
**The Effectiveness of
University Technology
Transfer**

The Effectiveness of University Technology Transfer

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Abstract

In recent years, there have been numerous studies of the effectiveness of university technology transfer. Such technology transfer mechanisms include licensing agreements between the university and private firms, science parks, incubators, and university-based startups. We review and synthesize these papers and present some pointed recommendations on how to enhance effectiveness. Implementation of these recommendations will depend on the mechanisms that universities choose to stress, based on their technology transfer “strategy.” For example, institutions that emphasize the entrepreneurial dimension of technology transfer must address skill deficiencies in technology transfer offices, reward systems that are inconsistent with enhanced entrepreneurial activity and the lack of training for faculty members, post-docs, and graduate students in starting new ventures or interacting with entrepreneurs. Universities will also have to confront a set of issues related to ethics and social responsibility, as they more aggressively pursue technology commercialization. Finally, we suggest some possible theoretical frameworks for additional research.

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1

Introduction

Some university administrators in the U.S. and other industrial nations have asserted that university technology transfer can potentially provide substantial revenue for universities. At the same time, policymakers in these countries have also pointed to the possibility that technology transfer can enhance national and regional economic growth. The key university technology transfer commercialization mechanisms are licensing agreements between the university and private firms, research joint ventures, and university-based startups. These activities can potentially result in financial gains for the university, other benefits to these institutions (e.g., additional sponsored research, hiring of graduate students and post-doctoral fellows), and job creation in the local region. Given the importance of these commercialization mechanisms, many universities and policymakers continually seek guidance on how to evaluate and enhance effectiveness in university technology transfer.

Organizations such as the Association of University Technology Managers (AUTM) in the U.S. and the University Companies Association (UNICO) and the Association for University Research Industry Links (AURIL) in the U.K. have helped to promote technology transfer activity by publishing benchmarking surveys. These surveys have been

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used by scholars to explore key research questions relating to the drivers of effective university technology transfer. While such studies have been useful, the literature remains somewhat embryonic, with many unresolved managerial and policy issues.

In many countries, national governments have provided support for these initiatives via legislation to facilitate technological diffusion from universities to firms (e.g., the Bayh-Dole Act of 1980) and collaborative research (e.g., the National Cooperative Research Act of 1984), subsidies for research joint ventures involving universities and firms (e.g., the European Union's Framework Programmes and the U.S. Commerce Department's Advanced Technology Program (ATP), and shared use of expertise and laboratory facilities (e.g., the National Science Foundation's Engineering Research Centers, Science and Technology Centers, and Industry-University Cooperative Research Centers). Along these lines, national, state, and regional government authorities have also provided support for science parks and incubators.

The growth in private and public investment in university-based technology initiatives has raised important policy questions regarding the impact of such activities on researchers, universities, firms, and local regions where such investments occur. Given that many of these initiatives are relatively new, university officials and policymakers seek guidance on "best practices." More specifically, they seek evidence on specific organizational practices related to incentives, strategic objectives, and measurement and monitoring mechanisms, which might enhance technology transfer effectiveness. Inductive, qualitative research is also useful in this context, since notions of "effectiveness" are likely to vary across different types of initiatives (e.g., incubators vs. technology transfer offices) and for different players involved in such activities (e.g., university scientists, university administrators, and corporations interacting with the university).

The purpose of this paper is to review and synthesize research on the antecedents and consequences of university-based technology transfer and to explore the implications for practice and future research in this domain. Before presenting a review of the extant literature, it is useful to provide some background information on the rise of university technology transfer.

In the late 1970s, U.S. research universities were often criticized for being more adept at developing new technologies than facilitating their commercialization into the private sector (General Accounting Office, 1998). Furthermore, it was asserted that the long lag between the discovery and commercialization of new knowledge at the university had weakened the global competitiveness of American firms (Marshall, 1985). While such conclusions glossed over the principal mission of research universities as creators of new knowledge, they generated sufficient concern for policymakers to take action. As a consequence, in 1980, the U.S. Congress attempted to remove potential obstacles to university technology transfer by passing the Bayh-Dole Act. Bayh-Dole instituted a uniform patent policy across federal agencies, removed many restrictions on licensing, and allowed universities to own patents arising from federal research grants. The framers of this legislation asserted that university ownership and management of intellectual property would accelerate the commercialization of new technologies and promote economic development and entrepreneurial activity.

In the aftermath of this landmark legislation, almost all research universities in the U.S. established technology transfer offices (TTOs) to manage and protect their intellectual property. The number of TTOs increased eightfold, to more than 200, resulting in a sixfold increase in the volume of university patents registered (AUTM, 2004). TTOs facilitate commercial knowledge transfers through the licensing to industry of patents or other forms of intellectual property resulting from university research. The Association of University Technology Managers reports that from 1991 to 2004, university revenues from licensing IP have increased over 533%, from USD220 million to USD1.385 billion (AUTM, 2004). The number of firms that utilize university-based technologies has also increased. Finally, the evidence also strongly suggests that venture capitalists are increasingly interested in ventures founded on the basis of basic research (Small Business Administration, 2002).

Our literature review will also encompass the institutional context of university technology transfer, which includes science parks and incubators. We will also discuss the organizational context, including organizational design, processes, and incentives, as well as the roles of

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individual agents, such as scientists and technology transfer officers. Finally, because much of the early research has focused measures of effectiveness and the building of robust theoretical models depended on well specified dependent variables, we review research on measures of technology transfer effectiveness such as licensing revenues, the introduction of new products and services, and new business starts.

The remainder of this review is organized as follows: In the following sections, we present an extensive review of the literature on university technology licensing, selected studies of science parks, and studies of start-up formation at universities. Section II discusses the institutional context of university technology transfer. The following section considers the organizational context of this activity. Section IV contains a discussion of the role of individual agents (i.e., academic and industry scientists, entrepreneurs, managers at firms and universities) in university technology transfer. Section V presents some methodological issues, in the context of a review of studies of licensing and business formation. The following section discusses theoretical implications, while Section VI presents lessons learned for policymakers and university administrators. The final section consists of some tentative conclusions.

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