

University Technology Transfer Through Innovation Incubator: A Case Study

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This paper examines innovation incubators connected with Innovation University in the United States. The main goal of innovation incubators is commercializing new technologies and economic development. The research methodologies adopted in this research study are literature reviews and a case study, from Stanford University. Stanford University has been a leader in technology transfer, commercializing new technology and economic development since 1970. The paper concludes that innovation incubators represent a strategy for commercializing new technologies, and leading to sustainable economic growth. The case study covers the period from 1970 to 2010.

1. Introduction

It is estimated that there are 7500 incubators worldwide growing at an annual rate 33% and that approximately 2500 are connected with universities (Knopp, L., 2010; Monkman, 2010). Furthermore, the university incubators foster technological innovation and industrial renewal (Allen and Rahman, 1985; Smilor and Gill, 1986; Allen and McCluskey, 1990; Mian, 1996).

Stanford University has been a leader in technology transfer, commercializing new technology, and fostering the growth of Northern California Silicon Valley, the birthplace of Silicon Valley being Stanford University itself. In addition, Stanford University provides creative solutions to new challenges for research and economic growth including innovation, start-up companies and new technologies (Fisher, L.M., 1998).

Today there are many innovation incubators connected with innovation universities in the US, such as Georgia Institute of Technology (Georgia Tech), North Carolina State University, Ohio State University, Pennsylvania State University, Purdue University, Texas A&M University, University of Wisconsin, Virginia Polytechnic Institute, The University of California-San Diego, and University of Utah. Furthermore, the main universities' goal statements and mission are leading center for research, technological development, commercialization of new technology, and promotion and the growth of business and industry for national economic development (Tornatzky, L., Waugaman, P.G., and Gray, D., 2002).

Innovation incubators are designed to be a laboratory to encourage innovation primarily through the use of technology. The goal is to use the entrepreneurial spirit to spur ventures across the University housing the incubator and throughout the local economy.

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The objective of this paper is to examine the innovation incubators at United States' universities and particularly how it relates to technology transfer. It will focus on the analysis of Stanford University as case study for innovation incubators. This study represents the first time a researcher has examined how innovation incubators enhance technology transfer. Prior research on business or innovation incubators did not examine the role of these institutions on technology transfer.

The paper is structured as follows: Section 2 provides a thorough review of the literature on the details of university incubator models. In Section 3, the research methodology includes the successful case studies to illustrate different key performance of the university incubation. In Section 4, the authors briefly discuss the finding of the study drawn from analysis of case studies of university incubators. Section 5 concludes with implications of the university incubators from successful international universities.

2. Literature Review

Many universities in the US and other countries have asserted that university technology transfer can potentially provide substantial revenue for universities (Phan, 2006). The successful transfer of new technologies from the research laboratory to the commercial sector has many benefits: 1) promoting economic development, 2) commercializing new technologies, 3) enhancing universities, 4) research mission, 5) the creation of wealth, 6) new jobs, and 7) new solutions to society's problems (Fisher, L.M., 1998).

The most successful innovation incubators have been those associated with substantial local economic growth and the development of new technology industries. In addition, the Austin Technology Incubator, associated with the University of Texas. Austin has incubated more than 38 companies, created more than 500 jobs, and brought approximately \$60 million to the local community in its first four years of operation. Furthermore, Stanford University's cumulative income from incubators outcomes, such as patent licenses since the creation of technology licensing office, is more than \$300 million. However, the annual revenue of the companies born at the university total more than \$100 billion. These figures reflect the positive potential of innovation incubators on economic development and jobs creation (Fisher, L.M., 1998).

Today, President Barack Obama supports the fund of the Regional Innovation Clusters model with the amount of \$50 million. The fund is intended to help the successful implementation of an innovation model and to link innovation assets, people, institutions, capital and infrastructure to lead to a sustainable ecosystem (Monkman, 2011). The innovation incubators are a tool for economic development and commercializing new technologies.

While the literature does show that many articles have been written on business incubators and their impact on variables like economic growth and job creation, surprisingly there appears to be nothing on innovation incubators. Hence this paper will attempt to address that gap in the literature.

We hypothesize that the transfer of technology from the public or private institution that developed the technology to the commercial applications will be increased through the use of innovation incubators. We seek to accept this hypothesis by studying the case of

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one of the first innovation incubators. That is the one found at Stanford University which began in 1970.

3. The Methodology and Model

3.1 Case Studies

The study employs an individual case study methodology which evaluates a number of aspects as key indicators of Stanford University: 1)mission and goal, 2)technology transfer, and 3)economic development. In addition, the case study method is recognised as the most effective research strategy to capture the rich experience of complex projects (Eisenhardt, 1989; Yin, 1994).We thorough examine the workings of the innovation incubator at Stanford University. In order to determine the effectiveness of the program we show how the royalties earned from licensing the technology have grown to be a substantial sum, indicating that the technology is used extensively in the real world.

