

**RESEARCH AND INNOVATION ISSUES  
IN UNIVERSITY - INDUSTRY RELATIONS**

*Background Information Document  
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## INTRODUCTION

1. The Bayh-Dole Act, enacted in the US on December 12, 1980, marked a breakthrough in the history of university - industry relations. The Act had essentially two purposes: (1) to allow universities and other non-profit organizations to patent and commercialize the results of their inventions made under government-funded research programs and (2) to allow federal agencies to grant licenses for their technology to provide more incentives to business. By creating a uniform patent policy for all federal agencies that fund research and enabling universities to retain title to government-funded inventions, the Act provided a national policy framework to encourage universities and other non-profit organizations to collaborate with commercial enterprises in the commercialization of inventions and new technologies.
2. The results of the Bayh-Dole Act are best illustrated through statistical evidence of its impact on the American economy. In a recent survey conducted by the Association of University Technology Managers in the US, it is estimated that “technology transfer in federal year 1999 – specifically the licensing of innovations by US universities, teaching hospitals, research institutes, and patent management firms - added about \$40 billion to the US economy and supported 260,000 jobs.”<sup>1</sup>
3. Since the enactment of the Bayh-Dole Act, many other countries have followed suit passing legislation and establishing an institutional framework to encourage university-industry collaboration and facilitate the commercialization of university research results. Encouraged by the success of the Bayh-Dole Act, in 1998, the Japanese Government enacted the Law for Promoting University-Industry Technology Transfer. The law provided for the establishment of Technology Licensing Offices (TLOs), which would receive financial assistance (up to US\$250,000 annually) from the government to facilitate their administrative costs, and thereby encourage technology transfer contracts between universities and the private sector.<sup>2</sup> Since the enactment of the law, a number of TLOs have been established in every region of the country. In order to provide further support to the development of the TLOs, in 2002, the Government of Japan has launched a program to strengthen the technology transfer functions of universities including the dispatching of experts and personnel with business experience in the private sector to universities and TLOs and the development of “Intellectual Property Headquarters” within universities.
4. By establishing new rules of the game, particularly concerning the ownership of federally funded research results, the Bayh-Dole Act and other similar legislative measures in other countries, have not only provoked a sea change in terms of the new role of universities within the national innovation system but also significantly altered the policy priorities of government for science, technology and education. Intellectual property, and in particular patents, has therefore emerged as an essential tool, providing

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<sup>1</sup> <<http://www.autm.net/pubs/survey/facts.html>> October 30, 2002.

<sup>2</sup> See Institute of Intellectual Property, *Experience of Japan. Contribution by the Patent System to Industrial Development of Japan*, 2001.

the appropriate incentives, for an intensification of university – industry collaboration and for turning laboratory research results into commercially viable products. The establishment of a functioning system and viable institutional set-up for successful technology transfer is not a straightforward task and experience over the past two decades has provided a great deal of insight on the necessary steps and possible obstacles which are likely to emerge in the process.

### **THE ROLE OF INTELLECTUAL PROPERTY IN UNIVERSITY - INDUSTRY RELATIONS**

5. Technology and knowledge transfer from universities to industry may occur in a variety of different ways. Publication of research results in technical journals is one crucial way through which research results are shared among researchers in the private and public sectors, including universities and research centers. The leading peer-reviewed journals in each technological field traditionally provide the most valued source of technological information for researchers and help in disseminating the latest findings among all interested readers. Information on research results obtained from technical journals may provide researchers in industry with crucial information that may be used to develop new products with a market potential. Conferences, seminars and meetings among researchers involved in a specific field of research are generally attended by researchers from university and industry alike and provide an even more direct means of exchange and transfer of technological know-how from university to industry and vice-versa.

6. In addition, technology transfer may take the shape of more long-term and direct cooperation between university and business through paid consultancies, technical assistance programs, collaborative research, training and professional development or internships. Partnerships between universities and enterprises may often be a two-way process by which university researchers may also be the receptors of technology and know-how from industry, including information on the specific research needs of enterprises that may provide motivation for future university research. Finally, staff mobility between industry and academia also provides a means by which technical information, particularly tacit knowledge embodied in the researchers themselves, is transferred between academia and industry.

