Chapter 77
Impact of ICT on Innovation: The Case of Japanese SMEs

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ABSTRACT

The innovation process in SMEs (small- and medium-sized enterprises) is complex and in comparison with large firms the causal relationships between promoting factors and innovation have yet not been sufficiently clarified. This chapter attempts to analyze the innovation process using Structural Equation Modeling, in particular focusing on the role of ICT. Seven hypotheses are demonstrated by two models. The results obtained are as follows: (i) top management participation and employee motivation in the innovation process enhance the effect of introducing ICT; (ii) the effect of ICT use raises innovation capability, in particular the ability to connect with external linkages; (iii) ICT use, innovation capability and external linkages enhance innovation activity; and (iv) the effect of ICT use and innovation capability promote innovation directly.

INTRODUCTION

To achieve innovation is essential for sustainable economic development in all economies. In Japan, SMEs (small- and medium-sized enterprises) were looked to as an important economic actor in the Reconstruction Japan Initiative decided by the Cabinet Office in July 2012, in which SMEs were expected to develop into global firms and to create employment opportunities in the region. In reality, on the other hand, SMEs have found themselves facing a severe situation due to the long stagnation. In this environment, only a few SMEs achieved a greater than average rate of profit (The Small and Medium Enterprise Agency, 2009). These SMEs have a number of common features such as strong leadership by

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top management, quick and flexible decision making, strategies for seeking niche markets, engineering craftsmanship, and effective use of ICT (Information and Communication Technology). Efficiency of the business process is improved by introducing and utilizing ICT. Introducing ICT is considered to be one type of process innovation which includes adopting new production methods and logistics. Moreover, information on customer needs and the market can be promptly obtained by using the Internet and social media, for example. In addition, since communication among employers and top management is activated and intramural knowledge management can be strengthened by ICT, all these lead to innovation (Dodgson, Gann, & Salter, 2006; Lee & Xia, 200; Idota, Bunno, & Tsuji, 2012a).

However, ICT is not the only factor driving innovation, since the innovation process is complex. In this analysis, innovation is categorized into the following four types according to the Oslo Manual (OECD & Eurostat, 2005); (i) product innovation (new products and services); (ii) process innovation (new production methods and new logistic methods); (iii) marketing innovation (changes in design, packaging, and production sites); and (iv) organizational innovation (business practices, workplace environment, and the relationship between the organizations both inside and outside the firm). Since both product and process innovation are created as a result of organizational innovation, and some marketing innovations include product and process innovation, this chapter discusses both kinds of innovation. Regarding the sources of innovation, on the other hand, based on the analysis of many previous studies, the authors' previous studies identified the following three key factors; (i) innovation capability, (ii) external linkages, and (iii) ICT use. The objectives of the paper are (i) to define the content of innovation capability of firms and (ii) to analyze how innovation sources contribute to innovative creation, in particular to examine the causal relationship between the three sources and innovation.

As shown below, although there has been ample research on innovation capability, fewer analyses have been conducted in the context of innovation capability and ICT. Moreover, little research focuses on the *causal* relationship between the above three sources and the final outcome of innovation. These problems have not been successfully clarified yet. Hence, this chapter attempts to analyze the causal relationship by employing Structural Equation Modeling (SEM).

BACKGROUND: PREVIOUS LITERATURE

Definition of Innovation

Schumpeter (1934) defined innovation as a process of "carrying out new combinations" (p. 47). This definition includes the following types of innovations: (i) introduction of a new good; (ii) introduction of a new method of production; (iii) opening of a new market; (iv) acquisition of a new source of supply of raw materials or intermediate goods; and (v) carrying out new organizational forms. The first is termed product innovation, while the others are referred to as process innovations. The Oslo Manual mentioned in the previous section categorized innovation in the similar way.

There are two ways to create product and process innovation; one is called closed innovation, which is achieved by one particular firm, while the other is known as open innovation, which is carried out by collaborating with other firms or organizations. To date, Japanese firms have successfully achieved innovation through "the independence principle," which implies that firms have been accumulating knowledge and knowhow for innovation within a limited number of firms such as their own firm or group firms. Japanese firms constructed industrial groups by connecting related firms vertically or horizontally