

International Finance Corporation

IFC Emerging Markets Technology Transfer Facility (TTF)

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Project Leader:

Gordon I. Myers
Principal Counsel – Team Leader
IFC Legal Department/Technology and Private Equity
gmyers@ifc.org

Project Consultant:

Stephen M. Sammut
Senior Fellow
Wharton Health Care Management and Entrepreneurship
smsammut@wharton.upenn.edu

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1.0 Introduction: The IFC Technology Transfer Study and Concept

1.1 Basis for Project

Technology transfer is generally defined as the process of sharing of skills, knowledge, technologies, and methods of manufacturing among industries, universities, governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. The same definition applies to technology transfer emanating from academic research. Academic technology transfer is today an important part of the university environment representing each institution's commitment to improving the public good by promoting the commercial development of its inventions and other intellectual property into usable products. The efforts have the collateral benefit of promoting economic growth by creation of companies around academic technologies, job creation, and attendant economic multipliers.

Many universities have specifically added technology transfer to their stated missions: education, research, patient care (where applicable) and promulgation of its technologies for the public good: a so-called "four legged-stool").

Academic technology transfer is rapidly becoming a universal activity **in both Part I and Part II countries**. The United States, however, effectively had a 30 year head start as a result of the provisions of its enabling legislation, the Bayh-Dole Act, which is described in detail in Section 2. The provisions or principles of the Bayh-Dole Act have been largely adopted throughout the developed world and the emerging markets.

This study shows that while the adoption of enabling legislation is an immensely positive development, the establishment and execution of a technology transfer enterprise is expensive and challenging. Within any country or university, the planning and development of an office demands assessment of research capability, a rationale for undertaking technology transfer, a stated set of objectives and measurements, and the appropriate policies and resources necessary to launch a program. This framework, however demanding, does not exclude Part II countries from participating in the process.

In order for technology transfer to work within Part II countries or for Part II countries to derive benefits from technologies originally created in Part I countries there must be an acceleration of internal capacity building AND access to other service providers and structures that address existing inefficiencies and resource limitations.

There is a critical role for the IFC to play in improving the overall process, especially for Part II countries, through the formation of an IFC Technology Transfer Facility (TTF) which is the subject of this report.

Currently, the IFC has a strong technology investing business, including well-performing investments in information technology, biotechnology and clean technologies. It also has developed a capacity to deliver financing to small and medium-sized enterprises, through wholesaling vehicles and other mechanisms.

The larger objective of IFC TTF is to develop the capacity and effectiveness of emerging markets institutions, such as universities or research institutes, to identify marketable technologies they develop, and to commercialize those technologies with private sector partners globally. It would do so with a combination of advisory services, assistance in developing technology management capacity, and wholesaling structures, such as credit lines, that would allow IFC to provide early stage financing through trusted gatekeepers. IFC's business in turn would benefit through its early association with entrepreneurs and companies that will grow to need additional financing, including equity, to meet their business objectives, as well as corporate governance and other services.

1.2 Project Description and Hypotheses

In Part I countries, public research organizations, such as universities and research institutions, have developed sophisticated Technology Licensing Offices (TLOs). The TLOs have a recognized capacity to identify and harvest technologies with commercial potential, and to identify private sector partners able to realize that potential. They also may structure cross-licensing deals and similar arrangements, where necessary, to assure that the partner has necessary commercialization rights.

Box 1: Does technology transfer matter in a time of financial crisis?

- Movement towards value-added products is critical for development
- Existing stock of innovation must continue development or become a wasted asset
- Technology transfer programs contribute to the recruitment and retention of scientists, engineers, physicists and business professionals in Part II countries, especially those at risk of brain drain
- Innovation in areas such as food production, energy, environment, IT and health services and technology will be critical to building growth momentum and diversifying local economies
- Technology transfer is ultimately a currency of human development

At the start of the project, it was anticipated that the Facility would: (i) identify best practices for replication or modification in emerging markets, and (ii) partner with Part I institutions to develop similar capacity in emerging markets. Specifically, it was projected that the IFC would provide or mobilize advisory financing for emerging markets research organizations to create TLOs. The IFC, we speculated, could identify Part I partners, to provide expertise in establishing and managing TLOs, as well as identifying marketable technologies. We also anticipated working with these partners to identify appropriate pilot institutions in our client countries.

It was speculated that at the conclusion of the research that the IFC would also provide a small seed capital facility that would allow the TLOs to invest money in their new ventures, and perhaps attract other private sector financing. A possible model for the facility, we thought, might be the IFC's early microfinance efforts (or variations thereof), which provided funds to local institutions for "onlending" to projects vetted by Shorebank or another institution. Under that scenario, Part II institutions might be authorized to draw down IFC funds for opportunities cleared by representatives of a Part I partner, or a committee comprising representatives of both the Part I partner and the Part II client.

Box 2: Core Hypotheses Summarized – We expected to find that:

1. Universities in Emerging Markets are growing their research platforms
2. National priorities are evolving to encourage technology transfer but the process lags for reasons of human and financial resources
3. Part I and Part II countries are generally emulating the US technology transfer model but it is likely that the model is not entirely suitable outside the US, especially in Part II countries
4. Industrial relationships of EM research institutions with Part I countries remain limited
5. Professional staffing and training remain limited
6. Universities in Part I countries rarely directly license companies in Part II countries. Universities typically will issue a world-wide exclusive license with a right to sublicense to companies with capacity for global reach; for our purposes we describe such companies as "master licensees." Master licensees are rarely companies headquartered in Part II countries and it is seldom the case that the master licensees pursue development or product introduction in Part I countries.
7. Institutions in Part I and Part II countries have articulated economic goals and metrics and are largely evaluated on meeting these

8. The World Bank Group has a role in addressing policies, capacity development, financing of programs and companies, and promotion of intellectual property flows.

Innovation requires commercialization. The uniqueness of a Silicon Valley or similar innovation-focused economy is that a surrounding "ecosystem" facilitates and incentivizes practical application of inventions. The first step in many U.S. ecosystems at least, has been a local research institution that proactively seeks identifies and promotes possible commercial application of its scientific and engineering achievements.

Many Part I countries have endeavored to replicate these ecosystems. These efforts may be promoted, and in some cases financed, by government agencies, local economic authorities, professional trade associations, and similar organizations. Our markets also show interest. For example, in a SECA country, where local government and civic society may have less capacity, IFC has been asked to consider investments in research parks associated with private universities, to provide incubation opportunities for research-based entrepreneurs.

We also hypothesized that the IFC can also play a more direct role, so that the economic benefits of innovation can be harvested and realized in-country. The Corporation has a unique convening power, to bring together universities and institutions that might not respond to lower profile initiatives. It can adopt and enhance existing TLO approaches for emerging markets companies, including advice on governance and sustainability where appropriate. Finally, the IFC can provide a cofinancing facility through intermediaries, based on its prior microfinance experience.

1.3 Observations

The research methodology of this study is described in Section 3. Technology licensing offices or government funding agencies were interviewed in the following countries (See Annex for details of interviews:

Argentina – Government Ministry of Science and Technology

Brazil - UNICAMP

Chile – CORFO (govt. economic development agency) and NEOS (private agency)

China – Tsinghua University

Germany – Humboldt University

India – “STEM” (National organization representing universities)

Israel – Yissum (Hebrew University commercial development arm)

Japan – METI central tech transfer organization, Waseda University, two prefectural consortia

Malaysia - Universiti Sains Malaysia and Universiti Putra Malaysia

South Africa - Medical Research Council Innovation Center

Sub-Saharan Africa - Ghana, Rwanda, Tanzania, Kenya (secondary from a doctoral student)

United Arab Emirates – UAE University

United Kingdom – Cambridge University
USA – Stanford, MIT, Cornell, Wistar Institute

As written previously, academic technology transfer has become a near-universal activity. The provisions or principles of the US legislation, the Bayh-Dole Act, have been largely adopted throughout the developed world and the emerging markets. Despite the best intentions, the collective allocations of resources and internal educational efforts, using the US as a benchmark, Part II countries in varying degrees face significant challenges as related to:

- Staffing offices with professionals with requisite skills and experience
- Financial resources for the establishment and growth of offices
- Ability to fund the cost of local and international patenting
- Overall research quality, capacity and output
- Mechanisms to market and promote available technologies
- Ready access to licensees
- Limited legal counsel for contracts and patent support (or limited resources to pay for such services)
- Immature or developing intellectual property statutes or administrative systems
- Absence or limited availability of value-added risk capital for the creation and funding of new companies formed around their technologies
- Little to no cross-collaboration with other universities, either locally, regionally or internationally

An outcome is that Part II countries generally have limited ability to license their technologies to companies in Part I countries for all the above reasons. Within their own countries there are often a limited number of potential licensees that can bring a university's technologies to global markets.