7. While collaboration between universities and industry by means of all such mechanisms has long since existed, active cooperation and partnerships for the commercialization of research results and the development of new technologies has generally remained low. The risk of a vast amount of research results with a high commercial potential remaining in laboratory shelves is a concern of policymakers in charge of science and technology policy worldwide and has been a recurring theme particularly in the light of the amount of research worldwide that is publicly funded.

8. The transfer of technology from university to industry in the form of the commercialization of research results faces an inherent problem of costs and incentives.

Once university researchers have developed or invented a new technology it often requires a significant investment to translate the technology into a marketable product. Technologies emerging from university research laboratories are generally not mature for the market: they require a significant amount of applied research, development and marketing before any concrete benefit may be obtained. Post-research investment is typically significantly higher than the costs of basic research. Thus, published research results which may be used by all companies alike without exclusivity may be of limited interest to industry wherever significant investments are required to turn an invention into a marketable product and competition from many other companies is likely to be met.

9. This is why patents are crucial. By providing exclusivity over the commercialization of an invention or new technology, patents provide an incentive to industries to invest in taking a new technology from the research laboratory to the market as they will have a legal monopoly over the exploitation of the said product. At the same time, if the royalties obtained from licensing a given technology are shared by the university and the researchers, patents provide an incentive to the researcher and the university to actively seek industry partners to commercialize their latest inventions and technologies. Patent protection and exclusive licensing, therefore, act as a tool to provide the appropriate incentives to researchers and universities to seek ways of exploiting their inventions, and to industry to invest in the development of a marketable product from a promising invention or new technology.

10. According to M. Allen, author of a review on best practices of university technology licensing offices, “university technology transfer is mainly a system of disclosure, patenting, licensing, and enforcement of patents and licenses”.<sup>3</sup> For such a system to work and effective transfer of technology to take place a number of issues need to be addressed and instruments need to be in place. The following sections of this document will review some of the main IP-related issues that need to be addressed by policymakers and institutions alike when dealing with intellectual property rights within the context of university-industry relations.

### National Policy Framework

11. The existence of a national policy framework is generally the crucial first step. In Section 1, mention was made of the impact of the Bayh-Dole Act in the US in providing a national framework with a clear set of rules concerning the ownership of IP rights by universities as well as other non-profit organizations. A national (or regional) strategy is required that clarifies issues of ownership under different scenarios in particular whenever research is publicly funded. Conditions and criteria on exclusive licensing of such technologies also need to be considered as well as broader issues concerning the role of universities in science and technology policy, on the one hand, and educational and cultural policies on the other. The necessity to view the issue from a broader perspective is also driven by the need to address potential conflicts of interests (see below) that may

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<sup>3</sup> Allen, M. “A Review of Best Practices in University Technology Licensing Offices” in *The Journal of the Association of University Technology Managers*, Vol. XIII (2001) (<http://www.autm.net/>).

exist between universities' efforts to facilitate the exploitation of their research results with their other educational and research objectives.

### Institutional Policy Framework

12. Aside from developing a national policy framework, each university or research institute also needs to develop its own policy on commercialization of research results, distribution of benefits arising from such commercialization, as well as responsibilities for patenting and/or marketing inventions.

13. Universities in the US, Canada and many European countries have adopted a wide range of different policies on patent ownership and royalty-sharing formulas between researchers, the researcher's department, the technology licensing office and the university itself. Anecdotal evidence from a number of countries shows that lack of a clear policy on royalty-sharing and the exclusion of any benefit to the inventor/researcher or his/her department have resulted in a lack of incentive to patent and exploit inventions as well as, on occasions, university researchers patenting under their own name.

14. Institutional policy on IP for universities should also consider issues relating to IP ownership within collaborative research programs and/or other contractual agreements with various partners (including other universities, sponsors, companies, public sector bodies, etc.).

### Establishment of Technology Licensing Offices (TLOs)

15. Over the past two decades, many universities and research institutes have developed institutional structures that are specifically in charge of handling every aspect of technology transfer activities. The specific institutional arrangement has varied greatly ranging from off-campus private sector technology brokers and technology incubators for university spin-offs, to university-managed units integrated to the overall university administration. The Technology Licensing Office (or TLO) in its broadest sense<sup>4</sup>, has emerged as an important player within universities and generally plays a crucial role in identifying technologies with a commercial potential, assisting researchers to patent their inventions, packaging the technology appropriately so as to attract industry, developing a strategy to market such technologies, and leading the licensing negotiations with potential licensees.

