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Rethinking TT Metrics for Developing Countries

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Many commentators point to the United States technology-transfer system as a model of success for other countries to emulate. The concept of technology transfer, spurred by early notable successes at the University of Wisconsin, the Massachusetts Institute of Technology and others, was brought to most US research universities in the 1980s by the Bayh-Dole Act. To meet the requirements set forth by Bayh-Dole, research universities began to clarify university intellectual property policies, and established technology licensing offices to facilitate technology transfer and commercialization. As a result of this new focus on technology transfer, a vast number of technologies first developed in university research laboratories have been successfully transferred to the private sector through licensing agreements. It is widely believed by technology transfer professionals in the US that the technology transfer activity spurred by Bayh-Dole has contributed to the growth of a number of new industries, including biotechnology, information technologies and nanotechnology.

It is difficult to argue against the assertion that Bayh-Dole radically changed the role of universities in the US economy. However, critics of technology transfer have, over the years, placed doubt upon the actual benefits technology transfer has brought. Motivated to answer these critics, some within the technology transfer profession set out to demonstrate how technology transfer has indeed benefited the country, both economically and socially. Early work in this endeavor demonstrated that the commercialization of university technologies

encourages private sector Research and Development (R&D) investments.[1] Probably the most often used instrument to demonstrate the positive impact of technology transfer has been the results of the yearly survey conducted by the Association of University Technology Managers (AUTM).

Begun in 1991, the AUTM survey has become the most well known method of gauging technology transfer performance in the US, and to a lesser extent, in Canada. The voluntary survey, distributed to research universities throughout the US and Canada, asks a series of questions pertaining to technology transfer capacity and achievement, including university research expenditures, patents filed, start-up companies formed and licensing income. This effort in tracking technology transfer performance has served as a model for similar survey activity in other countries, including the United Kingdom, Canada and Japan.

Licensing Revenue – The Accepted Measure of Success

In some circles, the most touted measure of technology transfer success within the AUTM survey is gross licensing income. Gross licensing income holds a special position as a litmus test for success because it is used to show the economic impact of technology transfer. Most licensing agreements that universities sign with industry call for a relatively small percentage in royalty fees. Thus, it can be assumed that royalty revenues that universities do receive actually reflect substantially larger overall value generated for the private sector. One study, using licensing income received by universities as a basis for aggregate economic impact, estimated that the $565 million in licensing revenue that universities received in 1998 translated into $28 billion in product sales.[2] Since universities received $1.38 billion in gross licensing revenue in 2002, logic can only conclude that product sales have also risen over the years.

Gross licensing income is, naturally, also a favorite measure of success for TLOs in the upper tier of this category. High licensing revenue can translate into self-sufficient TLOs and more money for university research and general spending. This of course raises the status and prestige of TLOs at these universities and within the technology transfer profession at large.[3]

The observed economic benefits of technology transfer in developed countries have inspired efforts in developing countries to build technology transfer systems that tap into the R&D capacity of their universities and government research centers. While most of these efforts are still in their formative stages, policy makers are looking at the measures of success used in established technology transfer systems for guidance in measuring their own progress. However, as argued below, the very different characteristics between developed and developing countries make it unwise to use gross licensing revenue – the standard of success in the US and other developed countries – as a guide to their technology transfer success.

Comparing Apple Orchards and Orange Groves

While there may be compelling reasons for universities in the US and other developed countries to use gross licensing revenue as a key measure of success, it makes very little sense for developing countries that are in process of building their own technology transfer systems to measure their success by this standard. The ability of a university to engage in technology transfer activity does not develop overnight – there are a number of factors that go into a successful technology transfer system. Universities must craft intellectual property policies, technology transfer duties must be integrated into the overall research administration, and technology-licensing officers must be trained. Given the fact that technology transfer is a very new concept to most universities in developing countries, much time and work must be devoted to ensuring a suitable environment for technology transfer before attention can be diverted to gross licensing revenue. Furthermore, if the US experience is any indication, it takes a long period – in fact, up to ten years – before new TLOs begin to receive any noticeable revenue stream from licensing activity.[4]

But the most important reason why gross licensing revenue is a poor measure of technology transfer success for developing country universities is because there is a fundamental difference in the role R&D plays in the economies of developed and developing countries. According to the National Science Foundation, developed countries tend to invest quite a lot in R&D compared to developing countries, and this investment is led by the private sector. For developed countries like the US, Japan and Germany, it is not uncommon to see national investment in R&D investment range between two and three percent of GDP. Further, the vast majority of R&D activity in these countries – some 65-75% – is paid for and performed by industry.[5]

