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The development of university spin-offs: early dynamics of technology transfer and networking

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Abstract

Measuring the contributions of 'hi-tech' small firms by looking only at their product sales, innovation outputs and employment generation may understate their effectiveness. Another important contribution of entrepreneurship 'hi-tech' firms is their catalyzing role to knowledge creation and transfer in innovation networks. This paper addresses two exploratory research questions: how active in network development and technology transfer are university spin-offs during their early years to overcome initial disadvantages? Is there any relationship between early networks development and knowledge creation and technology transfer in university spin-offs? Using data from companies spun off from a Spanish university in the period 1990–2000, the empirical results suggest that technology transfer and networking at university spin-offs decreased after their early years but at the same time the relationships with customers increased.

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1. Introduction

A knowledge-based view of the firm is a contemporary approach to strategic management that guides attention toward the understanding of the organizational learning process and the management of a firm's knowledge base (Conner and Prahalad, 1996; Grant, 1996; Spender, 1996; Teece et al., 1997). The management of knowledge plays an outstanding role in any interdisciplinary theory of entrepreneurship (Ripsas, 1998), and in the development of technology-based companies. 'Hi-tech' small firms are a key element in the creation and transfer of knowledge. Measuring the effectiveness and contributions of 'hi-tech' small firms by looking only at their product sales, innovation outputs, and employment generation may understate their contribution. Although the traditional body of research on new 'hi-tech' firms and their regional impact overwhelmingly focuses on the growth of these firms, many empirical studies suggest that rapid organic growth is both rare and often even unwanted among new 'hi-tech' firms. For example,

Kamshad and Hay (1996) found that profitability, not growth, constituted the key managerial goal of small and medium-sized firms in the UK. Other studies show that new 'hi-tech' firms do not perceive rapid or even moderately rapid organic growth as a feasible way to develop their activities (Oakey, 1994).

Another important contribution of 'hi-tech' firms is their catalyzing role to technology and knowledge accumulation processes in innovation networks. Through the process of becoming embedded to local institutional and organizational design, 'hi-tech' firms start contributing to knowledge spillovers and technology accumulation processes. Then an important part of their economic contribution should be delivered through mechanisms other than direct organic growth. However, there are very few empirical studies which have analyzed the role of entrepreneurship and innovation networks on the dynamics of technology transfer during the early years of 'hi-tech' start-ups and none of those studies has analyzed university spin-offs.

The purpose of this paper is to study the evolution of the technology transfer practices used by university spin-offs during their early years and the influence of innovation networks on the dynamics of technology transfer. The paper is structured as follows: the next section reviews the literature on university spin-offs; the third

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section studies the technology transfer practices used by the surveyed spin-offs and the development of their innovation network; finally some concluding remarks are presented.

2. Academic spin-offs: features and propositions

2.1. *Technology-related spin-offs—state of the art*

An entrepreneurial spin-off arises when an entrepreneur leaves an organization to start a firm of her/his own. To be a spin-off, this must also include the transfer of some rights, e.g. knowledge, from the existing organization to the new firm. Spin-offs can be categorized depending on what organization they are spun off from, and on where the entrepreneur has gained her/his background experience. According to Oakey (1995), the two major sources of new technology-based firms are higher-education institutions (university spin-offs) and well-established industrial firms (corporate spin-offs). Although the two kinds of entrepreneurial spin-offs have a lot in common, there are considerable differences. For example, while a private company often tries to keep research and technology within the firm, a university often encourages the transfer of the results to be used outside the university.

From the existing literature, very few empirical studies of technology-related spin-offs have been made. Most studies deal with the background characteristics of spin-offs, including the spin-off entrepreneurial motivations (Chell et al., 1991; Autio and Kauranan, 1994; Martínez and Urbina, 1998). University spin-offs are founded primarily on the basis of some technological advance rather than on the presumption of competitive advantage in regard to marketing, sales or distribution. The founders are for the most part engineers and scientists, with some marketing/sales and business experience present in the multifounder teams. Not all university entrepreneurs have unique ideas and high need for achievement; some of them are initially merely pursuing more independence or are somewhat dissatisfied (Roberts, 1991). A comparison of founders' personal motives between spin-off and non-spin-off companies found that the motive of having the freedom to explore new ideas was more common than to test one's entrepreneurial ability (Dahlstrand, 1997).

Roberts and Malone (1996) identified four principal entities involved in the spin-off process: (1) the technology originator, the person or organization that brings the technology from basic research through the stages of the innovation-development process to the point at which the transfer of technology can begin, (2) the parent organization in which the R&D is conducted by the technology originator, (3) the entrepreneur(s) who take(s) the technology created by the originator (an

entrepreneur her/himself) and attempts to create a new business venture centered on the technology, and (4) the venture investor that provides funding for the new company in return for partial equity ownership or benefit-sales sharing in the new company.

On the other hand, Olofsson et al. (1987) and Roberts (1990) studied how spin-off companies changed business priorities over the first several years after founding toward more product-oriented businesses and away from consulting and R&D contracting. Their founders were initially primarily oriented toward engineering and technology, not sales and marketing, with evolution toward marketing occurring over time, if the firm survives. They also found that a multifounder firm showed a greater tendency toward both product and sales/marketing orientation initially, and also evolves more rapidly in both areas, than the single founder company.

Some other scholars have studied the relationship of entrepreneurial spin-off with the parent organization from which it originates. The importance of the parent organization in technology transfer has already been demonstrated by Roberts (1991) because that is where most of the 'hi-tech' entrepreneurs acquire the knowledge transferred to their own companies. Besides, there is a higher degree of technological transfer from the earlier employer to the spin-off than to the non-spin-offs, and the degree of technology transfer from the parent organization can be assumed to contribute indirectly to the development and higher growth of the spin-off (Roberts, 1991; Harmon et al., 1997).

Regarding the parent organization size, the literature reveals conflicting views of what size of organization creates the higher share of spin-offs. In some studies, the large organizations are argued to be more favourable to the formation of spin-offs (Granstrand and Alänge, 1995); in others the small organizations are found more likely to spin-off new firms (Cooper, 1984; Dorfman, 1993). Regarding the type of parent organization the literature offers more conclusive results: corporate spin-offs are far more frequent than university spin-offs (Cooper, 1984; Dahlstrand, 1997). But considering the vast difference in number of employees between industry and universities in most parts of the world, this result is not very surprising. If instead a relative measure of spin-offs per employee were used, the results might be rather different.

2.2. *Technology transfer, networking and spin-offs—research questions*

Technology transfer is the application of information into use, and involves a source of technology that possesses specialized technical skills, and the transmission to receptors who do not possess them and who cannot or do not want to create the technology themselves. Spin-offs are one, although not necessarily the most

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