16. It is important within this process that structures are in place to facilitate as much as possible the procedures so that researchers are not discouraged. The establishment of a structure with responsibility over technology licensing greatly simplifies the process of commercialization enabling the inventor/researcher to focus on the research side of the project and less on the related legal/business aspects for which they may not have the appropriate expertise.

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<sup>4</sup> For the purposes of this paper, the term Technology Licensing Office (or TLO) will be used to refer to all set-ups established to facilitate the transfer of technology from universities to industry, regardless of their institutional arrangement.

17. In many institutions, TLOs also play an active role in sensitizing researchers and students on the existence of the office, on the benefits of considering exploitation of their research results and on the appropriate procedures for disclosing inventions, patenting and licensing. Training and awareness raising therefore constitutes an important added function of the TLO.

18. Lack of expertise is often perceived as one of the most limiting factors in managing the commercialization of IP by universities. Bernhard Hertel, managing director of Garching Innovation points out that “the right mixture of scientists, lawyers and businessmen and a well-organized back-office is the basis for success in technology transfer.”<sup>5</sup> This contrasts with many TLOs where emphasis was devoted to technical expertise at the expense of legal and business expertise. Limitations in terms of expertise and human resources often leads to the outsourcing of part of the work to patent agents, technology brokers, business consultants, etc. Studies in the US<sup>6</sup> note that the vast majority of university TLOs outsource the preparation of patent applications to external patent agents in order to make sure that people with the appropriate technical expertise are selected to draft each patent application.

### Cultural Gap

19. The cultural gap between university and industry is largely a result of the difference in objectives. An industrial culture based on profit maximization, secrecy and search for competitive advantage over other firms is contrasted with a university culture based on broad dissemination of knowledge and sharing of results. The cultural gap is also reflected in the reasons for conducting research activities and is often a source of tension during collaborative research efforts.

20. Against this background, the patenting of inventions which results in the exclusive use of a technology and its commercial exploitation for profit maximization has traditionally been perceived as distant from the knowledge-sharing world of universities. It is important in this context to highlight the “disclosure function” of patents and the wealth of technological information contained in patent documents that may be freely consulted by researchers. A more active use of patent information by scientific researchers within universities is likely to result in a greater predisposition of researchers to pursue the patent route for their inventions. In this area, promoting greater awareness of the usefulness of patent literature and training on how to use patent databases should be perceived as important goals for universities in general and for TLOs in particular. A clear limiting factor in this respect is the fact that “the patent jargon” in which patent applications are written differs significantly from the language of technical journals. This barrier, however, may be surmounted through use and by introducing patent literature at an early stage of university education.

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<sup>5</sup> Bernhard Hertel, *Technology Transfer at Garching Innovation*, document presented at the Patinnova '01 Conference in Cardiff (UK) on 16 October, 2001.

<sup>6</sup> See, for example, Allen, M. , *op. cit.*

21. The cultural gap between university and industry often becomes most apparent when the attention shifts away from the research itself to what is to be done with the research results. The university researchers' priority to publish the results as soon as possible, motivated by the fact that publications are generally perceived as the main measure of performance and scientific credibility for academic researchers, often results in early disclosure of the invention thus compromising its patentability. In order to address these issues, discussions on the introduction or extension of the "grace period" are very much on the agenda in many countries, including the European Union.

### Conflict of Interests

22. The concern remains for many that a greater emphasis on technology transfer by universities will result in a deference of universities to the needs of the corporate world or in a move away from research projects that will not result in commercially viable technologies (e.g. basic research). According to Tsekouras *et al.*, "the basic source of tension is the conflict between the public interest which is supposed to be behind the funding of public research and the commercial interest which needs to be taken into account if IP rights become a widely used strategy for PSR [public sector research institutes]"<sup>7</sup>. These are issues that need to be addressed in order to ensure the autonomy of the university and that efforts to facilitate technology transfer from universities to industry do not result in neglect for some of the basic functions of universities. In addition, it is generally necessary to address issues concerning the differences that are likely to arise between university departments with the ability to develop commercially viable technologies and, therefore, benefit from external financing and royalty incomes, as compared to other departments where research is of a more academic nature (e.g. the humanities).