Universities in Part I countries are not entirely immune from some of the above issues and are limited in their capacity in varying degrees.

Another unexpected outcome is that Part I countries have significant obstacles of their own in either directly transferring their technologies to companies in Part II countries or to companies in Part I countries that will undertake commercialization of the technologies for sale and use in Part II countries.

And finally, while the US is the benchmark, its own system is arguably inefficient even in its own markets; it is the basic model emulated in both Part I and Part II countries. It is the prevailing model, but not necessarily the most suitable model, and in some cases wholly inappropriate.

1.4 Conclusions

Conclusion: *With some variations, this study confirmed that an IFC TTF can play an essential role and offers as its conclusion below well-defined and immediately actionable “Hypothetical Interventions.”*

The Hypothetical Interventions **appear starting on Page 11**. They are derived from observations and the articulation of challenges confronting technology transfer offices in Part II countries but have equal applicability for many institutions in Part I countries.

The Hypothetical Interventions describe how the IFC can attenuate the problems of technology transfer and promote new approaches to make the process more efficient. While there is a general consensus among interviewees as to the nature of the problems, there has not been an open discussion among the stakeholders as to whether the Hypothetical Interventions are appropriate, practical, implementable and sustainable.

Based on the findings in this report, we have scheduled a **Technology Transfer Convocation** to be held at the IFC on May 14 and 15. The purpose and goals of the TTF’s Technology Transfer Convocation (**see structure starting on page 20**) are to vet the proposed Hypothetical Interventions. The participants will be a working group of representatives of the universities and institutions that were interviewed, IFC staff and others from the World Bank Group, corporations with an extensive history of in-licensing university technologies and ultimately offering ensuing products globally, directly or through sub-licensees, and other stakeholders in the technology transfer process. Participants will have a significant working role before, during and after the Convocation.

Box 3: Will improved technology transfer systems truly contribute to innovation and commercialization in Part II countries?

Technology transfer contributes to research capacity in a number of ways:

1. Provides additional sources of resource funding
2. Creates potential collaboration between investigators in Part I and Part II countries
3. Assists in faculty recruitment and retention; slows “brain drain”
4. Encourages the creation of local companies
5. Builds entrepreneurial resources
6. Expands awareness of export opportunities
7. Forms a basis for foreign direct investment
8. Funds development of high-margin products suited for Part I countries where the funding, capital or profits can underwrite the modification and use in local markets
9. Brings companies in Part I countries a better understanding of market opportunities in Part II countries
10. Creates a bridgework for technologies from Part I countries to be developed and modified for use in Part II countries.

1.5 Recommendations

1.5.1 The **Hypothetical Interventions** (HI) herein set forth should be used as a discussion mechanism to reach a consensus and action plan for an IFC TTF. The HIs should be vetted in a Convocation (scheduled for May 14 and 15 2009 at the IFC as a 1.5 day event).

1.5.2 The Convocation

- 1.5.2.1 The Convocation structure is described starting on page 19.
- 1.5.2.2 The major goal of the Convocation is to produce a consensus as to how the HIs should be modified and incorporated into the TTF.
- 1.5.2.3 The Convocation is structured as four Working Groups, one for each of the HIs described below. Note that HI # 1 is divided into Parts A and B. Each Part will be the subject of a Working Group.
- 1.5.2.4 The Convocation is to include internal IFC/WBG stakeholders for critical analysis and discussion; internal stakeholders will be asked to participate as co-chairs in the working group of most interest to their IFC responsibilities.
- 1.5.2.5 Outside invitees includes university representatives who, as co-chairs, will provide critique and guidance as to the value and practicality of the HIs. Each working group will have one US tech transfer professional and one or more tech transfer professionals from outside the US.
- 1.5.2.6 Other outside invitees will include corporations proposed by IFC/WBG stakeholders and foundations with a relevant interest, such as the Kauffman Foundation.
- 1.5.2.7 The Convocation will be professionally facilitated.
- 1.5.2.8 MBA student interns from the Wharton School will be assigned to the Working Groups to serve as recorders and developers of presentations to be delivered in plenary session on the second day of the Convocation.

1.5.3 Implementation

- 1.5.3.1 The results of the Convocation will be summarized for further comment by the IFC/WBG and outside co-chairs

- 1.5.3.2 Based on the results of the Convocation the IFC - TTF will form an internal/external Advisory Board. The preliminary recommendation is that the Advisory Board include the academic participants at the Convocation.
- 1.5.3.3 The TTF structure resulting from the Convocation will also be presented to a mid-June conference of the Association of University Technology Managers (AUTM) in mid-June 2009. The conference theme is international technology transfer and will provide a venue for further comment and suggestions
- 1.5.3.4 The results of the Convocation will be combined into a comprehensive business plan for the TTF by the end of June, 2009
- 1.5.3.5 The business plan will be presented to senior management of the IFC by the end of June.

Technology Transfer Facility Hypothetical Interventions (See 1.4 above)

Intervention	Nature of Problems to be Solved	IFC-TTF Capacities and Possible Role(s)	Working Group Issues for Business Plan
HYPOTHETICAL INTERVENTION 1: Facilitate integration of emerging markets research institutions into global technology flows and marketplace.	Challenge: Markets and innovation, as well as the challenges and needs that generate innovation, increasingly involve emerging markets. Part I and Part II research institutions recognize this, but have not yet developed an infrastructure to support globalization.		
Support development of an international community of TTO professionals	Operational background and issues: 1. Need for global organization of TTO professionals. Currently, many countries have well-established, effective professional organizations for technology transfer professionals. There have been formal and informal attempts to meet jointly or form other linkages. These efforts have not yet resulted in an effective mechanism to coordinate global learning and facilitate cooperation in technology opportunities. 2. Training and development programs Training and development programs and materials are well served in most Part I	<i>(a) use its convening power to support establishment of a joint organization,</i> <i>(b) provide early support for design and implementation of programs for Part II countries</i>	Concept Elements: <ul style="list-style-type: none"> • <i>Form/structure</i> • <i>Membership (individuals or institutions?)</i> • <i>Research programs and activities</i> • <i>Training programs and activities</i> • <i>Implications for global scope (offices, alliances, IT and communications needs)</i> • <i>Staff and advisory needs</i> • <i>Financial requirements</i> • <i>Sponsoring institutions</i> • <i>Funding sources (sustainable revenue models?)</i> IFC Business Plan Elements: <ul style="list-style-type: none"> • <i>Seed financing</i> • <i>Introductions to existing partners</i>

