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BUSINESS CREATION AND COMMERCIALIZATION OF TECHNOLOGY AT A UNIVERSITY: IN SEARCH OF THE HOLY GRAIL

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ABSTRACT

The research mission of the university along with federal funding support has led to many technological discoveries that the Bayh-Dole Act of 1980 was intended to help commercialize and create a new revenue stream for higher education. After twenty-four years, apart from a handful of exceptions, the efforts of many universities have yielded disappointing results in licensing revenue, commercialization and business and job creation. This paper summarizes several reasons that have been proposed in the literature for the notable lack of success and proposes process models that may lead to a better understanding of the factors that contribute to commercializability. In addition, a list of best practices in the commercialization of technology at universities is reviewed. The importance of this subject emanates from the pressure, especially at public universities, to find new revenue sources and to actively participate in regional economic development.

1. INNOVATION AT THE UNIVERSITY

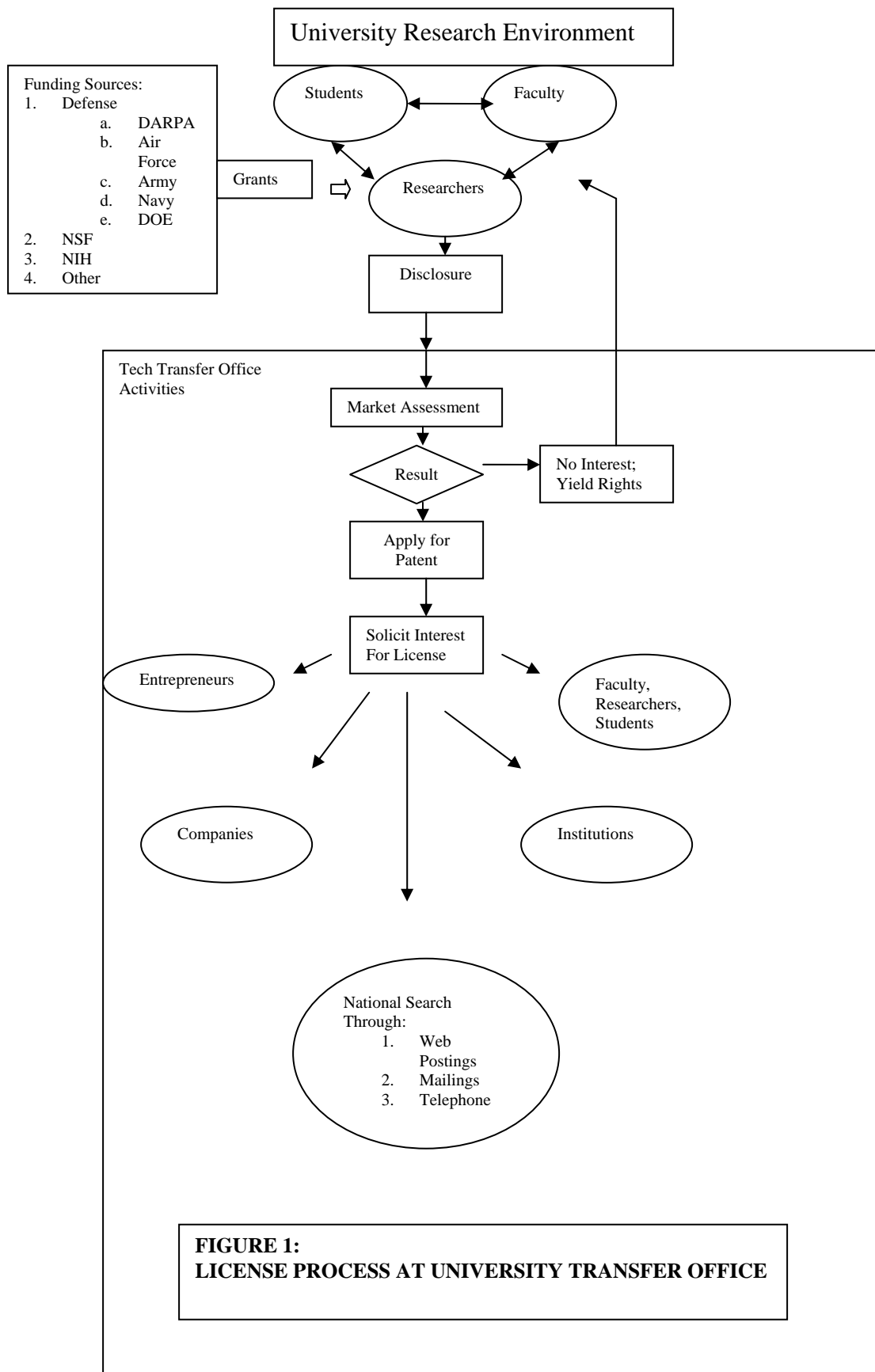
Although the university had always fostered and supported technological research among its faculty, students and researchers, it was not until the Bayh-Dole Act of 1980 that a clear signal was given to the universities that:

- (a) the intellectual property developed under federal funding belonged to the university;
- (b) the university could now exploit that technology and thus create a new revenue source, especially in the case of public universities who were experiencing decreases in public funding; (Selingo, 2003) (Zemsky, 2003)
- (c) the university in licensing its technology to commercial and industrial entities could now become a technology transfer agent for intellectual property generated by taxpayer dollars.

