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# Assessing the Impact of Open and Closed Knowledge Sourcing Approach on Innovation in Small and Medium Enterprises

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## Abstract

There is very limited research on open innovation in small and medium enterprises (SMEs). By drawing on complementarity theory and knowledge based theory, this study develops three hypotheses in order to identify the impact of knowledge sourcing approaches for innovation on SMEs' innovation performance. Surveys collected from 196 SMEs in Korea were analyzed to test the hypotheses by using supermodularity function. The results indicate no significant impact of external knowledge-oriented approach while positive impact of internal knowledge-oriented (i.e., closed approach) on innovation performance. Interestingly, this study finds that open innovation has significant negative impact on SMEs' innovation performance (i.e., both internal knowledge- and external knowledge-oriented approaches have a substitutive relationship). This study sheds new light on open innovation and knowledge management research by identifying the relationships between knowledge sourcing approaches for innovation and innovation performance in SMEs.

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## 1. Introduction

Over the past decades, open innovation defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand markets for external use of innovation, respectively” [1] has attracted a lot of attention from both academics and practitioners. The basic assumption of open innovation is that using external knowledge in conjunction with internal knowledge can increase firm performance in a rapidly changing environment. For example, Rass et al. [2] proposed that open innovation instruments positively affect firm performance through firm's social relations and networks.

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However, little research has demonstrated whether open innovation show better performance than closed innovation, despite the theoretical entrenchment of the idea that firms can use internal and external knowledge sources together. Some studies insisted that closed innovation which focuses on internal investment on R&D can increase firm performance by enabling firms to have an in-depth understanding of the strengths and weakness of its knowledge and capabilities [3-4]. Others pointed out that open innovation which focuses on combining internal and external knowledge sources can enhance firm performance by allowing firms have broader set of knowledge [5]. In order to fill these inconsistent results, many efforts have been made to investigate the conditions under which innovation approaches can be expected [6].

However, these studies have been largely performed for managers in large firms. There is very limited research on open innovation in small and medium enterprises (SMEs), although open innovation of SMEs is very important for their contribution to innovation in almost all economies. In addition, there is major differences between large and SMEs [7] and the need to adopt different innovation approaches [8]. Large variations exist between large firms and SMEs in terms of the resource that constrains a firm's ability to access, acquire, and use knowledge. Thus, viewing SMEs' innovation approaches as scaled-down versions of the innovation approaches found in larger firms is incorrect [9].

In order to explore the research gaps, this study examines how SMEs' innovation performance varies depending on knowledge sourcing approaches, defined as the extent to which an individual or organization intentionally accesses, acquires, and reuses knowledge from others such as expertise, experience, insights, and opinions [10]. For this purpose, this study first proposes three different approaches of innovation: internal knowledge-oriented, external knowledge-oriented, and open (i.e., combining internal knowledge- and external knowledge-oriented). This study then theoretically explores the positive or negative synergistic patterns in the strategic usage of knowledge sources and their impact on firm's innovation performance, by drawing on the complementarity theory from the economics literature [11].

## **2. Theoretical Background and Hypothesis Development**

### *2.1. Knowledge based theory*

Knowledge based theory (KBT) of the firm considers knowledge as the most strategically significant resource of the firm [12]. Its proponents argue that as knowledge-based resources are usually difficult to imitate and socially complex, these diverse knowledge bases and capabilities within the firms are the major determinants of sustained competitive advantage and superior firm performance [13]. Firms that are able to develop, manage and transfer this knowledge are more likely to gain sustained competitive advantage in the long run [12]. This knowledge is embedded and carried through multiple entities including organizational culture and identity, policies, routines, documents, systems, and employees [13].

A critical contribution of the KBT is the identification of two different knowledge sources for innovation: internal- and external-oriented [14]. The theory considers internal- and external-oriented sourcing as a distinct choice, thus the forces that motivate a firm toward internal-oriented knowledge sourcing may not be the same as those motivating it away from external-oriented knowledge sourcing [15]. Indeed, a substantial number of studies have discussed the relationships between knowledge sourcing and innovation performance based on internal- and external-oriented sourcing aspects. Therefore, the choice between internal-, external-oriented, or simultaneous sourcing (i.e., open innovation) becomes one of the firm's primary decisions [4].

### *2.2. Complementarity and substitutability theory*

Complementarity was formalized by the notion of supermodularity which was given by Topkis [16] and later expanded by Milgrom and Roberts [11]. The property of supermodularity in its ordinal form is narrowly

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