	<p>countries. For reasons of cost, distance, language, and the like, training is limited in many Part 1 countries and nearly all Part II countries. There have been organizations established to offer “moveable feasts” to countries throughout the world (e.g., MIHR), but these have suffered from limited resources, unsustainable demands on their faculties, materials not fully customized for local needs, and other limitations.</p> <p>Furthermore, as noted below, the model for university technology transfer may not yet be optimized. The training model may require tailoring for the specific needs and capacities of emerging markets institutions.</p>		<p><i>(Kaufmann, IBM, Tsinghua, Meteksan, Ventureast)</i></p> <ul style="list-style-type: none"> • <i>Development of “train the trainers” program</i> • <i>Leverage existing IFC consultancy brands (SME Toolkit, Business Edge) and direct advisory services</i> • <i>Leverage existing WBG exercises and programs (Handbook, Infodev)</i> • <i>Links to Cleantech research programs</i> • <i>Financial crisis link – eg, supporting higher education institutions, helping them identify revenue streams?</i> • <i>Will trust funds be interested?</i>
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<p>HYPOTHETICAL INTERVENTION 2:</p> <p>Target IFC advisory services to building TTO capacity in Part II countries</p>	<p>Challenge:</p> <p>How can IFC advisory capacities be supplemented, enhanced and packaged to develop TTO capacity in emerging markets?</p>		
	<p>Operational background and issues:</p> <p>Issues associated with the establishment, operation and effectiveness of TTOs in emerging markets include:</p>		<p>Concept Elements:</p> <ul style="list-style-type: none"> • <i>Is this the right portfolio of advisory services?</i> • <i>Can IFC deliver these services from its existing consultants, or does it need to develop new providers?</i> • <i>Should IFC partner with other interested organizations, for example, Kauffman Foundation?</i> • <i>Are funding sources available and sufficient? Who would pay?</i> • <i>Should these services be focused on research institutions in least developed countries and/or in priority research areas (cleantech, agribusiness)? Is there a difference in approach for least developed countries?</i> • <i>Should advisory services be focused on web-based toolkits or consultant intervention?</i> • <i>How can this be coordination with WB technology commercialization handbook?</i> <p>IFC Business Plan Elements:</p> <ul style="list-style-type: none"> • <i>Prioritization of services</i>

			<ul style="list-style-type: none"> • Identification of existing advisory services that can be packaged or adapted for TTOs • Rollout (what services in years 1-3, etc) • Staffing, including web vs. direct delivery by IFC consultants • Sources of funding, including client fees
	Issue 1: Enabling culture and environment	<p>(a) identify best practices for incentivizing innovation and technology harvesting at emerging markets research institutions and their faculty, eg, tenure decisions. IP ownership, outside compensation policies, conflicts management,</p> <p>(b) identify regulatory obstacles in member countries, including IP framework, eg by assisting H1 organization in preparing country audits (and promoting the use of audits in countries with no prior experience in this regard), and integrating intellectual property and related innovation issues into the Doing Business report,</p> <p>(c) structure formal and informal partnerships between research institutions and private sector,</p> <p>(d) develop local capacity, for example, in local development agencies</p>	<ul style="list-style-type: none"> • Should these services be provided through or in coordination with WBG partners, eg Doing Business? • What kinds of partnerships can be structured, and who are potential (ie, specified) partners? • Are local development agencies interested in this work?
	Issue 2: Operations, management and procedures	IFC can (a) advise on intellectual property identification and management,	<ul style="list-style-type: none"> • Can IFC identify an academic or commercial partner to advise on

		<p><i>(b) work with H1 organization to develop a web-based toolkit for technology transfer, to be included in its SME Toolkit product,</i></p> <p><i>(c) work with HI 1 international organization to provide training under the Business Edge brand,</i></p> <p><i>(d) support best practice governance principles, including conflicts and ethics considerations</i></p>	<p><i>intellectual property management?</i></p> <ul style="list-style-type: none"> • <i>What are the conflicts and ethics considerations that require case study and specification?</i>
	Issue 3: Marketing innovation licensing and spin-outs)	<p><i>(a) with other WBG groups, assist research institutions in identifying core competencies with possible commercial implications,</i></p> <p><i>(b) identify possible commercial partners from its client base,</i></p> <p><i>(c) provide training on managing commercial partners consistent with research needs and priorities, including license structures,</i></p> <p><i>(d) provide corporate governance and management advice to spin-outs.</i></p>	<ul style="list-style-type: none"> • <i>How can research institutions identify promising niches? Can they do so consistent with national priorities?</i> • <i>What skills are needed to manage potential commercial partners?</i> • <i>What value add services can IFC provide to spin-outs?</i> • <i>Does the group believe licensing or spin-out provides more promising avenue for technology transfer? If spin-out, what are governance needs, exit strategies?</i>
	Issue 4: Integration into global technology marketplace	<p><i>identify North-South, South-South and South-North technology opportunities, including establishing links among research institutions in partnership with HI 1 international organization</i></p>	<ul style="list-style-type: none"> • <i>Is separate advisory service in this area needed in light of other proposed interventions?</i>

	<p>Issue 5: Sustainable development</p>	<p><i>(a) enhance existing E&S guidance documents to address research and innovation concerns, for example, humane treatment of animals, use of indigenous knowledge, and biodiversity concerns, and develop guidelines for other areas, such as access to innovation by the most disadvantaged,</i></p> <p><i>(b) assist in identifying commercially promising technologies in climate change and energy efficiency areas,</i></p> <p><i>(e) consider and apply appropriate developmental metrics for TTOs and related IFC contributions, especially where technology transfer goal is embedded in larger programs (eg, national, regional or local economic development programs)</i></p>	<ul style="list-style-type: none"> • <i>Should updated Performance Standards include innovation and technology emphasis or sensitivity?</i> • <i>What are the key ethical concerns for Part I and Part II institutions in emerging markets? For what areas are standards needed, or are there existing benchmarks?</i> • <i>What are some appropriate metrics for developmental impact of IFC's TTO activities?</i> • <i>How can TTO support be tied to broader developmental aims? Why is this priority area during financial crisis?</i>
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<p>HYPOTHETICAL INTERVENTION 3:</p> <p>Provide IFC financing targeted to specific gaps and needs in TTO space</p>	<p>Challenge:</p> <p>Can IFC deliver financial products that meet identified market needs on sustainable (ie, quasi-commercial/DFI) basis?</p>		
	<p>Operational background and issues:</p> <p>TTO programs have generated financing needs and solutions that mirror IFC product offerings. In emerging markets DFI involvement may be required to attract other financing sources, provide value add services such as opportunity validation, market insight, corporate governance guidance and life-cycle financing options.</p> <p>Product needs might include:</p> <ul style="list-style-type: none"> • For spin-outs: “Valley of death” financing, in partnership with other institutions, local governments, private investors and/or through intermediaries • Risk-sharing or other forms of support for technology licensing by research institutions • Direct financing of post-VoD companies and venture capital funds • Financing to support local infrastructure development, such as research parks and associated services <p>There are several motivations:</p>	<p><i>IFC can offer tailored versions of existing financial products to meet some of these needs:</i></p> <ul style="list-style-type: none"> • <i>VoD financing: (a) credit line administered by Part I partner institution, as per TTF proposal, (b) seed capital financing, with IFC investment or risk-sharing (first loss or partial guarantee)</i> • <i>Subnational financing to support infrastructure financing for eg research parks</i> • <i>Direct financing of post-VoD companies and venture capital funds</i> • <i>Financing private educational institutions to develop innovation capacity?</i> <p><i>Consider also: (1) new forms of risk capital financing (eg, loan-type quasi-equity) from SME Ventures initiatives, (2) working capital facilities for intangible assets businesses</i></p>	<p>Concept Elements:</p> <ul style="list-style-type: none"> • <i>What financing interventions are most effective in principle (direct IFC financing, wholesaling, risk sharing)? Should IFC focus on investing in companies or infrastructure (including educational institutions)?</i> • <i>Are there any learnings (or potential partners) from SME Ventures proposals?</i> • <i>Are any other interventions needed urgently in light of financial crisis?</i> • <i>Are there other proven or needed financing tools? What are some model programs?</i> • <i>Will IFC investment activities bring later stage financing opportunities?</i> • <i>How will IFC costs (eg legal) be paid?</i> <p>IFC Business Plan Elements:</p> <ul style="list-style-type: none"> • <i>Product volumes over 5-year period</i> • <i>Pricing and profitability</i> • <i>Staffing and partner needs</i> • <i>Potential co-investors, including DFIs with complementary interests and/or activities</i> • <i>Whether financing operation should be</i>