### Financial Resources

23. One of the problems faced by TLOs relates to the resources required for their functioning, particularly during the start-up phase. The expectation in most universities is that the TLO will ultimately be self-sufficient and would indeed provide substantial financial resources to the university once royalty streams from patent licensing begin to flow in. According to Lita Nelsen, director of the Massachusetts Institute of Technology's TLO, the reality is somewhat different: "the direct economic impact of technology licensing on the universities themselves has been relatively small (...) most university licensing offices barely break even."<sup>8</sup> What this points to is perhaps not so much that TLOs are not economically viable, but that the initial optimism concerning the transfer of technology from university to industry is increasingly replaced by a more realistic approach. According to Bernhard Hertel "TT [technology transfer] is a long-term process. A TT office should have a basis to survive at least for ten years. It is difficult to predict when you will get your big project. But when it comes you must have

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<sup>7</sup> Tsekouras, G. , Papaioannou, T. "Innovation Policies to Promote a More Active Use of Intellectual Property Rights", 2001.

<sup>8</sup> See <http://web.mit.edu/newsoffice/tt/1998/aug26/nelsen.html> , reprinted from Science No. 5356, 6 March, 1998.

the skills to manage it and the resources to defend it if necessary.”<sup>9</sup> In this light, private sector technology brokers have often come to be perceived as a possible alternative wherever the market for technology brokering is sufficiently developed.

### Operational Considerations

24. Operational considerations on, for example, when to patent an invention and how to go about marketing it will vary significantly from institution to institution and will also largely depend on financial resources. In some cases, TLOs strategically patent any technology that may have some commercial application and subsequently proceed to market it intensively. In other cases, market research is conducted prior to filing a patent application and only if the invention is considered to have a clear market potential is it patented and subsequently marketed.<sup>10</sup>

25. One of the greatest limitations that has been noted in many countries or institutions following the establishment of TLOs is that inventions have been transferred from laboratory shelves to the TLO shelves without subsequent commercialization. The marketing of patented inventions is one of the most essential functions of a TLO but one that has often not received sufficient attention, as personnel has generally been recruited on the basis of their technical expertise rather than their business or marketing expertise. Web sites of TLOs advertising their licensable technologies may be successful where they belong to institutions with very high visibility and reputation but may not be the case for smaller TLOs. It is thus crucial for TLOs to have a clear marketing strategy and to establish fluid contacts with industrial partners.

### Licensing or Spin-off Route

26. The commercialization of university research results follows two main routes (each one implemented in a variety of different ways): (1) the licensing of the invention to one or more existing companies for the purpose of its commercialization (2) the creation of a spin-off company that will commercialize the invention. Different institutions have favored different routes and generally decisions are taken on a case-by-case basis, including considerations on whether the university researchers themselves are willing to become involved in commercializing the technology through the creation of a spin-off company. The spread of incubators within university structures (this is the case also in developing countries, see the case of Brazil in the annex) has been one way of facilitating the creation of spin-offs and in assisting the development of companies through its start-up phase. However, even when based within universities, incubators are generally not exclusively aimed at the commercialization of university research results but also accept extra-university start-ups. The existence of a well-developed venture capital market is also important for the establishment of university spin-offs. The Silicon Valley represents an example where the conjunction of universities with a high degree of technical expertise, technology incubators and ventural capitalists has facilitated the development of a large number of university spin-offs.

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<sup>9</sup> See Bernhard Hertel, *op. cit.*

<sup>10</sup> Carr, R. *Menu of Best Practices in Technology Transfer* in <http://millkern.com/rkcarr/flpart2.html>



## Conclusion

27. University – industry relations are strongly influenced by the existing national IP policy framework as well as by the patent policy of individual institutions. If an IP policy that encourages technology transfer and commercialization of university research results has proved to be important to establish the right set of incentives, there are a number of institutional issues that need to be addressed to make sure that the “cultural gap”, potential conflict of interests, financial issues and other aspects that may condition the success of TLOs are adequately taken into consideration. If a spread of a patent culture among researchers within universities is advisable in order to facilitate technology transfer and the commercialization of research results, promoting greater use of patent literature could be an important first step to partly bridge the cultural gap. This would be important as it would bring researchers closer to the patent system while at the same time making the “disclosure function” of the patent system more relevant to the research world as a whole.

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