We will develop a new model to show how the transfer process works starting from the initial research through to the transfer on new technology to the revenue generating stage. This model will show how the entire process works and how it leads to re-investment which leads to more innovation. This is a critical point when looking at problems of slow overall economic growth.

While there are other innovation incubators, we chose to examine the Stanford case as a representation of a successful innovation incubator. Others likely follow a pattern similar to Stanford.

3.2 History

A review of the history of Stanford University: It was established in 1891 by Leland and Jane Stanford in honour of their only son, Leland Stanford Jr., who had died of typhoid fever. Leland Stanford Sr. was an entrepreneur who had made his fortune in supplying goods to gold prospectors and in building railroads. Furthermore, Stanford has evolved into a first-rank research university. Its undergraduate and graduate education programs are highly competitive, and Stanford students are among the best and brightest. Stanford reported research expenditures of \$426.5 million in fiscal year 1999, which ranked eighth among all University (NSF, 2001).

U.S. News & World Report ranks (2001)it second in the U.S. only to the Massachusetts Institute of Technology in overall quality. In addition, the School of Engineering, founded in 1925, now enrolls 21% of all Stanford students and spends more than \$90 million for research annually. The School of Medicine was founded as the Cooper Medical College. It was merged into the university in 1908, and moved from San Francisco to Palo Alto in 1959. Furthermore, The medical school also has a strong research emphasis, receiving more than \$230 million for research and claiming the highest research expenditure level per faculty member. The Graduate School of Business was organized in 1925, and enjoys a national reputation (Tornatzky, L., Waugaman, P.G., and Gray, D., 2002).

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3.3 Mission and Goal

Stanford's vision continues to be that of a research university of the highest rank with a secondary goal to have a high degree of impact on economic development.

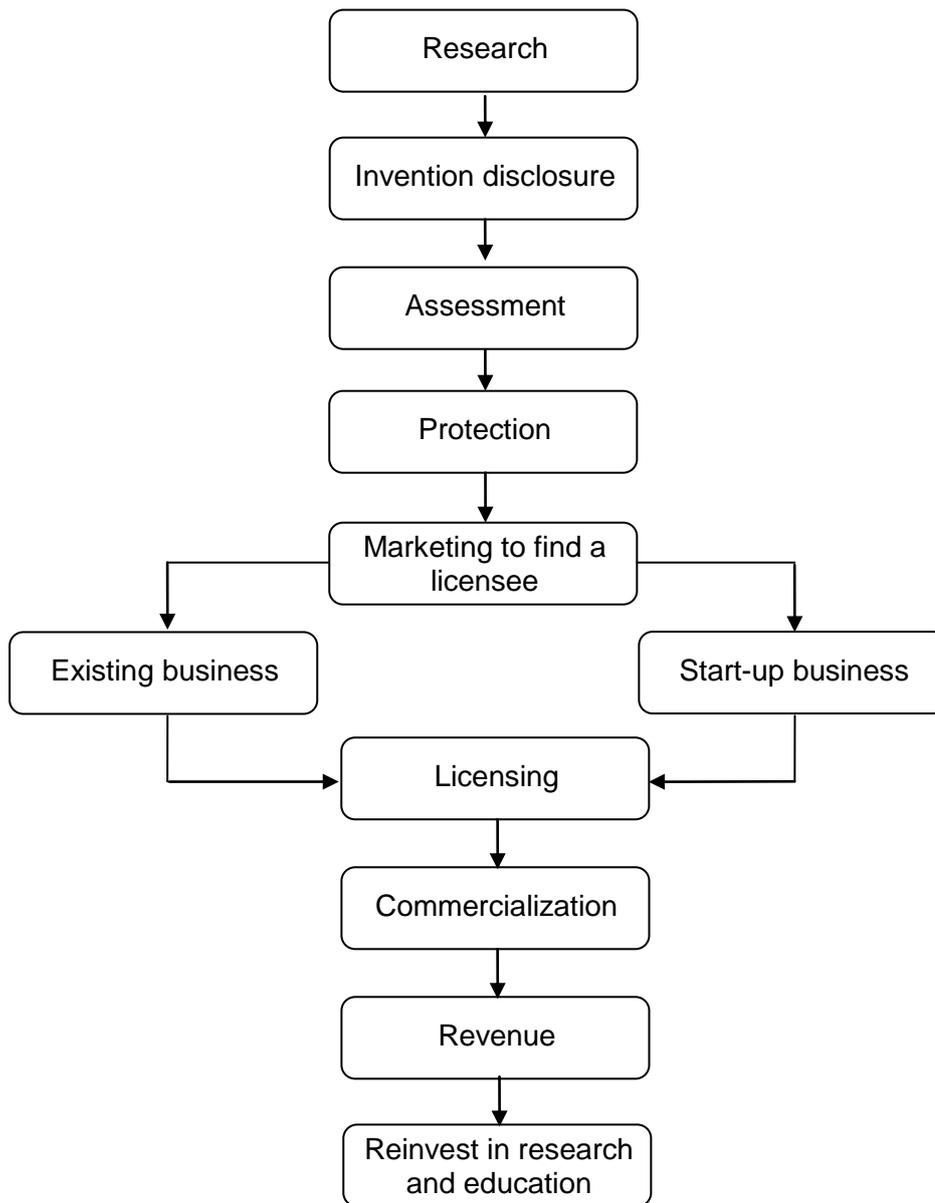
According to Tornatzky, L., Waugaman, P.G., and Gray, D., (2002) the Stanford university emphasized heavily undergraduate teaching and the humanities also the constant role of research in financial and intellectual future of the university. In addition, the undergraduate instruction the humanities was built the base of science and technology.