	<p>1. Most technologies are too early in development to be entertained for licensing by most companies. This tends to be most often true in the life-sciences, but is likely to be true in Cleantech. The company is formed and capitalized, typically by third parties (“angels” or VCs) and sometimes by a fund owned by the university, for the purpose of bringing the technology to a level of value and suitability for licensing.</p> <p>2. Local economic development. The entities are often formed and/or housed at an incubator facility associated with the institution.</p> <p>Institutions universally identify financing of innovation and spin-outs as the single biggest challenge. While there are some major regions where there are resources, most locations have very limited sources of capital. Many national, state and local governments have investment programs designed to provide funding at the seed-stage of development, but in many instances the level of funding and value add support is severely limited.</p>		<p><i>segregated in separate facility, operated by CIT, etc.</i></p> <ul style="list-style-type: none"> • <i>Whether education, CIT, life sciences projects, etc. can include TTO capacity/financing package (eg, research parks)</i>
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Intervention	Nature of Problems to be Solved	IFC-TTF Capacities and Possible Role(s)	Working Group Issues for Business Plan
<p>HYPOTHETICAL INTERVENTION 4:</p> <p>Facilitate flow of products derived from university technology in Part I countries to companies in Part II countries; facilitate flow of products derived from university technology in Part II countries to companies in Part I and Part II countries</p>	<p>Challenge:</p> <p>Products derived from university technologies in either Part I or Part II countries are often not developed, modified, manufactured or marketed globally.</p>		
<p>Establish a business or facility to support globalization of technology flows, in terms of (a) applying Part I innovations to Part II markets, and (b) incorporating Part II innovations in commercialization “packages”</p>	<p>Operational background and issues:</p> <p>Many technologies from Part I research institutions are licensed on a world-wide exclusive basis to a single corporation which then has the performance obligations to bring products to all markets covered by the patents or Know How. Most corporate licensees will serve some market segments or geographies through sub-licensing of their rights. Frequently, however, the corporate licensee does not pursue the emerging markets or developing countries directly or indirectly.</p> <p>Part I research institutions often rely on home-grown systems and web-access to their availability of technologies, as well as personal</p>	<p><i>(a) “pull” Part I corporate licensees into emerging markets, by (for example) (i) maintaining clearinghouses of potential technology partners (for example, who agree to code of conduct to respect intellectual property rights of licensors, as a condition of IFC financial support) , (ii) assisting corporate licensees in identifying scalable emerging markets product opportunities, (iii) proactively sponsoring real and virtual networking events matching TTOs with potential partners and other emerging markets stakeholders.</i></p>	<p>Concept Elements:</p> <ul style="list-style-type: none"> • <i>Should these activities be pursued directly, or thru HI 1 international organization? If indirect, what is IFC role?</i> • <i>Are these the right interventions to support globalization and emerging market participation?</i> <p>IFC Business Plan Elements:</p> <ul style="list-style-type: none"> • <i>Form/structure</i> • <i>Human resource requirements</i> • <i>Financial requirements</i> • <i>Funding needs and sources</i> • <i>Business/Revenue Model</i>

	<p>networks of the office professionals, the scientists, and their respective university community. While deals are done and many technologies are placed, the efforts are not systematic. These limitations have downstream effects as described above.</p> <p>Furthermore, companies in both Part I and Part II countries have no centralized way of listing their interests and capabilities. This is particularly acute for companies in Part II countries.</p>	<p><i>(b) support through its convening power, advisory capacity and funding sources, an international inventory of available technologies or specific capabilities.</i></p> <p><i>IFC may target these objectives directly, or through the international organization described in HI 1.</i></p>	<ul style="list-style-type: none"> • <i>On-going operation and management</i> • <i>Alliances</i> • <i>Rigorous commercialization planning</i> • <i>Standards and metrics for effectiveness and sustainability</i> • <i>Reporting/auditing for effectiveness and sustainability</i>
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IFC Emerging Market Technology Transfer Convocation (See 1.5 above)

Structure and Content:

Wednesday Evening, May 13

Reception and Dinner

Day One – Thursday, May 14

Session	Time	Session Title	Format	Content	Goals
	7:30 – 8:30 AM	Registration and continental breakfast			
1	8:30 - 9:00 AM Plenary Room	Welcome and Introduction	Short welcome by IFC management member Short welcome by GIM	Informal Outline agenda, objectives, process of Convocation	Establish (a) IFC interest in innovation, (b) goals and procedures
2	9:00 - 10:00 AM	Participant Introductions	Each participant has 3 to 5 minutes to describe their programs	Brief background, highlight priority challenges / solutions, operations, relationships with other partners in country or area	Establish relationships, describe dynamics of each organization and provide a common context
3	10:00 - 10:30 AM	Problem Identification	<ul style="list-style-type: none"> • Presentation of research results 	Short PowerPoint summary of research results by SS	Identify demands and define problems
	10:30 - 10:45 AM	Coffee Break			
4	10:45 -11:30 AM	WBG Products and Services	Presentation by one or more IFC staff on IFC operations, partnerships, advisory services (including SME Toolkit), direct and wholesaling investment operations, CIT operations including InfoDev, existing contacts with education sector, brand and value add Include WBG technology	Ask Corporate Relations if a marketing presentation/pitch can be developed	Identify range of specific products and services IFC presently offers, that might be available for “innovation package”

			commercialization tools, energy initiative		
5	11:30 AM - 12:00 PM	Hypothetical Interventions	<ul style="list-style-type: none"> • Introduction of possible IFC interventions • Time for questions and discussion 	Outline of interventions by SS and working group facilitators	Outline potential interventions to meet needs and overcome gaps
6	Lunch 12:00 - 1:30 PM	Working Group tables – will adjourn to Session 7 when ready Emerging Markets Innovations	<p>Keynote speech on innovations developed and commercialized via emerging markets research institutions, as well as Part I innovations that have found production or marketing in Part II countries</p> <p>Facilitated discussion to discuss effects of economic crisis and related needs</p>	Consider Alistair or Kauffman Foundation	Make anecdotal and empirical case for better integration of Part I and Part II technology economies
7	1:30 - 2:30 PM	Are Emerging Markets TTOs Different?	<ul style="list-style-type: none"> • Presentation on how Part I TTOs are structured and challenges of new economic environment • Presentation on Part II structures, including integration into economic development and concrete operating challenges • Facilitated discussion to draw lessons on similarities and differentiations 	Three parts: Part I presenter, Part II presenter, facilitated discussion	<p>Derive concrete insights into why TTO approach and business plan might be different in IFC markets.</p> <p>Understand Part I and Part II similarities, differences, challenges, solutions, implementation.</p>
8	2:30 to 6:00 PM Break-out rooms Each team will determine its own break	Hypothetical Intervention session for each Working Group (Suggested session time-table will be provided)	Working Groups retire to assigned breakout rooms to analyze their Hypothetical Intervention. Each Group will be managed by their group leaders and a “floating” professional group facilitators	Three interventions and four working groups – 1.Global integration and coordination (HI – 1A) 2.Entity for product development (HI – 1B) 3.Advisory services (HI - 2) 4.Financing (HI -3)	<p>Deliver thorough analysis and recommendations on the assigned hypothetical for reporting on the morning of Day 2</p> <p>NOTE: INTERVENTIONS TO BE PRETESTED WITH PARTICIPANTS TO MAKE SURE THESE ARE AREAS OF INTEREST TO THEM</p>

9	6:00 - 7:00 PM	General networking and cocktails			
		Informal one-on-one meetings for high-level debrief.	Individual meetings with Working Group leaders by Myers and Sammut. (Each to meet with four leaders for 15 minutes)		Discuss fine-tuning of deliverable for AM session
	7:00 – 8:30 PM	Reception and Dinner			
Through evening: Wharton Session Assistants to work with Group Leaders on Friday Morning Report					
Day Two – Friday, May 15					
Session	Time	Session Title	Format	Content	Goals
	8:00 – 8:30 AM	Continental breakfast			
10	8:30 - 9:30 AM Break-out	Working group session to review and modify draft report generated previous evening		Based on deliverables outline	Discrete, actionable recommendations on each Hypothetical Intervention
	9:30 - 10:00 AM	Break and Reconvene into Plenary Room			
11	10:00 AM - 1:00 PM	Debriefing on all four Hypothetical Interventions	Group leaders to provide a 20 minute presentation of their Working Group's findings and recommendations. Open <i>facilitated</i> discussion for each Working Group presentation by all participants (Total 10 minutes)		
12	1:00 - 1:30 PM	Convocation Wind-up Distribution of gifts	Review of Post-Convocation follow-ups and reiteration of plans going forward		
	1:30 PM	Convocation Adjournment			
	1:30 - 2:30 PM	Optional Lunch			

2.0 Technology Transfer Context

2.1 Technology Transfer Background

While academic technology transfer is often thought of as having began at the time of the passage of the Bay-Dole Act in the United States in 1980, in reality the function dates back to the 1950s when many major universities began adopting basic patent policies. In these original, often simplistic, documents the universities laid out the provisions for sharing and ownership of patents and other intellectual property and schedules for sharing any economic proceeds with the inventing faculty members or investigators employed with the universities. Many institutions began to follow suit as they experienced the loss of opportunity of technologies. The classic example of lost opportunity is the ENIAC project at the University of Pennsylvania in Philadelphia. (Penn) During the Second World War the US government provided \$500,000 to the University in a secret contract to construct the first digital computer for the purpose of calculating cannon and missile ballistics. It should be noted that since the 1970s US universities rarely conduct secret research and in some cases have faculty policies banning such contracts.

