smaller for ideators who comment on diverse categories of ideas from others. In a study that focuses on an online community for 3D printing designs, designs that borrow elements from other designs are more often liked and printed [Kyriakou et al. 2012]. This result is consistent with the notion that collective exploration is better than independent exploration due to the diffusion of good solutions [Mason and Watts 2012].

3. THE UNKNOWN

The phenomenon of collective innovation has led to a set of theoretical questions. As Bogers et al. [2010] point out, it is unclear how user innovation impacts the knowledge boundary of a firm. Pushing this question further, how does collective innovation affect the boundary, or even the definition, of an organization? Would a new form of organization emerge? How does collective innovation impact entrepreneurship? Would a new form of entrepreneurship become significant, or even outperform the traditional entrepreneurship?

Second, on the practical side, researchers may try to explore new mechanisms for collective innovation. Currently there are two major approaches for collective innovation: tournament-based and collaboration-based [Afuah and Tucci 2012]. Tournament-based approach induces competition and incentivizes people by extrinsic rewards while collaboration-based approach can tap into the synergy of diverse expertise. Are there conditions under which one approach is preferable? Can we combine these two approaches for better outcome? What kind of mixed approach is optimal? Majchrzak and Malhotra [2013] further articulated three challenges for crowd collaboration: tension between competition and collaboration, insufficient time-spending by individuals, and lack of condition for creative abrasions. In addition, Kittur and colleagues [2013] identified many technical aspects where research is still to be done, such as workflow and hierarchy design, the collaboration between artificial intelligence and crowd etc.

Another promising approach for collective innovation is to take advantage of existing social media, such as Facebook and Twitter [Wagner and Jiang 2012]. Wagner and Jiang [2012] propose that people can analyze the searching, blogging and browsing in social media to identify problems or needs and to collect and evaluate ideas. How does this approach compare with traditional R&D in terms of effectiveness? In addition, there are some practical issues to investigate, e.g., how to filter the noise in social media to get meaningful input, how to motivate people in social media for innovative effort, and how to keep proprietary information confidential etc. [Wagner and Jiang 2012]. Answering all these practical research questions would help firms better use collective innovation.

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REFERENCES