3.4 Technology Transfer

In 1980, the US Congress passed Public Law 96-517, the Bayh-Dole Act, which provides that rights to inventions resulting from government-sponsored research at universities would be assigned to the universities. In addition, the mission of Stanford University's Office of Technology Licensing (OTL) is to promote the transfer of Stanford technology for society's use and benefit while generating unrestricted income to support research and education. OTL is responsible for managing the intellectual property assets of Stanford University and help turn scientific progress into tangible products, while returning income to the inventor and to the University to support further research (OLT, 2011).

There are many parties receive tangible benefits of technology licensing such as 1) Stanford, 2) Stanford inventors, 3) Industry, 4) Silicon Valley/Biotech Bay, 5) The US Government, and 6) The Public. In addition, the close relationships between Stanford faculty and outside industry afford a platform for technology transfer and provide the optimum benefit for society and new generations. Figure 2 shows the process of the technology transfer(OLT,2011).

Figure 1. The technology transfer model



4. The Findings

Faculty and student start-ups based on Stanford innovations have been constantly springing up. Their increasing success over the past 40 years is reflective in Table 1 the Total Royalty Income by Decade of the entrepreneurial spirit found at Stanford. In the 1970s, totally royalty income was \$2712; in the 1980s it was \$58,834, in the 1990s it was \$393,305, and in 2000s it was \$877,524. The cumulative total for the 40 years was \$1.3 billion. In those same 40 years (1970-2010), Stanford inventors have disclosed over 8,000 inventions as seen in Table 2. Of these, 2700 were active inventions, 3000 were licenses signed and 850 were granted active licenses. As a result, the research incentive fund reached \$45.2M. This data came from Stanford’s office of technology licensing’s annual report 2010.

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Table 3 represents the top 3 revenue-producing inventions of the past 10 years. The top producing invention being Google Text Researching reaching revenues of \$337M, followed by Functional antibodies of \$271M and thirdly, Fiber Optic Amplifier of \$46M.

Table 1. Total royalty income by decade

Years	1970-1980	1980-1990	1990-2000	2000-2010	40 years
Total royalty income by decade (in thousands of dollars)	\$2,712	\$58,834	\$393,305	\$877,524	Cumulative Total:\$1.3B

Table 2. Inventions by decade

	Cumulative disclosures	Active inventions	Licenses signed	Active licenses	Cumulative gross royalties	Top three inventions	Royalties to Stanford and inventors	To research incentive fund
40 years(1970-2010)	8300	2700	3000	850	\$1.3B	\$870M	\$1.2B	\$45.2M

Table 3. Top 3 revenue-producing inventions-past 10 years

Top 3 revenue-producing inventions	Google Text Searching	Functional antibodies	Fiber Optic Amplifier	1272 other inventions	Total
10 years (2000-2010)	\$337M	\$271M	\$46M	\$224M	\$870M

5. Summary and Conclusions

The following general conclusions can be drawn from the previous overview of the findings of key studies into the innovation incubators as a strategy for commercialization of technology:

- 1- Technology commercialization from the innovation university leads to economic development based on the technology transfer license income and the high rate of total royalty income of \$1.3B.
- 2- Innovation incubators increased the research incentive fund to \$4.5M.
- 3- Innovation based on the university incubators produced over 8000 inventions.
- 4- The new technology adds value to the market with an accumulative total \$878M.

Drawing overall conclusions based on the above, innovation incubators are an effective tool for technology transfer, innovation, new technology and research incentive.

We recognize the limitations of this study in that only one case was analysed. Future research is needed to examine other innovation incubators including any that have not been as successful as the Stanford case. As previously noted, there is a gap in the

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literature concerning innovation incubators and we are attempting to provide the initial research in this area with the hope that other scholars will continue with this stream.

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