

IMPLEMENTING ENTREPRENEURSHIP IN UNIVERSITIES

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ABSTRACT. The role of entrepreneurs and entrepreneurial activities on university has been the subject of increasing attention over the past several decades. This article begins by examining the establishment by universities of dedicated technology transfer offices that serve as a focal point for universities’ interaction with commercial interests. Are explored three central mechanisms that universities may use in technology transfer, sponsored research, licensing, and the formation of entrepreneurial ventures. The universities are important to local innovative activity. The economic benefits of knowledge spillovers from universities are significant. The universities raise the average skill level of the surrounding area and positively affect wage and employment rates. The universities can play a significant role in economic development. Universities use a variety of mechanisms to transfer technology to industry. Each mechanism offers trade-offs in terms of achieving the technology transfer offices objectives. Because technology transfer is a relatively new activity for universities, there has been experimentation in the use of these mechanisms and the terms of the agreements made with industry. Formal mechanisms include sponsored research agreements with industry, licensing of university intellectual property to firms, and the formation of spin-off companies. Informal mechanisms, such as industry hiring of students, faculty consulting, and knowledge trading among friendship networks also contribute to technology transfer, but do not fall under the auspices of the technology transfer offices.

KEYWORDS: university, technology transfer, spin-off, entrepreneurship, research, relationship innovation.

Introduction

The relationship between university and industries has entered a new era marked by closer interaction as universities actively manage their intellectual property in a process known as technology transfer. Moving beyond publication and teaching, the traditional modes of disseminating academic inventions, many universities now have technology transfer offices dedicated to securing invention disclosures from campus research and establishing intellectual property rights over them. These offices work to license to firms the rights to use the intellectual property, sometimes encouraging the formation of new firms for this purpose.

The entrepreneurship, narrower sense, has become a favored mechanism by which universities transfer technology to the commercial realm. The university spin-off firms are seen as a means to transform local economies and a mechanism that provides a way for these economies to capture the benefits of proximity to research universities. Although university licenses have no locational constraints in principle, entrepreneurship is a decidedly local phenomenon in practice. As universities have been leveraged by policymakers to serve as

engines of local economic development, the rate of start-up formation has become an increasingly important indicator that they are succeeding in producing benefits.

University technology transfer efforts have intensified over the past thirty years due to four interrelated and reinforcing factors. One factor is the economic importance of new, high opportunity technologies arising out of such disciplines as computer science, molecular biology, and materials science. Basic scientific research in these fields is conducted primarily at universities. The new generic technologies have widespread commercial applications and are associated with the emergence of new firms and the creation of new industries. Second, many industrial products outside the high-technology areas have become increasingly science-based and technology-intensive, creating an even broader array of potential users of university research. Together these two factors create a demand for technology transfer. On the supply side, universities faced a need to find new sources of funding due to budgetary stringency and fiscal uncertainty, traditionally the largest sources of university funding. As a result, universities turned to industry for financial support. The fourth and final factor was a series of government policies aimed at raising the economic returns of publicly funded research by stimulating university technology transfer. In response to these four factors, universities have organized formal technology transfer operations to manage their intellectual property.

Consequently, the universities have established independent technology transfer organizations to engage in such transactions.

Universities are engaged in an ongoing search for the best way to organize technology transfer operations. Are three structural features associated with effectiveness in performing the technology transfer function. One such feature is the to coordinate its activities with those of several other administrative units, such as sponsored research, corporate giving, and industrial liaison. Another is its ability to receive, interpret, synthesize, and disseminate information both within and outside the university. The final key feature is an effective alignment of incentives between the technology transfer offices, faculty, and other administrative units.

In sum, the performance of the technology transfer offices can only be assessed within its broader organizational setting within the university. [1]

Knowledge dissemination is the most traditional objective for universities, and it would be natural for technology transfer offices to adopt it as a mission. The objective of fostering local economic growth also reflects this emphasis, but with a local focus.

Revenue generation may be another motivation for technology transfer offices; exploitation of intellectual property may augment university budgets in the face of fiscal austerity. Finally, service to the faculty reflects an orientation by technology transfer offices to serve an internal constituency as a part of the university.

