Journal of Global Information Management
Volume 28 • Issue 1 • January-March 2020

Effect of User Involvement in Supply Chain Cloud Innovation:
A Game Theoretical Model and Analysis

Yun Chen, School of Management, Wuhan University of Technology, Wuhan, China
Lian Duan, Hofstra University, Hempstead, USA
Weiyong Zhang, Old Dominion University, Norfolk, USA

ABSTRACT

Cloud innovation has become increasingly important to supply chain innovation and performance. User involvement is a crucial part of cloud innovation. However, the effect of user involvement in supply chain cloud innovation has not been thoroughly studied, particularly its effect on product cost and optimal price. In this paper, the authors attempted to bridge this major gap in the literature. The authors reviewed the relevant literature to define cloud innovation and user involvement in supply chain cloud innovation. Then the authors developed a game model based on the Bertrand model. Analysis of the model showed that user involvement affects product cost and optimal pricing in an interesting way. The authors also presented a real-life example of how user innovation takes place at Tailg electric vehicle company.

KEYWORDS

Bertrand Model, Cloud Innovation, Game Theoretical Model, User Involvement

INTRODUCTION

Firms today operate in a highly competitive global market. Supply chain performance excellence is crucial to business success. No wonder firms are always interested in methods that can lead to reduced cost and response time, and improved service level. Among all choices, innovation has proven its effectiveness in improving supply chain performance. Innovation leads to creative new products, or more efficient production processes. Through innovation, firms can establish and maintain a formidable competitive advantage. Therefore, it is not surprising that firms are highly interested in mechanisms that enables effective innovation.

Advancement of modern technologies has significantly changed how the innovation game is played. In the past, innovation was largely an intra-enterprise matter because information sharing across organizational boundaries was not easy and expensive (Guo et al 2012; Xu 2007, 2016). The advancement of technology, particularly the Internet and communications technologies, has completely changed the competitive landscape. Modern technologies enable ubiquitous and pervasive access to computing resources across geographical boundaries. Collaboration among supply chain players is no longer a difficult endeavor. Many studies have proven that technology advancement is positively associated with substantial supply chain performance improvement (Peruzzini & Stjepandić, 2017; Estorilio, Rodrigues, Canciglieri, & Hatakeyama, 2017; Achi, Salinesi, & Viscusi, 2016).

DOI: 10.4018/JGIM.2020010102
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Recently, new technology such as cloud computing has contributed to the success of cloud innovation. Through cloud computing, multiple parties of a supply chain can easily work with each other on innovation projects. Ideas, information, and resources are seamlessly shared on a cloud computing platform. Compared to traditional innovation activities, information exchange in cloud innovation is much faster and direct. Therefore, innovation efforts will be directed more toward customer needs but not wasted on ideas that are not supported by customers. In short, cloud innovation increases the success rate of innovation.

User innovation is a term that specifically refers to end users' involvement in supply chain cloud innovation. As cloud computing technologies gain popularity, user innovation has increasingly become the main content of cloud innovation. Through cloud computing platforms, massive number of end users can be easily recruited to engage in innovation. A massive involvement of end users means exposing many hidden improvement opportunities in a supply chain (Nikander 2017; Alyahya et al 2016; Wei et al 2017). For example, through a user community, end users can directly provide feedback to a product manufacturer. In many cases, they can even directly offer numerous innovation ideas such as what product features are needed. Reaching a large number of users to collect feedback used to be a daunting task. Moreover, such innovation ideas are not limited to products, but also extend to processes. Directed innovation effort undoubtedly will lead to better satisfied customers and more efficient supply chain operations.

While the literature has recognized the positive impact cloud innovation has on supply chain performance, surprisingly, the effect of user involvement in supply chain cloud innovation has not been carefully quantified. In this research, we attempt to bridge this major gap in the literature. Specifically, we adopt a game theoretical modeling approach to quantify the effect of user involvement on product cost and optimal price (price that leads to maximum profit). To the best of our knowledge, this is one of the first quantitative studies. Results from this study hence potentially can make a significant contribution to the literature and practices.

This paper is organized as follows. The next section provides the background of cloud innovation as well as reviews the literature on user involvement in supply chain cloud innovation. Then we develop and analyze game models based on the Bertrand model. We conclude the paper with a discussion of the results obtained. We also suggest some future research directions.

CLOUD INNOVATION: BACKGROUND AND LITERATURE

Cloud Innovation: Concept and Examples

Cloud innovation originates but differs from cloud computing. Cloud computing means ubiquitous access to shared pools of configurable computing resources, while cloud innovation is about leveraging cloud computing to engage multiple parties in innovation. Cloud innovation is based on a variety of Internet technologies, including Internet of Things (IoT), cloud computing, and e-commerce. Utilizing these technologies, cloud innovation can quickly absorb, gather, and accumulate both internal and external resources, knowledge, and technological achievements for innovation (Cai et al. 2014; Li et al. 2013; Xiao et al. 2014; Xu et al, 2014). Integration of resources many times lead to great innovations. In a supply chain setting, cloud innovation means users can integrate both upstream and downstream resources and collaborate on innovation activities throughout supply chain nodes. As a result, innovation performance of the whole supply chain can be significantly improved.

Cloud innovation becomes increasingly popular in recent years, owing much to the fast development of cloud computing technologies. Advancement of cloud computing technologies has facilitated efficient communications and collaboration across companies (Bendre and Thool 2016; Jiang et al 2014; Tao et al 2014a,b; Xu 2011; Xu et al 2014; Zheng et al 2014a, 2014b). IBM's "jam" program, launched in 2006, is probably the earliest successful example of cloud innovation. Apple's App Store is another example of cloud innovation, through which Apple and third-party developers

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