In the late 1940s, the engineers who invented the system, John Mauchly and J. Presper Eckert licensed the technology to the fledging computer industry players on their own with weak patents, funded personally, at arguably unfavorable terms. The technology became the foundation of commercial computing for more than a decade. The University easily lost hundreds of millions of dollars during the 1950s. In response, Penn adopted a patent policy during the 50s that was not substantially modified until the 1990s. Many universities had similar experiences.

There are two examples of prescient formation of university offices. One occurred at the University of Wisconsin where in 1925 the Wisconsin Alumni Research Foundation (WARF) which shortly achieved substantial revenue from the licensing of Vitamin D chemistry. WARF remains a leader in academic technology transfer. WARF was essentially formed as an external entity with governance by the University. Even earlier, Research Corporation Technologies (RCT) was chartered in 1912 by Frederick Gardner Cottrell, a university professor and inventor who championed the transfer of academic innovation to commercial use. Today, RCT is a technology investment and management company that provides early-stage funding and development for promising biomedical companies and technologies. RCT focuses on technology investments with origins from universities and research institutions worldwide. RCT has assets of more than \$300 million to advance technology development through venture investment, partnerships and special licensing programs. The RCT model was value-add from the start, i.e, they selectively acquired and developed technologies, and then licensed or sold the technologies to commercial partners. RCT developed a model whereby they sought ownership of title to inventions from universities with royalty sharing back to the universities. The concept of transfer of ownership from the university to a company began to change in the 1970s when the trend shifted towards retention of ownership title and the issuing of licenses.

In the 1960s and 1970s the early experience of the universities led to general internal acknowledgement that they did not possess the skill sets or the financial resources to pursue active patenting and licensing programs. Outside entrepreneurs alert to this discontinuity created independent for-profit businesses that entered, in most cases, exclusive agreements with client universities to review research portfolios, identify attractive commercial opportunities, take title to inventions of interest, file and assume the cost of domestic and international patenting, enter licenses and share a portion of the royalties with the universities usually after recovery of expenses. We will refer to these entities as Outside Patent Managers (“OPM”). While the OPM model had some similar characteristics to the RCT described above, OPMs were transactional agents and not value-add developers. This OPM is also distinct from the affiliated foundation structures, such as WARF.

It is worth referring to the brief existence of OPMs because their demise is indicative of the evolving role and responsibilities of TLOs. The technology transfer model began to shift away from working with outside agents when it became clear to the administrations that faculty expected a wider range of support and service from their institutions. This change occurred as faculty sought non-governmental support for their research and realized that inventions were often a key to developing such relationships. The OPMs were perceived as “cherry picking” the better opportunities. Institutions that had relationships with OPM gradually began to form in-house capability, often by adding the function to their research administration departments. In 1974, these administrators founded a professional organization, i.e., an organization of individuals not the universities as institutions, called the Society for University Patent Administrators (SUPA). Ten years later it was renamed the Association of University Technology Managers (AUTM). Its significance and impact on global technology transfer will be described below.

Several other factors should be noted. Up until the passage of the Bayh-Dole Act in 1980, universities could not out-license inventions developed with government funding (from agencies such as the National Institutes of Health or the National Science Foundation) on an exclusive basis without applying for an exemption from the agency. While this was largely an administrative procedure, it was indicative of the attitude that no one company should have a monopoly based on publicly funded inventions. While the political sentiment in Congress reinforced this notion, it was becoming clear during the late 1970s that the United States was losing its technological and competitive industrial edge. This led to a more accommodating view that the country should benefit from the national investment in research. Investigation into the obstacles to technology transfer revealed that the process had to be standardized and that licensees should have the ability to secure exclusive licenses in order to justify the cost of industrial development and commercialization.

In order to promote development of academic technology, the Bayh-Dole Act or University and Small Business Patent Procedures Act was passed in December of 1980. It is the United States legislation dealing with intellectual property arising from federal

government-funded research and is codified in 35 U.S.C. § 200-212 35 and implemented by 37 CFR 401. Among other things, it gave US universities, small businesses and non-profits intellectual property control of their inventions and other intellectual property that resulted from such funding. [Although the proportions vary widely among institutions, the national average for federal funding is approximately 80% with the remaining 20% shared equally by corporate and foundation funding. In very short order following the Bayh-Dole Act, universities policies and practices for ownership extended to all inventions saying that federal monies in some portion fund every laboratory.]

Perhaps the most important change is that Bayh-Dole reversed the presumption of title. Bayh-Dole permits a university, small business, or non-profit institution to elect to pursue ownership of an invention in preference to the government. If universities elect not to pursue patenting or development they must first offer the rights back to the funding agency. As a matter of practice, the funding agencies rarely accept return of rights, the presumption being that the institutions thoroughly vetted rights. The government, however, requires a non-exclusive license to use inventions resulting from its funding for “government purposes.” This government right is commonly called “march-in rights.” While use of these rights has been threatened in certain circumstances, they have not been exerted.

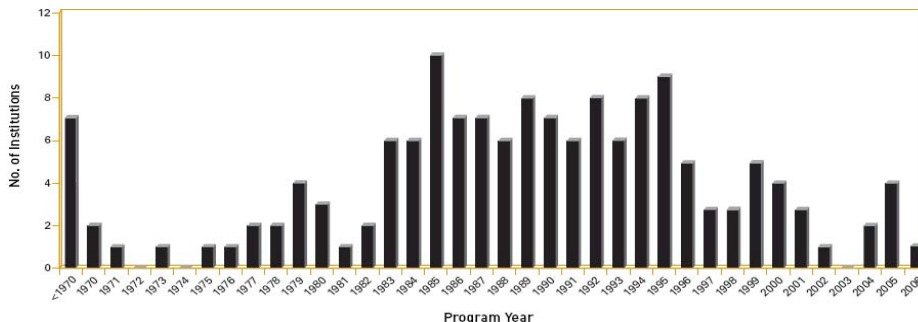
The passage of the Bayh-Dole Act elicited two simultaneous phenomena.

The first phenomenon was a nationwide debate within the research community about the impact of technology transfer on the integrity of research and the free-flow of information. The underlying concern was, and in some cases remains, that publication and disclosure will be either suppressed or delayed in order to secure rights, and that corporate licensees may require that discoveries not be promulgated. Universities ultimately addressed these concerns through policies; this response will be discussed in 2.2 below. It is the case, however, that rigorous academic studies on the impact of technology transfer on research continue to this day. Furthermore, there are periodic legal challenges to the Bayh-Dole Act, oftentimes instigated by lobbyists or within Congress itself.

The second phenomenon was that while the academic debates on technology transfer continued, universities began in earnest to form offices. At first, these were staffed, as was the case in earlier years, with staff from the research administration departments. While dedicated to the task, many of these administrators did not have experience in industry and were often limited in the skills to manage the process of technology transfer.

This graph, drawn from the 2006 AUTM report illustrates the growth in the formation of technology transfer offices (often referred to as Technology Licensing Offices or TLOs).