The mechanisms of university technology transfer

All universities can receive incentives for cooperation research centers. These centers were meant to enhance innovation by improving the cooperation between universities and industry. Within these research centers, the point of contact with industry is handled by dedicated technology transfer offices.

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experimentation in the use of these mechanisms and the terms of the agreements made with industry.

Formal mechanisms include sponsored research agreements with industry, licensing of university intellectual property to firms, and the formation of spin-off companies. Informal mechanisms, such as industry hiring of students, faculty consulting, and knowledge trading among friendship networks also contribute to technology transfer, but do not fall under the auspices of the technology transfer offices.

Technology transfer depends on technology creation and it depends on university employee that results in a discovery that may have commercial value. Such a discovery is the basis of university intellectual property. When the discoverer files an invention disclosure with the technology transfer offices, a claim is made that begins the formal technology transfer process. The technology transfer offices legally establishes the university's intellectual property rights in the form of patents, copyrights, or trademarks.

Only a small subset of invention disclosures generates any intellectual property, much less licensing interest; of those that do, very few generate sizeable net returns. The rule in university technology transfer is that for every one hundred invention disclosures, ten patents and one commercially successful product result.

The technology transfer process is fraught with peril. The knowledge being transferred is by its nature difficult to value and to appropriate. Indeed, uncertainty about the value of knowledge is highest for the most upstream, basic research activities conducted at universities.

Technology transfer agreements must be negotiated in the shadow of this uncertainty. The parties to these negotiations base their positions on subjective estimates of that portion of the value flowing from the knowledge that the firm will be able to appropriate.

These imperfect estimates of the value of the knowledge acquired by the contracting firm may lead to a market failure: the contractual price may be different from the social value of the knowledge involved in the transaction. The spillovers may be positive if the contractual price paid by the firm is below the social value or negative if there sulting private value is less than the contractual price. Negotiation under high uncertainty is characteristic of most formal technology transfer processes, such as sponsored research or licensing agreements. [2].

There are two other general factors that shape the technology transfer process in addition to the attributes of the knowledge that is transferred.

First, firm strategy and characteristics affect the choice of mechanisms for technology transfer. Large firms, for example, are more likely to sponsor research. If the research proves fruitful, the company may be able to devote substantial resources of its own to moving it forward without necessarily negotiating a license from the university.

Second, commercializing a university technology typically involves multiple, complementary transactions. The use of one mechanism does not exclude the use of others. The three mechanisms, sponsored research, licenses, and spin-off firms, should be viewed as potentially complementary elements in the larger technology transfer process.

Research is the process that creates knowledge and ideas that form the basis for university intellectual property.

Sponsored research is a mechanism for transferring technology. The university gains financial resources, while the contracting firm gains research results and access to university scientists.

Industry-sponsored research is typically more applied in nature than Research paid by state and, thus, closer to practical application and realization of commercial potential.

A research agreement between a university and industrial sponsors will specify the distribution of any intellectual property that results from the project. In addition, the agreement will differentiate between the background knowledge created within the university (and which may derive from a variety of different funding sources) and the foreground knowledge created by the new project. The industrial sponsor will typically retain ownership of intellectual property resulting from the sponsored research or will have the right to review such property with the first option to license. Again, firm strategy and market characteristics shape such agreements. If the technology is broad-based and involves network externalities, the sponsor may choose to let the university retain ownership and license the technology on a nonexclusive basis to other companies.

Licenses

Licenses are contractual agreements that provide firms with rights to use intellectual property. In return for the use of university intellectual property, the licensee will typically provide an up-front payment at the time of signing the agreement and make periodic payments at certain milestones, such as when regulatory or technical hurdles are cleared. In addition, licensing agreements typically include provisions for royalty payments, calculated as a percentage of product sales, which become a steady revenue stream when the product reaches the commercial market. The technology transfer offices typically have great latitude and flexibility in negotiating these agreements . [3] The typical licensing agreement has changed significantly over time. Initially, most university licenses were granted on an exclusive basis to one company. This approach limited the potential number of transactions and the amount of potential revenue. Universities are now more likely to negotiate licenses that are calibrated to certain applications or specific geographic markets. There is also significant variation in licensing agreements with respect to royalty rates, duration, and future option rights. [4] More research is warranted to understand how these contracts are negotiated and which partner, the university or the corporation, exerts the greatest bargaining power and under what circumstances.

