Two Dilemmas and One Trap with Open Innovation

Takeaki WADA

Abstract: In closed innovation (CI), each firm does R&D on its own; however, on the other hand, in open innovation (OI), companies use knowledge from external sources when necessary or let other firms use their proprietary technologies. Chesbrough (2003) pointed out the effectiveness of OI. OI is accompanied by (1) outsourcing dilemma that prevents a firm from getting a competitive advantage when rival firms can also gain the knowledge from same external sources, (2) integrator’s dilemma, which occur when firms sell parts to assemblers that produce and sell the same product, thus becoming formidable rivals, and (3) modularity trap, whereby when it is necessary to redesign the total product structure due to radical product innovations, the firm which selected open modular architecture and OI cannot respond because knowledge has dispersed among firms. OI is not necessarily the most efficient choice when these dilemmas or traps exist.

Keywords: open innovation, outsourcing dilemma, integrator’s dilemma, modularity trap

a) Faculty of Commerce, Fukuoka University, 8-19-1 Nanakuma, Jonan-ku, Fukuoka, Japan, twada@fukuoka-u.ac.jp
A version of this paper was presented at the ABAS Conference 2020 Summer (Wada, 2020).
© 2020 Takeaki Wada. This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.
Introduction

Chesbrough (2003) points out the effectiveness of open innovation (OI). Comparison with closed innovation (CI), in which each firm conducts R&D on its own, OI can add to the firm’s performance by combining internal and external knowledge, for example, using knowledge from external sources when necessary or promoting other firms to use their proprietary technologies.

Although Chesbrough (2003) showed the effectiveness of OI in the high-tech industry, it was also pointed out that OI is not always effective in the high-tech industry or in industries with similar circumstances. This paper discusses the outsourcing dilemma of Takeishi (2003), the integrator’s dilemma of Sakakibara (2005), and the modularity trap of Kusunoki and Chesbrough (2001), and further proposes some issues that will have to be resolved for OI to function effectively.

Outsourcing Dilemma Associated with OI

Chapter 5 of Chesbrough (2003) discusses the case of IBM. In this case, IBM’s mainframe business conducted its product development through CI, developing all the parts, assembly, and software itself. Subsequently, IBM used Internet technology that had been developed externally to enter the solutions business, and thus, it was OI-based product development using external knowledge. Juxtaposing these two points, Chesbrough regards this as a successful case of transitioning from a CI paradigm to an OI paradigm.

Although it was not mentioned in the case of IBM in Chapter 5, IBM’s PC business actually started between the era of the mainframe business and the era of the solutions business. IBM’s PC business is referred to in the discussion of the company’s business model in
Chapter 4, which regards IBM’s PC business as being open, while that of Xerox as closed. Gawer and Cusumano (2002) pointed out that by using Microsoft’s operating system and Intel’s CPU and outsourcing them, IBM could not prevent the emergence of PC/AT compatibles, and as a result, lost its key industry position. Chesbrough (2003) cites Gawer and Cusumano and opines that while this was detrimental to IBM, the upshot was that IBM altered the closed business model of its mainframe business. Chapter 5 of Chesbrough concludes that IBM’s case shows OI’s effectiveness, wherein the positive advantages of OI were strong, excluding a single case of failure.

Prior management studies have asserted that if another firm has better capabilities, outsourcing of R&D for parts and technology can have a major impact on a product’s performance, which, in turn, can increase the product’s value. However, we need to bear in mind that these studies have indicated that the following problems can occur.

(a) Using parts or technologies that are easy to purchase in market is linked to a decline in a product’s competitiveness, as the product becomes less rare and its imitability goes up (Barney, 1997).
(b) If a part or technology is essential, the bargaining power of suppliers will increase and the product will be deprived of most of its added value (Porter, 1980).
(c) Innovations that change the product’s overall structure will be inhibited (Kusunoki & Chesbrough, 2001; Shintaku, 1994).

As Takeishi (2003) proposes with respect to outsourcing dilemma, there are both positive and negative aspects to utilizing external knowledge through outsourcing, as in OI. Neither case studies nor theories can determine whether CI or OI with outsourcing is more efficient.

Overcoming the outsourcing dilemma requires that (i) the firm
produces in-house parts that have the most impact on the quality of the final product or that (ii) in the case of a product assembled with parts procured from external sources, the product should be enhanced with internal resources such as design capabilities and/or production know-how that increases its value (Takeishi, 2003).

