The Dynamics of Knowledge Spillover for Functionality Development in Japanese Acoustic Equipment Industry

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The purpose of this study is to demonstrate how Knowledge Spillover affects functionality development by an analysis of trends in the number of patent applications as proxy of technologies. We group acoustic equipment technologies, a speaker as a product, in Japan into two groups using International Patent Classification (IPC). We group Transducers as Basic Technology, and Components, Circuits and Diaphragms as Complementary Technology.

The result shows that, in the process of functionality development of a speaker, Basic Technology is first developed in order to have products working by focusing on structural technologies, and then Technological Knowledge is spilled over from Basic Technology to functional technologies indicated as Complementary Technology, especially Material Technologies.

Keywords: Innovation; Knowledge Spillover; Technology Knowledge

1. INTRODUCTION

It is important for companies to continuously produce valuable new technologies and, by assimilation of new skills, to create inventions and ideas which show their innovation capability. The Research and Development (R&D) efforts of companies, which lead to innovations, are essential for a company's growth and also for the growth of society itself.

A plethora of papers has been published discussing the usefulness of Knowledge Spillover as one of the foremost factors in encouraging the development of technological innovation. As Griliches (1979)[1] has mentioned, the level of productivity achieved by one firm or industry depends not only on its own R&D efforts but also on the general knowledge accessible by it, which includes Knowledge spilled over from other companies and industries.

In previous studies, patent data has been recognized as a useful indicator in quantitatively evaluating technological innovation (Griliches, 1990)[2]. A relation between Innovation and Knowledge Spillover is discussed by using patent data in many papers.

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In this study, we use patent data to analyze the relation between innovation and Knowledge Spillover among the technologies used in the manufacture of a product, and examine how Knowledge Spillover affects functionary development. We make use of the International Patent Classification (IPC) to group the technologies used in the creation of a product into Basic Technology and Complementary Technology. The purpose of this study is to propose a new scope of Knowledge Spillover between these technologies.

2. KNOWLEDGE SPILLOVER

2.1 In relation to Knowledge Spillover

We find three main points of view in previous papers in relation to Knowledge Spillover.

The first point is technological affinity. It is comparatively easy to obtain Knowledge from other companies which are working with similar technological systems, because it is assumed that these companies possess similar technological facilities and experiences. Companies working with similar technologies should be able to raise R&D productivity by referring to other companies' R&D result. (Jaffe, 1986[3]: Lee, 2006[4])

The second point concerns geographical distance between companies. Geographical distances relate to the ease of communication with other companies. Companies, which are located in a region close to one another, can easily make contact, so they have the advantage of prompt information exchanges. (Jaffe, Trajtenberg and Henderson, 1993[5]: Tappeiner, Hauser, and Walde, 2008[6])

The third feature is cultural differences. It is relatively easy for companies to cooperate with another company which shares a similar culture concerning management principles, business structure and language. A mutual understanding of culture could be the key for promotion of Knowledge Spillover.

In this paper, we focus on the technological affinity in analyzing Knowledge Spillover.

2.2 The new scope of Knowledge Spillover

Many previous papers have mainly discussed the Knowledge Spillover at the level of countries, industries, or companies. For instance, how the spillover effect among different foreign countries