University-based spin-offs

Spin-off firms are local phenomena. Defining academic entrepreneurship solely in terms of start-up firms is far too restrictive to capture the full scope of the interaction between research universities and high-technology entrepreneurs. But even if one sticks with the narrow definition, one must be careful to include not only successful start-up firms but also those that never get very far off the ground (and perhaps some that never get going at all).

The university spin-off is a firm formed around a university license of intellectual property. This definition is not the only one that may be employed. Spin-offs are an increasingly important means of commercializing university research. Given the difficulty of evaluating the economic potential of university intellectual property, the researchers who made the relevant discovery may be in the best position to carry the work forward toward commercialization. Life-cycle models suggest that scientists invest heavily in human capital early in their careers to build reputations and establish positions of primacy in their fields of expertise. [5] In the later stages of their careers, they are more likely to seek an economic return on this investment. Starting a company may serve the purpose of realizing that return. It also allows the founders to appropriate the value of the intellectual property they created while at the university and to accelerate

progress on their research agenda by providing access to additional funding. The potential financial rewards of starting a company coupled with tightening university budgets and competition for the relatively fixed pool of public funding create incentives for scientists to engage in entrepreneurial activity. [6]

In general, entrepreneurs who start companies do not relocate but stay close to the source of their perceived competitive advantage, which is typically the referent organization where the founders were previously employed (Feldman and Francis 2002). For university-based spin-offs the university serves as the source of advantage, providing skilled labor, specialized facilities, and expertise.

In addition, university personnel who start companies often split their time between the university and the firm, making close location advantageous.

This pattern in university-based entrepreneurship fits what we know about entrepreneurship in the larger knowledge economy. The knowledge spillovers from universities are most important in knowledge-intensive industries.

“Star scientists” [7] are a particularly important form of skilled labor, better termed “intellectual capital,” which transforms scientific knowledge into commercial applications. Star scientists embody knowledge of break-through techniques that are initially available only at their lab benches, making it costly for others to obtain or use. The entrepreneurial venture is one important pathway through which this intellectual capital yields returns. [8].

Firms with access to leading-edge scientists perform better than enterprises lacking such access in terms of products in development, products on the market, and employment growth in the firm. [9]

Most important, a university’s founding mission, institutional context, and prior experiences with commercial activity influence its interaction with industry and ultimately affect the ability of the university to impact its local economic and innovation environment. [10].

Conclusions

Universities are attractive for economic development purposes for several reasons. The universities are perhaps less mobile than any other institution. Although it is common for universities to establish programs in new locations, they are relatively fixed in place due to historical accident. Firms change headquarters locations; universities do not. [11]

The new system of technology transfer will interfere with the norms of open science and adversely affect the role of universities in the national system of innovation ?

This is an important questions. The process may be viewed as a natural experiment. Scholars are only beginning to understand the impact of this experiment on the broader national system of innovation. [12].

The same question is also worth thinking about at there regional level as universities are asked to become engines of local economic development.

Universities have demonstrated great adaptability in fulfilling their commitment to active technology transfer. Their attempts to spin off new companies satisfy an increased expectation that they be engaged in local economic development and demonstrate their relevance. [13].

Yet, universities add more to their local economies than the metrics of technology transfer capture, and there are certainly many different models for assessing how universities interact with and enrich their local economies. [14]. Thus, we may question whether university

programs intended to encourage entrepreneurship and local economic growth make the best use of state and university resources. [15].

The commercialization requires much deeper engagement and interaction between researchers with significant technical expertise and reputation, and the entrepreneur with business expertise and access to external capital and ongoing resources.

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