How High-Technology Start-Up Firms May Overcome Direct and Indirect Network Externalities

Mark Pruett, George Mason University, USA
Hun Lee, George Mason University, USA
Ji-Ren Lee, National Taiwan University, Taiwan
Donald O’Neal, University of Illinois-Springfield, USA

ABSTRACT

This paper presents a conceptual model of strategic choice for high-technology start-up firms in the face of network externalities—the strength of the market’s preference for standardized technology. Our model suggests that the commercialization strategies followed by such a firm will depend on the type of network externalities—direct versus indirect—as well as the degree of appropriability—the firm’s ability to retain the value of innovation. We offer a number of propositions generated by the model and discuss their implications.

Keywords: network externalities, appropriability, high-technology start-ups

INTRODUCTION

A particularly vexing barrier for some start-up firms is how to overcome network externalities that may exist in their markets. Similarly, another hurdle for many start-up firms is how to appropriate value from an innovation. The model in this paper suggests that the distinction between direct and indirect network externalities, and the degree of appropriability, will determine whether the firm’s commercialization strategy focuses on internal resources and decision variables or on interactions with its competitive environment.

High-technology start-up firms may be particularly sensitive to network externalities and appropriability since many such firms are introducing products based on technologies for which there are yet no market standards for compatibility (Hill, 1997) and facing particularly uncertain appropriability conditions that affect their ability to grow and survive (Shane, 2001). Not all new technologies, and not all start-up firms, face network externalities or appropriability issues. For those that do, however, overcoming these barriers to commercialization is crucial as these barriers may influence the firm’s strategy for commercialization, growth, and survival.

This paper models strategic choice for start-up high-technology firms in the face of network externalities—the strength
of the market’s preference for standardized or compatible technology (Farrell & Saloner, 1985; Katz & Shapiro, 1985). It suggests that commercialization strategies will depend on appropriability—the firm’s ability to retain the value of an innovation (Arrow, 1962; Teece, 1986)—and the type of network externality—direct versus indirect. Following prior researchers (Katz & Shapiro, 1985; Kotabe, Sahay & Aulakh, 1996), direct network externalities refers to a direct relationship between the number of users of a product and the product’s quality or utility, while indirect network externalities refers to the indirect effects from the price and availability of goods and services that complement a product. The paper is rooted in streams of research from technology and innovation literature on how technologies become commercialized (Lee, O’Neal, Pruett & Thomas, 1995; Tushman & Rosenkopf, 1992), organization research on technological discontinuities (e.g., Anderson & Tushman, 1990; Tushman & Anderson, 1986; Tushman & Rosenkopf, 1992), and literature from strategy and economics focused on the impact of technological standards (e.g., Farrell & Saloner, 1987; Garud & Kumaraswamy, 1993; Hill, 1992, 1997; Katz & Shapiro, 1986; Majumdar & Venkataraman, 1998; McGrath & McGrath, 2000).

These streams have posed longstanding questions for researchers and for firms. How can standards be established? How can a new entrant compete? What roles do switching costs, first or second mover advantage, regulation, and intra-industry cooperation play? In competitive strategy, how can a firm profitably commercialize its own technology if the technology poses a network externality for customers and there is the potential for competition from other firms, either through imitation or through alternative technologies? In particular, our model suggests that direct network externalities will lead firms to pursue strategic choices centered on internally controllable decision variables. Indirect network externalities, on the other hand, will lead firms toward efforts to manage their competitive environment by cooperating with outside actors. In addition to theory-building, these questions also pose the need for additional work to empirically quantify the relationship between strategic choice, appropriability, and the two distinct forms of network externalities. The model developed in this paper offers a basis for subsequent empirical study.

**SIGNIFICANCE TO HIGH-TECHNOLOGY INDUSTRIES**

This topic is particularly significant in a global economy that is evolving rapidly in the area of so-called “high” technology, a term encompassing a variety of industries focused on newer technologies. The most prominent may be telecommunications and information technology (IT) hardware, software, and services. There are other significant areas as well that often are placed under the high-technology umbrella, including biotechnology, advanced manufacturing technologies, and advanced product technologies. These industries have moved to the forefront of business activity and change in the last decade, in part because of their impact on traditional economic sectors, but also
A Framework to Build Process Theories of Anticipatory Information and Communication Technology (ICT) Standardizing
[www.igi-global.com/article/framework-build-process-theories-anticipatory/2588?camid=4v1a](www.igi-global.com/article/framework-build-process-theories-anticipatory/2588?camid=4v1a)