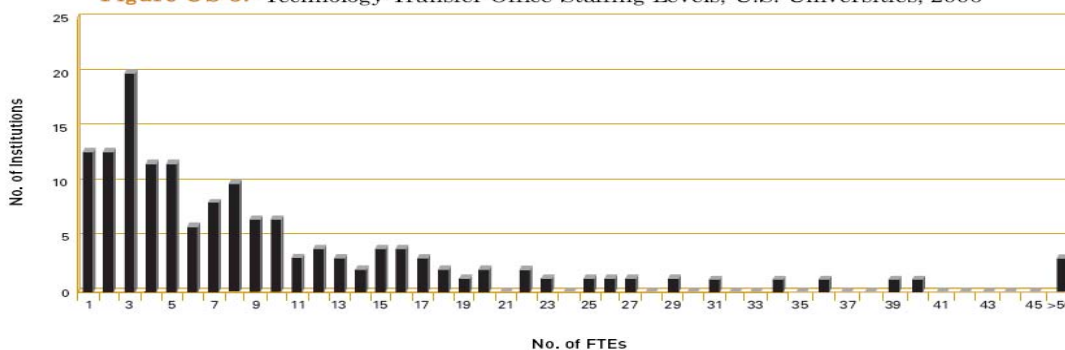
Figure US-1. Technology Transfer Program Start Date of U.S. Universities, 1970–2006



As described earlier, the professional staff members of the universities developed their own organization. From its website (www.autm.org), The Association of University Technology Managers (AUTM) is an organization devoted to promoting technology transfer between universities and colleges and private enterprise and/or the government. Membership consists primarily of technology transfer professionals that work for universities but also includes industry professionals responsible for business development or technology acquisition. Many patent attorneys also participate in AUTM. The organization is primarily US-oriented but has an inclusionary philosophy with 6,000 members worldwide. AUTM is the creator and promulgator of preferred university polices, best practices, sample agreements for licensing and institutional cooperation, and most importantly extensive training manuals and education programs. AUTM encourages professionals from outside the US to participate in training programs. AUTM annual reports on research and technology transfer activity through extensive surveys.

The existence of AUTM has enabled the growth of quality staffing at universities. This graph demonstrates the staffing growth:

Figure US-3. Technology Transfer Office Staffing Levels, U.S. Universities, 2006



The historic staffing levels in the US begin to illustrate the challenge to other countries, both Part I and Part II, in closing the gap with human resources dedicated to technology transfer in the US. AUTM data is represented in the following graph.

Table US-2. Historic Staffing Levels of U.S. Offices of Technology Transfer, 1997–2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Licensing FTE	415.4	452.6	494.2	552.5	627.7	733.7	793.7	832.9	847.0	910.7
Other FTE	461.6	476.0	538.7	575.5	630.8	717.8	759.5	817.0	848.0	921.0
Total FTE	877.0	928.6	1,032.8	1,128.0	1,258.5	1,451.4	1,553.3	1,649.9	1,695.0	1,831.7

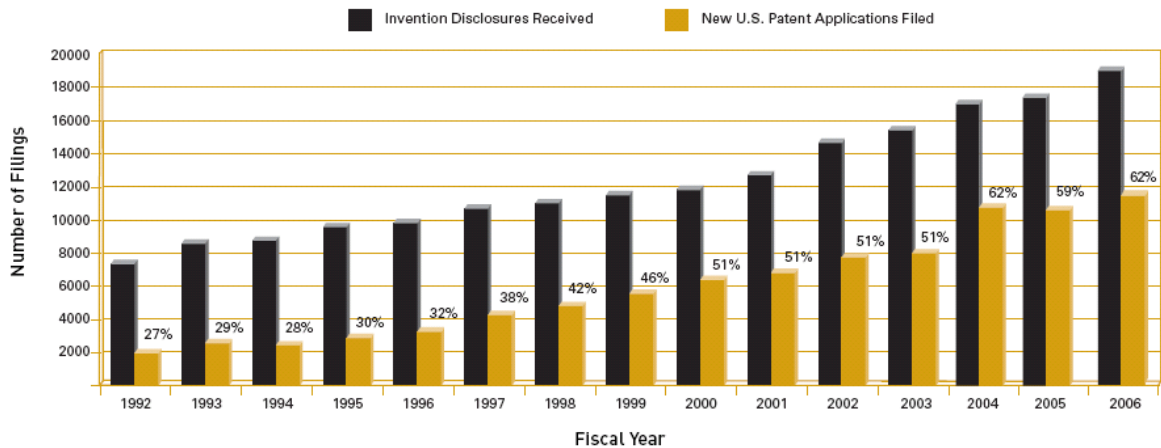
In the overall context of the national research enterprise the head-count is not surprising. For example, in FY2007, US university expenditures for federally funded science and engineering were \$30.4 billion. Universities reported total funding for science and engineering of \$49.4 billion. Of that amount, \$2.7 billion, or slightly over 5%, came from industry sources. Again, from AUTM data:

Table US-3. Total Research Support from Federal and Industrial Sources for U.S. Universities, Hospitals and Research Institutions, 1997–2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Research Expenditures (\$ billions)	21.63	23.25	25.67	27.87	29.96	34.96	38.50	41.20	42.30	45.40
% Federal	65%	63%	63%	62%	64%	64%	66%	67%	67%	68%
% Industrial	9%	9%	10%	9%	8%	8%	7%	7%	7%	7%

The research support base in other countries does not approach these levels of support. The implications are that a significant base of research is needed to produce a significant base of patents. According to AUTM, US universities collectively produce about 3000 US patents per year. These patents are licensed to outside firms or start up companies in order to have these third parties commercialize the inventions. Licensing revenue received by US universities from licensing in 2006 was over \$1.25 billion. This table identifies the invention disclosures received by US universities and the proportion that were patented over the last decade:

Figure US-8. New Patent Filings and Invention Disclosures Received, 1992–2006



It is important to point out that, generally speaking, an invention or patent is not necessarily considered a proxy for a major scientific contribution; few universities recognize inventions or patents in the rank and tenure review of faculty. Patents are, however, an asset taken seriously by universities. **It is noteworthy that on average in the US approximately \$2.5 million in research support produces one patent.** In South Africa for example, national support for medical research is approximately USD 60 million. South Africa will be profiled below. Suffice it to say that the base of patents with which to participate in global technology transfer is modest and equal to a small US university or research institute; that does not imply that South Africa or any other country is disenfranchised from global participation. This in no way implies that the universities in South Africa, or any other nation, with a relatively small scale of research are disenfranchised from the technology transfer enterprise, but it does suggest that technology transfer enterprise be managed more efficiently and through a model that it more appropriate to circumstances.

AUTM reports that the base of patents translated into licenses and options at these levels in 2006:

Table US-6. Licenses and Options Executed by U.S. Respondents in 2006: Exclusive vs. Nonexclusive

FY 2006	Number of Respondents	Total Executed	Startups	% of Total	Small Companies	% of Total	Large Companies	% of Total
U.S. Universities	161	4,192	698	16.7	2,127	50.7	1,327	31.7
U.S. Hospitals & Research Institutions	28	755	66	8.7	289	38.3	321	42.5
Technology Investment Firms	1	16	0	0	0	0	0	0
All Respondents	190	4,963	764	15.4	2,416	48.7	1,648	33.2

This table has many implications. Note that in 2006, a total of just under 5000 licenses were executed. To allow for the inevitable lag period between patenting and licensing, if 5000 license are benchmarked against the 2004 disclosure and patent activity, we see that three Invention Disclosures are needed to produce one license agreement; or approximately two patents are needed to produce one license agreement.

The term “Intervention Disclosure” as used herein means the formal submission of a written notice of invention to a university’s technology transfer or similar office. Faculty that have been educated in the invention process will file an Invention Disclosure with ample time for assessment of patentability and possible filing of a patent prior to making a “public disclosure.” A public disclosure prior to the filing of an invention will bar patentability throughout the world except for the United States which still allows a one-year period for filing. In a world of international markets, however, a US only patent significantly diminishes value or even the ability to license. Invention Disclosure is capitalized to indicate that the disclosure is pre-public.

These numbers might appear to be inherently discouraging for other countries, both Part I and Part II, because they suggest an enormous investment, over and above the operational costs of running technology transfer offices, for participating in the global flow of technology transfer.