A few universities – Georgia Tech, Rensselaer Polytechnic among others - immediately capitalized on the opportunity and laid out plans for encouraging faculty, students and researchers to generate disclosures. A patent process was put in place to first assess the commercial value of the disclosures and then to apply for patent protection for those discoveries worthy of commercialization. An indirect consequence of the tech transfer activities at universities is a surge of interest in technology-based entrepreneurship in both the classroom and in the research laboratory. Traditionally, entrepreneurship study was a domain of economists or of the business school. Since 1980, the schools of engineering, health sciences, agriculture and arts and sciences at many universities have led the way in establishing centers of technological entrepreneurship. In many cases, these centers have had the support of regional economic development agencies that see the creation of jobs and revitalization of the economy in the serving area of the university. The university and its resources of a tech transfer office, entrepreneurially-minded faculty, researchers and students and regional investment sources have teamed up to create companies with extensive support from the university in the form of licensing deals, leave of absence from teaching or research duties, and incubator services such as business planning, market research, management training and mentoring programs.

2. COMMERCIALIZATION INITIATIVES

Although the primary duty of the tech transfer office at a university was envisioned to be the licensing of technology, it was not long before the newly established office realized that a marketing and sales effort was required before any licensing deal could be closed. Figure 1 illustrates the process that a discovery from university research follows on its way to a possible licensing deal.



This process does take time to complete and, of course, incurs expenses in the form of professional and legal staff time. Not every disclosure results in a patent since an assessment of the discovery may find that the disclosure has very little if any commercial value. According to the Association of University Technology Managers, in 1999, only a few universities were able to achieve an efficiency of 1 patent per million dollars of research grants. In fact, very few tech transfer offices at universities today recover their expenses through licensing revenue. One notable exception is Columbia University who has leveraged its association with medical research facilities and hospitals in the New York City to help develop intellectual property from which it receives record setting licensing revenues of nearly \$100 million per year. (Kalis, 2001, p. 5]

3. DEMOGRAPHICS OF UNIVERSITY ENTREPRENEURSHIP

Research centers at universities focus on one or more technical areas that are of interest to federal defense or research agencies from which most of their funding originates. At times these research topics sponsored by federal agencies do not relate easily to problems whose solutions have commercial value. Often, university researchers and faculty and students are ill prepared to make the connection to societal needs in which commercial and industrial entities have more experience. Rarely do researchers and faculty in technology have the commercial experience or business training to see any connection between their topic of research and the satisfaction of a societal need. When a discovery is made in a research center, universities often do not have the resources to investigate its commercial value unless a formal disclosure is made to the tech transfer office. Many universities do not reward authors of discoveries for simply submitting the disclosure. Faculty who teach graduate courses and conduct research with graduate students have incentives to publish their results and tutor those students in the process of original research. Topics of this research follow the faculty member's interest or the objectives set by a research grant from a federal agency.

4. UNIVERSITY POLICY OF BUSINESS CREATION

The university's motive for supporting the creation of business from its own intellectual property is primarily for the generation of licensing revenue. Few universities are rewarded for exerting efforts in regional economic development although in the case of public universities, clearly such efforts economically benefit its constituencies in job creation and perhaps diversification of the regional economy. (Schmidt, 2002) (Klein & Associates, 1998) The creation of a new business requires investment, the quantity of which is dictated by the type of business involved. Regional investors in technology in the form of serial entrepreneurs, venture capitalists and angels do become partners to university efforts to support start-up companies. In some cases, the university itself, through its management of endowment funds, can become an investor of such start-up companies with the assistance of professional investment advisors. In this case, the university becomes an investor in the commercialization of its own intellectual property. (Fried, 2003)

5. BUSINESS TRAINING FOR STUDENTS AND FACULTY IN TECHNOLOGY FIELDS

Advanced study in technology fields often entails intensive classroom and laboratory work so that students find it difficult to obtain concurrent business training through coursework or seminars administered at the business school. Some universities have addressed this problem through an integrated double degree program in both the technology field and the study of business subjects such as accounting, finance, organizational behavior, marketing and strategy. Other colleges have schools of engineering, health sciences or arts and sciences actually offer courses in business subjects as alternate "tracks" or electives. A "minor" in business is at times an option given to technology students. The decision to become an entrepreneur, or at least consider the possibility of becoming a member of an entrepreneurial team, can occur at any time during the career planning process of university students. Studies of successful entrepreneurs have shown that some students, while still undergraduates at a college, have already made the decision to start a company. It is this revelation that has led many universities to actually offer the opportunity for freshmen to take courses in entrepreneurship. Students are also offered the opportunity to attend seminars and take advantage of internships in small

technology companies where they can get some commercial or industrial experience while still a student.