**Integrator’s Dilemma Associated with OI**

In discussing the case of IBM, Chesbrough (2003) mentions that IBM decided to supply other firms with its hard disks for laptop PC, and this is regarded as an OI success story of providing technology to external firms. Although selling parts to external firms makes it more difficult to differentiate a firm’s products from the products of other firms that are using its parts, Chesbrough points out that economies of scale in parts manufacturing outweigh the demerit.

To counter this assumption, we present the case of Japanese watch makers selling parts to external firms as evidence to the contrary. Seiko Epson and Citizen Watch among others in the watch industry sell watch movements\(^1\) to other firms. By using these movements, Chinese assemblers can make cheap watches that have the exact same degree of precision as products made by Seiko Epson and Citizen Watch, so that they have become formidable rivals to those two Japanese companies. Moreover, the movement business has become commoditized and profitability has declined as a result of mass production, mass marketing, and price competition between Seiko Epson and Citizen Watch (Sakakibara, 2005). In response, Seiko Epson has moved from OI to CI by developing a movement that uses proprietary technology known as a spring drive, which is being used exclusively in its high-end watch models.

Sakakibara (2005) argues that for assemblers involved in

---

\(^1\) This device drives the hands on an analog watch, and the performance of this part is linked with the watch’s precision.
producing parts and assembling finished goods, selling parts externally has both merits and demerits, which presents an *integrator’s dilemma*. Like OI that employs outsourcing, OI that sells parts to external firms does not necessarily improve a firm’s competitive advantage or its performance.

For OI to increase profits by selling parts to outside firms, there needs to be additional conditions, such as manufacturing competitive parts that cannot be imitated by other companies, or acquiring the de facto standard.

**Modularity Trap with OI**

Chesbrough (2003) holds that the shift to OI will continue as integral architecture changes over to modular architecture and as external outsourcing and sales of modules become possible.

However, Kusunoki and Chesbrough (2001) points out that a virtual organization that uses modular architecture to divide work among multiple firms will fall into a *modularity trap* as it will be difficult for the organization to come up with innovations that redesign the product’s overall structure. Kusunoki and Chesbrough use the example of the hard disk industry. In this industry, vertical disintegration and specialization of manufacturers of magnetic heads and other components were progressed. IBM created new innovations for magnetic heads; however, this necessitated changing the method for correcting errors in the signals for reading and writing on the disk, which is the media, and these adjustments had to be coordinated with the media, firmware, and other components. There occurred a *modularity trap* that this problem could not be solved because knowledge was dispersed due to specialization among companies. The solution was a shift to integral architecture, which integrates all related technologies within a firm for overall optimization, thereby translating that there was a shift from OI to CI.
When a *modularity trap* occurs, CI integrates knowledge internally or builds a close cooperation between the assembler and each component manufacturer, and redesigns the entire product. In other words, Chesbrough himself says that sometimes dividing and combining the knowledge of multiple companies for OI can impede innovation.

Kusunoki and Chesbrough (2001) points out a dynamic shift of product architecture that alternates between times when integral architecture and modular architecture are effective. In dealing with this dynamic shift, CI is effective when there has been a shift toward integral architecture and the total product innovation is required, so that vertical integration or close collaboration and coordination among firms is efficient. Subsequently, OI becomes effective when there is a shift toward modular architecture when vertical disintegration occurs, which enables innovations that are specialized for each part. However, the analysis in Chesbrough (2003) is incomplete in displaying the effectiveness of OI as it focuses on vertically-integrated firms and only analyzes shifts from CI to OI.

Premised on a dynamic shift of product architecture, companies that have been successful with OI in modular architecture are also required to encompass the capability to escape from the *modularity trap*, such as moving toward vertical integration or building close collaboration between companies, for redesigning the entire product (Nakagawa, 2006; Wi, 2002). If companies do not possess this capability, even if they have been temporarily successful with OI, they will lose their competitive advantage when the shift to integral architecture occurs.

**Discussion**

Beside issues posed by these two dilemmas and one trap, it can also be pointed out that there is a problem with the analysis unit in
Chesbrough (2003). Vanhaverbeke (2006) points out that the unit of analysis for OI is the firm and the discussion on OI emphasizes close ties and a network among firms. If an innovation involves the participation of several firms, even if capital ties and personnel exchanges will exist among those firms, or product development occurs through integral architecture that involves close coordination, this will be considered OI, not CI.