This observation begins to suggest that the model used in the US on the basis of inputs and outputs will not translate to the realities of research, inventions, patenting and licensing elsewhere, especially in Part II countries. At present, however, the US model is generally emulated throughout the world. This issue will be discussed below. There is no obvious, workable alternative to the prevailing US model, but it is the case, as will be argued below, that the IFC/WBG can offer interventions that can compensate for this imbalance.

2.2 Technology Transfer Office Formation and Operations

CAVEAT: The diagram below titled the “Technology Transfer Office Formation and Operations” is an idealized schematic of how an office might come into existence and the flow by which it will operate. It shows an iterative, somewhat logical, progression of events or operational process with *no* time scale. In fact, the sequence of events or processes is not necessarily in the order presented. No time frame is provided – either for the establishment of the precursors of an office (the four small boxes at the top) or for the time involved in processing a disclosure to the point of a license agreement. The time frame for any the patenting an licensing of any given invention varies from months to years. The different functions, especially in the “Screen and Evaluate Disclosures” box are not equally weighted in terms of effort or time and resources allocated.

Another way of expressing the time frame: A file opened for an Invention Disclosure submitted in March of 2009 might not be closed until March of 2029 and maybe later if there are additional related inventions that follow. Put yet another way, the students who will matriculate into the class of 2029 haven't been born yet.

There is another way of interpreting the diagram. Essentially, the diagram is an “after the fact” retrospective of all the factors that have had to come into play to form and complete a functional system. In other words, if one were to look at a mature technology transfer office in a country where legislation had been in effect a decade or so, most if not all of the boxes would have more or less similar text inserted. The top to bottom sequence, however, does not necessarily suggest that the establishment of the particular legislation on the one hand or the institutional systems on the other would have followed a neat linear progression. Every institution has had to create an office consistent with the prevailing vision of its senior administration and within the context of institutional culture, politics (rarely found in academic communities), the existing base of research activity (or at least the hopes for its future direction), and the funding available for growth and expansion of the office, and of course, crises or unintended consequences of prior deals.

Tech Transfer Office Formation and Operations: See Caveat

Motivation: National Regional Economic Development

Internal Motivation: Research/Royalty Revenues/Faculty Demand

**Adoption of National Laws
(other countries often model on (Bayh-Dole))**

Internal policies based laws; often modeled on other univ. for IP, Conflicts of Interest, etc.

Formation and continued training and development of a staff diversified by scientific/ industrial field; managerial experience and other skills; develop compensation scheme (not universal)

Develop operating procedures for disclosures, “standard” legal documents for corporate sponsored research, licensees and other agreements; determine approval process

Generate deal flow: Education directed at faculty on the process and inventions

Screen and evaluate disclosures:

1. Intellectual property assessments (legal and commercial); assessment of geographic filing
2. Market analysis and applications of the technology
<YES/NO Decision>
3. Identification of potential licensees or sources of risk capital
4. Valuation relative to prospective licensees
5. Formation of a license strategy:
 - a. Existing company
 - b. Form a start-up
6. Secure a prospective licensee

Structure and negotiate a license agreement
Determination of product development milestones and performance measures
Monitor compliance
If start-up, assist with capital raising, possibly board/governance

In the case of the US, several of the leading universities had internal policies and programs in place long before enabling legislation of the Bayh-Dole Act. Moreover, perfection of the internal policies, and expansion into such areas as “Conflicts of Interest Analysis and Adjudication” were part of a perpetual evolution driven by new circumstances and events. These institutions were largely the pioneers. Their technology transfer offices, like all that followed, evolved in response to the articulated needs and concerns of a variety of stakeholders.

2.3 Stakeholder Analysis

After the adoption of the Bayh-Dole Act most universities formed a technology transfer office. In addition to the Act itself, there are other factors as articulated by the first stakeholders – the President and the Provost – fall into two categories

The President’s and Provost’s thinking:

Category 1: Mission and moral obligation

1. “We have great privileges in society and exist through the largess of the community. We, therefore, have a duty to see that the public benefits from the new knowledge created here.”
2. “Our role as a health care and research institution means that we have a positive duty to facilitate the commercialization – whether contributed or for profit -- of our discoveries for the benefit of people at large.
3. “Our stakeholders, through legislation and other programs, are looking to us to provide solutions to problems and contribute to economic growth.”
4. “If done correctly, students will benefit educationally when observing how ideas are transformed into products.”

Category 2: Practical factors

1. “We can’t rely on steady growth of government research grants, so we had better diversify our sources of research income.”
2. “If we secure patents on the inventions from faculty research we will assure corporations that we can speak their language of proprietary products. They will sponsor research here with more confidence that they can get something for their money.”
3. “We can’t ignore the royalty revenue that some other universities have achieved from major inventions.”

4. “The governor has set aside millions of dollars for [a new tech park; biotech initiatives; nanotech; etc.]. We probably won’t derive much direct benefit relative to our total research enterprise, but we have to be good citizens and support the efforts.”

5. The provost speaking to the president: “The Med School Dean called me with disturbing news. Apparently, she and the Pathology Department Chair spent six-months trying to recruit a rising star investigator who has significant research grants. The investigator decided to go to accept a position at another institution because they have a better patent policy, a more experienced tech transfer staff, and a program to work with faculty in spinning out companies. It turns out that the investigator was motivated to move because of inadequate support of his inventions. Technology transfer has faculty recruitment and retention implications that we had not considered.”

While there are more motivations, these stated philosophical and economic motivations are enough to beg the question: “**What’s not to like?**” Stakeholders have differing points of view on this question; these include:

The **University Chief Financial Officer’s** view of “What’s not to like?”

1. “I spoke with my counterpart at State U. You know, over the first five years they spent over \$10 million on an office and on patents before they saw any royalties worth mentioning. They did get some decent corporate sponsored research, but in the big picture not a whole lot, and the companies wouldn’t even pay the full indirect cost rate and State U is getting a lot of grief about that from the federal auditors.”

2. “Our budget is already strained. What are you willing to give up in order to cover the cost of this investment? **[NOTE: CFO’s have different points of view as to whether TLOs are an investment or simply an expense. As described elsewhere some universities contracted with “Outside Patent Managers” (OPMs) as a means of reducing costs, but as previously described these unrelated institutions did not address the full range of institutional needs. The spinning out of offices – governed directly or indirectly by the institution -- into separate foundations or capitalized commercialization entities are growing as a solution and may become a trend in emerging markets.]** There are limits to the amount of indirect costs we can allocate to tech transfer and patents. Our forecasted indirect costs are spoken for the next 20 years to pay for the research buildings.”

3. “If we allocate the funds, I’ll have to come up with a way of rolling over the patent costs from one year to the next or we’ll never break even or know where we stand.”

4. “Whatever you do with royalty distribution in the patent policy, please make sure that we recover expenses off the top, and make it worth the institution’s while economically to get something out of this investment. We pay for tech transfer out of the central budget, but when I look at the patent policies at other places, the scientists get nearly one-third

personally, then a portion for their labs. Their departments and schools take a chunk and the university gets what's left, which isn't very much given the hole we're digging."

The CFO asking these questions is doing a good job. Implicit but not directly stated in all of them is:

"Whether or not we call this an investment per se, how are we going to measure the outcome, especially since the funding of the office and patent costs is coming out of the institution's back pocket, but the benefits are mostly going into the pockets of all the other stakeholders."

Box 6: Are there standard financial metrics for measuring performance of technology transfer?

Other than those few institutions with separate outside foundations or other entities that work off a base of capital and have their own P/L, US universities have struggled with the issue of measuring the performance of their offices and the overall return on the investment in intellectual property portfolios.

Universities generally are excellent at developing and applying carefully derived metrics that become major factors in program evaluation and budget allocation. So, the problem does not arise from a lack of skills or complacency. Rather, it is a function of the full range of tangible and intangible responsibilities of a tech transfer office AND the time lag (years to a decade or more) over which efforts today produce results tomorrow.

Fortunately, institutions do have a means to benchmark their activity and performance statistically relative to other institutions thanks to the annual survey of technology transfer compiled and published by AUTM. The survey does an excellent job of grouping data (many of the graphs are reproduced in this report).

While the AUTM report is an important tool and a necessary foundation for comparison among institutions, it neither represents a body of metrics for assessing financial returns on the investment in an office nor the economic development impact.