6. SUPPORT SYSTEMS FOR BUSINESS CREATION AT A UNIVERSITY

Best practices at business incubators focused in technology include making available services to start-ups such as the review of business plans, seminars in business topics, mentoring programs and the placing of student interns at incubated companies. An important policy that has been adopted at universities allows faculty members to take entrepreneurial leave without risking the loss of tenure track position. This is most useful for that faculty member who wishes to assist the start-up company in the development of technology but does not wish to become a permanent member of the entrepreneurial team. Another policy that universities have adopted in the commercialization of its intellectual property is the direct investment in the company that has licensed its technology. The investment is usually made as a limited partner through a professionally managed investment company.

7. PROGRAMS FOR SENSITIZATION OF COMMERCIALIZABILITY

Another approach for increasing the awareness in faculty and researchers of the commercial value of a discovery is to actually encourage the interaction of university research with the commercial world as illustrated in Figure 2.

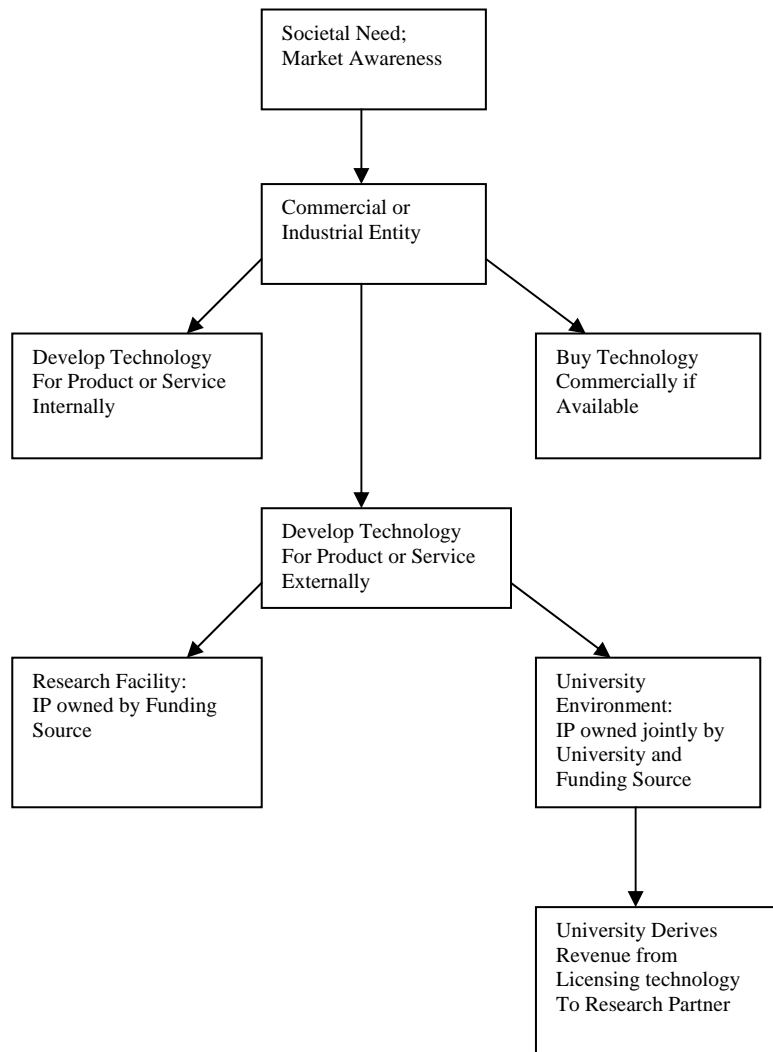


FIGURE 2: ALTERNATIVE METHOD OF GENERATING LICENSE REVENUE AT A UNIVERSITY

The results of the research are jointly owned by the university and the commercial sponsor. Hence, intellectual property created by the research has a ready market in the sponsor. Students get an appreciation for conducting research that has an immediate societal need. Further research work by the faculty member in the topic of commercial interest could very well be sponsored by the same commercial entity or a federally funded research grant that may be broader in scope. The joint project between academic and commercial parties can also address the “premature” disclosure problem that university research creates by insisting on publication as soon as possible. Such disclosure practices discourage commercial sponsors who wish to capitalize on discoveries before the competition does and perhaps wish to patent the discovery as well before any publication of the academic research. From the university or an overall research perspective withholding publication causes concern that research progress can be delayed. (Gibbs, 1996)