Kusunoki and Chesbrough (2001) analyzed changes in patterns of innovation from the perspective of product architecture. This enabled the authors to look at substantive activities to ascertain parts that were being coordinated, the scope of integration of relevant knowledge, and changes in the scope of coordination in product development activities. On the other hand, Chesbrough (2003) analysis is based on firm, which is an institutional unit, and it is not possible to understand the activities in practice. It seems that this led to a surge in cases that were CI in substance but were classified as OI.

As pointed out in Takahashi (2014), the firm as an institution is merely the concept of a boundary or partition. To ascertain the scope of knowledge integration and the scope of coordination in product development activities, should we define whether they are CI or OI, depending on whether the participating firms are in close coordination on a set basis? In other words, it seems that innovations taking place internally in a transfirm organization theory in Takahashi’s study should be defined as CI and those that are not should be defined as OI.

Although they do not include the term “OI,” Kokuryou (1995, 1999) are Japanese studies discussing the merits of being open from the perspective of business networks. These studies define the formalized business relationships like those of the Japanese corporate keiretsu as 

2 "kakoikomigata" (closed-type) management. In contrast, open-type management is defined as a situation in which knowledge can be freely consolidated internally and externally via modularization.
Acknowledgments

This work was supported by JSPS Grant-in-Aid for Publication of Scientific Research Results, Grant Number JP16HP2004.

References

Barney, J. B. (1997). *Gaining and sustaining competitive advantage*. Reading, MA: Addison-Wesley.

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.

Gawer, A., & Cusumano, M. A. (2002). *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation*. Boston, MA: Harvard Business School Press.

Kokuryou, J. (1995). *Opun nettowaku keiei: Kigyou senryaku no shin chouryuu* [Open network management: New trend of corporate strategy]. Tokyo, Japan: Nihonkeizaishimbunsyya (in Japanese).

Kokuryou, J. (1999). *Opun akitekucya senryaku: Nettowaku jidai no kyoudou moderu* [Open architecture strategy: Collaboration model for network era]. Tokyo, Japan: Diamondsya (in Japanese).

Kusunoki, K., & Chesbrough, H. (2001). Seihin akitekucya no dainamiku shifuto: Bacyaru soshiki no otoshiana [Dynamic shift of product architecture: Trap of virtual organization]. In T. Fujimoto, A. Takeishi, & Y. Aoshima (Eds.), *Bijinesu akitekucya: Seihin, soshiki, purosusu no senryakuteki sekkei* [Business architecture: Strategic design of product, organization and process] (pp. 263–285). Tokyo, Japan: Yuhikaku (in Japanese).

Nakagawa, K. (2006). How do firms compete when faced with architectural changes?: Lessons from the optical storage media industry. *Annals of Business Administrative Science, 5*, 1–18. doi: 10.7880/abas.5.1

Porter, M. E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors*. New York, NY: Free Press.

Sakakibara, K. (2005). *Inobeisyon no syuuekika: Gijutsu keiei no kadai to...*
two dilemmas and one trap with open innovation

bunseki [Monetization of innovation: Issues and analysis of technology management]. Tokyo, Japan: Yuhikaku (in Japanese).
Shintaku, J. (1994). Nihon kigyou no kyousou senryaku: Seijuku sangyou no gijutsu tenkan to kigyou koudou [Competitive strategies of Japanese firms: De-maturity and competitive behavior in matured industries]. Tokyo, Japan: Yuhikaku (in Japanese).
Takahashi, N. (2014). Transfirm organization view. Annals of Business Administrative Science, 13, 31–46. doi: 10.7880/abas.13.31
Takeishi, A. (2003). Bungyou to kyougyou: Kyousou yuui no autososingu manezimento [The division of labor and competition: Outsourcing management of competences]. Tokyo, Japan: Yuhikaku (in Japanese).
Vanhaverbeke, W. (2006). The interorganizational context of open innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), Open innovation: Researching a new paradigm (pp. 205–219). Oxford, UK: Oxford University Press.
Wada, T. (2020, September). Overgeneralized impact of open innovation. Paper presented at ABAS Conference 2020 Summer, University of Tokyo, Japan.
Wi, J. H. (2002). Organization strategy of established firms to adapt to a change in product architecture: Dynamic management of sub units inside an organization. Annals of Business Administrative Science, 1, 9–16. doi: 10.7880/abas.1.9