

PL-1 (Plenary)

**Start-Up Companies, University-Industry Relations, and
Emerging High-Tech Markets: Implementing the New Innovation
Systems of the 21st Century**

Richard B. Dasher

Stanford University, US-Asia Technology Management Center <and> Center for Integrated Systems
420 Via Palou Mall, Stanford, CA 94305-4070, USA
Phone: +1-650-725-3621 Fax: +1-650-725-9974 E-mail: rdasher@stanford.edu

1. Introduction

“Innovation” refers to processes that lead from the discovery or creation of a new idea or technology to its practical implementation. The early stages of an instance of innovation involve scientific research, in which the chief concerns are theory in an academic field or other discovery whose potential for real-world application is typically unknown. At its later stages, innovation involves engineering development, e.g. improvements in existing designs or manufacturing processes, that is necessary to bring a specific new product or technology to practical use (often via commercialization). Early and late stage innovation activities thus draw on the interests and skills of different groups of people and different types of organizations, and so almost all instances of innovation include a transfer of technology across organizational boundaries. “Innovation system” refers to the groups and organizations that participate in a path of innovation, and to the dynamics of the relationships that these groups have with each other and with their surrounding context.

This presentation examines the role of start-up companies (sometimes called “venture businesses”) in innovation systems involving technology transfer between university and industry. Christensen (1997) has argued that start-up companies are uniquely capable of bearing the risks both of a new, emerging technology and a new, emerging market. Accordingly, this presentation holds that start-up companies will comprise an increasingly important channel of technology transfer

between university and industry as innovation systems evolve to keep up with rapidly changing technologies and markets. Nevertheless, start-up companies present challenges for traditional patterns of university-industry interaction, even in the U.S., and so this presentation discusses some best practices and pitfalls to avoid in implementing this new type of university-industry innovation system.

2. University-Industry Innovation Systems in the U.S. and Japan

Traditionally, university-to-industry technology transfer has occurred primarily through employment of graduates and public dissemination of research papers; these represent a “linear hand-off” (Rosenberg and Nelson 1996) in which there is relatively little real-time interaction between university and industry. Rosenberg and Nelson (ibid.) go on to note the additional appearance of “spillover” technology transfer patterns from the 1980’s, which include university-industry consortia with substantive research agendas. Along with the continuation of those two dominant channels, they further note a recent emergence of technology marketplaces, in which university-to-industry transfer occurs through technology licensing.

Japanese universities have tended to transfer technology to industry at early stages of development and with relatively little real-time interaction. Factors behind this pattern include the distribution of government funding for applied research, which in Japan goes more to industry than to academia, and also the tradition in Japanese industry of offering lifetime

employment to researchers and engineers. That custom made it more advantageous for industry to hire “younger” graduates and subsequently invest heavily in their on-the-job training and education, rather than paying a higher premium for Ph.D. graduates. Given the relative insulation of Japanese universities from late-stage applied research and from interactive collaboration with industry, it is not surprising that their research programs yielded few opportunities for the creation of start-up companies.

In contrast, U.S. universities are typically closely involved with applied research, and over the years they have developed various forums for real-time interaction with industry. This pattern has often yielded opportunities to form start-up companies. Nevertheless, the appearance of start-up companies in the university-industry technology transfer system would appear not to be in the best interests of either a university or of industrial sponsors of university research. Start-up companies lack the resources to support subsequent university research, because they must focus on their own product and business development. Similarly, transfer of university technology to a start-up company can be expected not to be pleasing to a large firm that has sponsored the university research. Consequently, the attitude that has prevailed in the university-industry innovation system of the U.S. is one of tolerating the creation of start-up companies, not active institutional promotion of this channel of technology transfer.

Nevertheless, start-up companies often comprise the only channel through which a university technology can be transferred to practical application. Even in the U.S., large firms license only a small percentage of the patents generated from university research, namely those which happen to fall within their pre-existing strategic product development plans. Close interaction with industry, however, has stimulated professors and students in the U.S. to look for commercial potential that may be latent in their research, and they have often been the prime movers in creating business entities to realize that potential.

3. Best practices in university spin-out start-up company creation

University-industry relations in general, and start-up company creation in particular, require careful balancing of the interests of two fundamentally different sectors of an economy. For a university, it is important to recognize the appropriate point for handing off business-related activities to the industry sector, and to develop conflict-of-interest policies that will protect its core mission. The creation and management of a start-up company involves business decisions that are most appropriately made by professional investors; university practices such as tenure and the guarantee of academic freedom are not suited for corporate governance, which may require the removal of a founder from the management team of a start-up company. At the same time, the university must have an organizational structure and policies that allow it to preserve its control over academic quality and yet enable its responsiveness to the interests of external research sponsors. For example, at Stanford University, research centers that exist to receive and channel industry funding for research do not take part in decisions of student admissions, graduation, tenure, or faculty hiring. Conflict-of-interest policies aim to ensure that all students are treated fairly and that actively employed faculty fulfill their primary responsibilities to the university. Industry must likewise develop sophisticated expectations in regard to university relationships, including the capacity to make use of access to an independent university-driven research agenda that by nature focuses on exploratory work rather than specific deliverables.

Christensen, Clayton. 1997. *The Innovator's Dilemma*. Boston: Harvard Business School Press.

Rosenberg, Nathan, and Richard Nelson. 1996. “The Roles of Universities in the Advance of Industrial Technology.” In Rosenbloom, Richard S. and William J. Spencer, eds., *Engines of Innovation*, Boston: Harvard Business School Press, 87-110.