Another program along these lines is sponsored by the Space Alliance Technology Outreach Program (SATOP) by NASA. A faculty member volunteers his/her time (limited to a number of hours of consultation) to work with a small company experiencing a problem involving technology that is in the area of expertise of the faculty member. A stipend is paid to the university for the consultation. A prior arrangement is made between the university and the faculty member as to how much of the stipend will be kept by the university, the rest constituting compensation of some form for the faculty member. The point here is not the compensation but that the faculty member gets experience in solving a problem that has commercial value. A research topic can very well be formed from this experience that the faculty member has undergone.

8. UNIVERSITY POLICY ON ENTREPRENEURSHIP AND COMMERCIALIZATION OF IP

Many universities encounter difficulty in working with commercial or industrial entities due to what is commonly known as the “anti-donation” clause in either state statutes for public universities or as regulations that private universities follow due to their non-profit status. The clause was originally instituted to prevent non-profit organizations from assisting commercial or industrial entities from taking advantage of their facilities and other resources without due payment. The exact amount of “due payment” is thus difficult for a university to establish and many simply discourage any collaboration between university staff and commercial entities that utilizes university property, equipment or other resources. In addition, universities have traditionally been warned by commercial organizations that they should not “compete” with services already offered by them. These issues may explain why only 7% of research funding at universities is from the commercial or industrial sector. (Table 4.1 in NSF, 2004) Nevertheless, some universities have found ways to establish successful partnerships with industry based on economic development activities “formed around mutual needs, market demands, and the potential of value added as a result of teaming.” (Ryan & Heim, 1997)

The policy that a university owns all intellectual property created on its premises or under its guidance greatly inhibits the learning of commercial value in research. Many would-be sponsors of university research from the commercial or industrial sector insist on some joint ownership agreement of the IP created from the research. Progress in this area would result in an increased level of commercial value of university research. Similarly, the use of the university facilities and resources by start-up companies for in kind payments made on behalf of the start-up by economic development agencies would help in commercializability of university IP.

Finally, the tradition of hiring junior faculty straight from graduate school has undoubtedly kept university payrolls low. However, the tenure track system typically “locks in” junior faculty into a purely academic career with little opportunity to gain commercial or industrial development experience except in other research facilities of governmental agencies or large industrial companies. Such non-academic experience does not lead to learning the commercial value of technological discoveries but simply duplicates the same research environment they have at a university. Another initiative that can be taken is in the desired qualifications of new faculty hires. The university, especially in the professional fields such as health sciences, engineering, business, law and architecture, could consider hiring faculty who have worked on commercial applications of their field of study. These faculty members are well suited to assess the commercial value of discoveries made in their research.

9. SUMMARY AND CONCLUSIONS

A set of best practices for commercializing technology have emerged from the experience gained by universities since the passage of the Bayh-Dole Act of 1980. These practices are summarized in Table 1.

| No. | Practice | Desired Result |
|-----|---|---|
| 1 | Industrial Partner Engaged at Project Initiation | Licensee Commitment |
| 2 | Faculty Aware of Commercial Application | Minimize market study for commercializability |
| 3 | Flexible university policy for joint IP ownership, commercial research partners | Provides incentive for commercial partner to invest in research |

| | | |
|----|--|---|
| 4 | Entrepreneurship Training Available to Faculty, Researchers and students | Creation of entrepreneurial culture at university |
| 5 | Commercial internships, mentorships available to students | Creates entrepreneurial culture at university |
| 6 | Networking event co-sponsored by university of entrepreneurs, investors, faculty and students; | Enables formation of entrepreneurial teams |
| 7 | Technology Incubator Co-sponsored by university | Facilitates application of university intellectual resources to start-ups |
| 8 | University (or Foundation) invests in IP development by start-up | Investment capital made available to start-up interested in university IP |
| 9 | Facilitate inter-disciplinary research with industrial or commercial partner | Facilitates full solution to commercializability of university IP |
| 10 | Engage regional business and political leadership in university programs | Gains support from local and state economic development agencies |

**TABLE 1:
BEST PRACTICES FOR TECHNOLOGY COMMERCIALIZATION AT A UNIVERSITY**

Successful programs in technology commercialization can probably occur with only a few of these practices being implemented. However, more leverage for success and acceleration of desired results can be realized by implementing most if not all of the practices with adequate financial and administrative support from the university administration. In fact, most of these practices cannot be put in place without strong support from the university president or chancellor and his/her board of regents or superiors.

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