

# Spin-off enterprises as a means of technology commercialisation in a transforming economy—Evidence from three universities in China

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## Abstract

Recently, some university spin-off firms have begun to substantially contribute to the technological upgrading of China's economy. The corresponding academic literature, however, does not yet deal with spin-off activities of Chinese universities in a comprehensive and theoretically sound way. Currently, most articles on Chinese spin-offs focus on case studies of the most prominent government-sponsored enterprises in Beijing. This paper aims to contribute to the literature in a more comprehensive manner by providing a theoretical discussion of spin-off formation in a developing and transforming economy, and by presenting results from a comparative study based on data from 82 interviews with spin-off enterprises in three metropolitan regions in China.

The study shows that under the initial framework conditions, government-driven spin-off formation has indeed proved an appropriate solution for technology transfer at Chinese universities. Many of the companies thus formed, however, suffer from defective incentive structures and lack of performance. Consequently, since lifting or easing restrictive regulations, the formerly unique model of Chinese spin-off formation has been complemented by a surge of entrepreneurial spin-off formation.

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## 1. Introduction

In the years following China's WTO accession in 2001, a number of articles focusing on the issue of university–industry cooperation and knowledge transfer in China have established a framework to analyse university–industry relations in China. The authors of these papers and books have concentrated on aspects like the transformation of the country's S&T system (Liu and White, 2001; Zhao and Guo, 2002; Sun, 2002), the commercialisation of university-generated knowledge (Baark, 2001; Liu and Jiang, 2001), the emergence of spin-off companies (Lu, 2001; Parker, 2002), or the establishment of high-tech parks (Walcott, 2002, 2003; Chen and Dai, 2003). Due to the fact that university–industry cooperation is a very

recent phenomenon, the empirical basis of these contributions has been limited. For example, Liu and Jiang (2001, p. 186) concluded that the environment for the commercialisation of knowledge through spin-off companies was going through dynamic changes that call for continuing theoretical advances and empirical testing.

This paper's aim is twofold. Firstly, it considers theoretical arguments that help to understand how China's university spin-off companies evolve and develop. Secondly, it analyses survey data from 82 spin-off companies in three locations in order to corroborate the main theoretical arguments.

## 2. Theoretical background: technology commercialisation outside industrially developed market economies

### 2.1. University–industry relations in developing economies

The industrial sector's demand for new knowledge and—strongly related to this—cooperation with universities differs in developed and developing economies. Companies

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in developed market economies compete with each other through the creation of new and better products and through improved product quality. Companies whose products are new to the world market enjoy a temporary monopoly that generates high profits. Once competitors join the market with similar products, profits decline and the pressure to invent a new product increases (Schumpeter, 1926; Kirzner, 1973). To generate these innovations they use human capital, i.e. highly skilled labour, as the main production factor. Due to large public and private investments in research and education, developed economies are relatively rich in human capital. In this context, universities are an important source of new and potentially product-related knowledge in developed economies (Gibbons et al., 1994). The opposite is true of developing countries where the largest part of the workforce remains unskilled. Consequently, companies in developing countries tend to use cheap, unskilled labour in their production processes and compete through low product prices.

The latter description of the factor endowment for a typical developing country holds true for China. Despite sizable efforts to modernise teaching and research and to upgrade the educational background of the country's workforce, China still faces shortages of human capital (Dahlman and Aubert, 2001, pp. 69–81). Unskilled labour, contrastingly, is abundant and the wages of unskilled workers are very low. These factor proportions affect Chinese companies' overall business strategies and their demand for new knowledge. In terms of profitability, the most promising approach for doing business in China is to focus on simple manufacturing tasks using little production technology and a lot of manpower. Chinese companies that follow this strategy and provide cheap products for export markets form the most dynamic segment of the country's economy (Lemoine and Ünal-Kesenci, 2004). The alternative strategy, employing skilled workers and investing in new product design and new production technology, has proven to be costly and to generate little return on investment (Liefner et al., 2006).

A direct consequence of this preference for low-tech production is a low overall demand for new knowledge in the Chinese industrial sector.

In response to this general pattern, the Chinese government is intent on improving the technological capabilities of the industrial sector, thus enabling it to develop new foreign markets in the future. Accordingly, it is interested in furthering the extension of research and innovation in industrial enterprises, as well as in the improvement of technology transfer from the university to the industrial sector (Dahlman and Aubert, 2001, pp. 107–137; Baark, 2001; Liu and Jiang, 2001).

The former policy results in public "innovation funds" for state-owned and other enterprises to upgrade the technical standards of their products. The latter policy results in the government urging universities to implement technology transfer to the industrial sector wherever possible.

The framework conditions for university–industry relations in the Chinese economy, in which the majority of companies are not interested, are therefore quite different from the situation in developed economies (cf. Su, 2000).

These substantial international differences have not yet been sufficiently reflected in the current literature on university–industry relations in general, and on spin-off activities in China in particular.

Usually, university–industry relations are discussed within the theoretical framework of *National (or Regional) Innovation Systems*. This concept is based on interactive models of innovation that stress the importance of cooperation between innovating firms and partnering organisations such as universities, banks, or business service providers (Kline and Rosenberg, 1986). Close interaction allows companies to acquire knowledge from partner organisations and to utilise it in the innovation process. It presupposes that the innovation it describes represents a radically new combination of knowledge, or a so-called "platform technology," that can be the basis for the future development of genuinely novel products and processes.

This concept provides a very suitable framework for developed countries. However, it is not very useful to analyse innovative activities in developing countries, since the latter do not usually create radical innovations. Instead, developing countries tend to adapt knowledge that has been developed in industrialised countries to their industrial sectors' absorptive capacity and local market demand (Viotti, 2002; Mathews, 2001). Drawing on this knowledge, they imitate, copy, or generate products that are technologically similar to existing ones in developed economies. The process of adapting and learning what has been invented elsewhere does not necessarily require close cooperation with organisations like universities or banks. The only requirement is a knowledge inflow from technologically advanced companies. Recognising these differences, Viotti (2002) calls the innovation systems of developing countries *National Learning Systems*.

In practice, however, the differences between innovation systems of developed economies and learning systems of developing economies may be smaller than theory implies. Asheim and Vang (2004) point out that metropolitan regions in developing countries may offer conditions for innovation and learning similar to industrialised countries. In the authors' view, this statement certainly holds true for the most developed cities in emerging nations such as Shanghai, Beijing, the Pearl River Delta, Delhi, Bombay, Bangkok, Sao Paulo, or Mexico City. As universities and research institutes in these cities are usually their respective nations' top institutes, human capital concentrates around them. This skilled workforce, in turn, attracts the respective countries' most technologically advanced companies. Firms in these regions may therefore find local conditions that not only allow for knowledge adoption and learning, but also for innovation.

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