In comparison, most developing countries invest little in R&D (see chart), and those investments that are made are usually financed by governments, and/or performed by public research organizations like universities and government research institutes. For instance, 60% of all R&D funding in Brazil came from the public sector, while 55% of all research activity was performed by universities and government research institutes.[6] In South Africa, 65% of all R&D was performed by either universities or government science councils;[7] while in Mexico, 79% of R&D was performed by public research organizations.[8]

R&D Investment as a Percentage of GDP [9]	
Japan	3.01%
U.S.	2.63%
Germany	2.38%
Brazil	0.91%
South Africa	0.69%
Mexico	0.34%
Malaysia	0.22%

The stark differences in the R&D characteristics between developed and developing countries have significant implications for technology transfer practices in developing countries. The lack of R&D investment by the private sector in developing countries necessarily implies that the market for technology in these countries is not as robust as it is in developed countries. It has been observed by economists for some time that private industry in developed countries embrace not only price competition, but technological competition as well, which has led to increased productivity and greater economic growth.[10] Private industries in developing countries on the other hand, have focused much more on price competition, capitalizing on low-cost labor as their primary competitive advantage.[11] Since, generally speaking, most TLOs license their technologies to firms in their local area, the lack of private sector investment in R&D in developing countries makes it much more difficult for TLOs in developing countries to license their technology than their counterparts in developed countries, thus negatively impacting a TLO's ability to secure gross licensing revenue. This problem is further exacerbated by the fact that most R&D capacity is concentrated in public sector research centers, limiting the ability of the private sector to make use of technological improvements developed by public research organizations.

The Metrics that Matter

The practices of TLOs in developing countries must reflect the circumstances they in which they find themselves. Given the poor R&D investments made by the private sector in developing countries, the goal of securing a substantial, stable stream of income from licensing activity may not an attainable goal in the near-to-mid-term. This, however, does not mean that a policy of building a technology transfer system in universities is not worth pursuing. There are still substantial social and economic benefits to be had by developing countries through technology transfer. What it does mean though, is that a technology transfer policy must be crafted with certain goals in mind and the metrics used should be designed to measure the attainment of these goals.

For instance, a technology transfer policy should set out to engage researchers in the technology transfer. Since most universities in developing countries have not had much experience with technology transfer, one of the first priorities of a technology transfer policy is to encourage participation of researchers in the technology transfer system. More often than not, this entails establishing TLOs. Most TLOs take on a number of duties to facilitate technology transfer, but one of the most important, yet understated of these duties, is to encourage researchers to participate in technology transfer. Indeed, while the intellectual assets created by researchers serve as the starting point for technology transfer, these assets do little good if they are left fallow. It is the role of TLOs to "mine" for intellectual assets that may be commercialized, by building relationships with researchers and guiding them through the technology transfer process. Thus, a good measure of the success of a TLO in promoting technology transfer among academics is the number of invention disclosures received yearly.

Another important goal for a technology transfer policy is to help build a stronger role for R&D in the private sector. As discussed above, there is comparatively little private sector investment in R&D in most developing countries, and this fact impedes the ability of a TLO to license its technologies. To directly address this, a developing country's technology transfer policy should focus on supporting the creation of start-up/spin-out companies to commercialize university-developed technologies. To do this, there must be a proper infrastructure in place. This includes ensuring there are adequate levels of venture capital or other funding for technology start-ups, corporate and bankruptcy laws that encourage risk-taking and entrepreneurialism, and intellectual property laws to secure the necessary investments in technology development. The measure of success in this case, would of course be the number of technology start-up companies formed yearly, as well as the aggregate number of start-up companies formed over the years.

(Endnotes)

1 Peter Kramer, et. al., Induced Investments and Jobs Produced by Exclusive Patent Licenses – a Confirmatory Study, The Journal of the Association of University Technology Managers, Vol. 9 (1997); Lori Pressman, et. al., Pre-Production Investment and Jobs Induced by MIT Exclusive Patent Licenses: A Preliminary Model to Measure the Economic Impact of University Licensing, The Journal of the Association of University Technology Managers, Vol. 7 (1995).

2 Lori Pressman and Don Kaiser, Measuring Product Development Outcome of Licensing at MIT, presentation at AAAS Annual Meeting (Feb. 17-22, 2000).

3 It should be noted that the vast majority of US universities receive very little income from licensing activity, compared to overall research funding.

4 Eric Garduño, South African University Technology Transfer: A Comparative Analysis, IIPI Study (Jan. 2004).

5 National Science Board, Science and Engineering Indicators – 2002, §§4.7-4.8.

6 Id.

7 National Advisory Council on Innovation, Key Facts and Figures (2002).

8 National Science Foundation, supra note 6.

9 Id.

10 Joseph Schumpeter, Capitalism, Socialism and Democracy (3rd ed., 1950).

11 Vernon Ruttan, Technology, Growth and Development: An Induced Innovation Perspective (2000).