The specific problem of metrics is discussed below, but it is important that the reader be aware that performance measurements are a serious challenge intramurally. When economic development measures are sought to demonstrate a universities importance to a community, the problem is compounded. The Federal and State governments also struggle with measurement. AUTM has tracked hundreds of examples of the contributions of given technologies over the years. Quantification is a challenge but the cataloging itself is valuable.

There is, of course, the sobering point of view of the *University's General Counsel*. The theme goes something like this: "While it is all well and good to seek new sources of revenue and not lose faculty, there are a great many risks that we have to address:"

1. "Are we jeopardizing our non-profit status? Are we subject to unrelated business taxes?"
2. "Can we make the patent policy unambiguous enough that we are not opening ourselves to claims by the faculty? How will we handle disbursements, especially if the royalty takes the form of equity? Can faculty hold us accountable for botching an opportunity?"
3. "Can we put the administrative machinery into place to secure assignment of rights to the university?"
4. "We are going to have to come up with air-tight indemnification by the licensees for protecting us with product liability, and they will have to back it up with insurance. We have to protect our endowment."
5. "I am responsible for all relationships with outside counsel. Who will control the engagements with the outside patent attorneys? I don't have the budget? How will the patent costs be administered? I have to control that."
6. "Do we really want to give the head of the tech transfer office autonomy to do deals, or should we have an oversight committee and an approval process?"
7. "Who gives legal approval of the license contracts? If the tech transfer office has its own attorneys on staff, shouldn't they answer to me? I am not after power here; I am concerned about consistency with policy and alignment with our overall contractual requirements which often change."
8. "There have been some real disasters with conflicts of interest at other well-intentioned institutions and there are federal guidelines. We can draft a policy, but how will it be administered and monitored?"
9. "How do we protect students in the labs from having their own work diverted into projects of economic interest to the faculty?" [This is cited by most faculties as well – usually at the top of the list.]
9. "I have real concerns about confidentiality obligations when we have corporations sponsoring research. They generally want confidentiality provisions. We can't enforce these given our Charter on Academic Freedom. This gets really sticky if a faculty member has additional outside consulting agreement with the sponsor. And by the way, are the consulting agreements a back door through which the company can secure IP rights outside the patent policy?"

The faculty as stakeholders

The principal stakeholders in technology transfer are, of course, the faculty. Motivations differ from one faculty member to another, but an important common thread is that they seek additional support of their laboratories from either or both of corporate sponsorship or a royalty stream. Many faculty members, especially those senior in their careers, also desire that their life's work be translated into useful products.

Any discussion about faculty as stakeholders must take into account that in the world of technology transfer there are the "haves and the have-nots" (and in a few cases the have-yachts). There are anecdotal accounts as to the proportion of faculty members who make inventions relative to those that do not. Suffice it to say that it is a generally small portion of *research faculty in the natural and physical sciences or in engineering* who are the beneficiaries of services by the technology transfer offices and the investment made by their institutions. For faculty in the arts and humanities, social sciences, law, and even business, inventions rarely emerge. There may be other IP rights, such as Know How or particularly copyrights that are relevant. For reasons of tradition and practicality, ownership and control of copyrights are in the hands of the creators, and institutions generally exempt royalties on textbooks or other creative works such as artwork, designs, musical composition and the like. There is an exception, however, when the copyright or Know How is the product of commercially sponsored research where the agreement requires that the sponsor have rights to license the product of the research. In such cases, the Know How or copyright of the faculty are assigned to the university in order to allow fulfillment of obligations to such sponsors.

Interestingly, there is little discernable tension between the haves and have nots. In fact, faculty senates or similar groups generally have to approve any policies that affect the faculty, intellectual property included. There is, therefore, a forum for debate. Many issues have arisen over the years, and if there was measurable tension, at least in the US, it occurred a generation ago. The issues raised were, as a matter of principle and practical necessity, resolved through policies and committee oversight and ultimately translated into the very provisions of sponsored research agreements, license agreements, outside consultancy agreements, and related documents. Among them:

1. Protection of students and their own research activity. One of the few dogmas of universities is that the professional development of students is sacrosanct and that in laboratory settings their own research should be guided but not subverted by their mentors, especially on commercial research projects. Provisions for protecting students were instituted at the start of the technology transfer enterprise and are monitored assiduously by departmental chairs and by faculty peers.

2. Undue delay in publication. Ultimately a researcher makes his or her own decision as to when to publish. The university can not exert or take upon itself any obligation to delay or suppress publication. As a practical matter in a sponsored research or license

agreement the university and the sponsor need some provision for allowing for review of papers pre-submission for publication. Generally the concept of review windows of 30 to 60 days have effectively become the standard practice in agreements for the last 20 years, but the finer points of wording took somewhat longer to resolve. By and large faculty senates are comfortable with a delay PROVIDED that the faculty member involved is fully aware of the limitations and in some fashion signs off on the obligation. In the final analysis, and in a somewhat sleight of hand, universities do not assume an institutional obligation on publication delay.

3. Confidentiality provisions. These provisions have an indirect relationship to publication. In short, in order to develop a product or have true transfer of technology, a licensee often must disclose its own proprietary information to the faculty member who has made the invention. The company, understandably, wants to protect its information. Who is the recipient of the information? The university position is that as an institution it neither needs nor desires the company's information and will not undertake any responsibility for protecting the information. There are numerous arguments for this position but the major one is that the university can not restrain the real recipient, i.e., the faculty member, from doing with that information whatever he or she chooses to do. In the license agreements, therefore, universities expressly exempt themselves from confidentiality obligations. Oftentimes, the faculty member must undertake this obligation on their own in a side-letter or a consultancy agreement.

The newest stakeholders: state and local governments.

At the start of this report the metaphor of the four-legged stool was offered as a way of describing the institutional mission of teaching – research – patient care – and regional economic development. The last on the list is also the most recent addition to the mission. As the economies of states in the US shifted from manufacturing and services (in some states the manufacturing sector was decimated), state governments became desperate in adding jobs to their economies and diversifying the industrial base.

One of the questions asked by national or local economic development authorities is: “What is our base of assets, where is it and how can we exploit it.” One of the resounding answers is UNIVERSITIES. Governors and legislators had to acknowledge that the other three legs of the university mission played a huge role in the economic vitality of the state

- **Education:** students come from in-state, out-of-state and overseas, bringing with them cash from federal student loan programs, cash from other states, and cash (usually with no offset on tuition) from the families throughout the world eager to give their children US higher education. It didn't take much analysis to appreciate that the faculty and institutional support staff positions were high-wage and relatively secure. Communities surrounding the universities grew and prospered. Universities in their purest form are a business and many students stay and plow back the

benefit of the education into the local economy in the form of higher skills and entrepreneurial activity. Put another way; “Education is one of our main exports. We do it by importing students.”

- **Health Care.** Many universities have medical schools and hospitals, the latter of which are major employers with high-wage and, again, secure positions. Health care is one way that states obtain federal allocation in the form of Medicare. Health care facilities generally have significant economic multipliers.
- **Research.** Historically, academic research did not register as a factor in economic development strategies. In the United States, the realization of several factors caused a reassessment of its role. These same factors have implications for all countries or regions to a greater or lesser extent. Some of these are:
 - Most academic research is funded by the federal government, through virtually every of its agencies, be it the NIH, the NSF, the DOD, DOE, EPA, USDA, NIST, etc. In other words, nearly every research discipline derives funding from the national treasury. Research is a means by which states received remittances from the federal government – the more out of proportion to other states, the better.
 - Research programs bring the best and brightest scientists, engineers and students into a state. A significant portion of federal grants is actually used to finance graduate education. Put another way, the funding of research produced a human-resource capacity that state economic development agencies could present as a critical asset when recruiting corporations to set-up research or manufacturing facilities in their state.
 - Research, by its nature, creates technology and the opportunity to create new businesses in a state or region, especially when the technology is licensed to start-up companies in the state. This realization came at the same time that state officials toured the San Francisco Bay Area, Greater Boston and Research Triangle Park in North Carolina. They came away from those tours with a new appreciation of how academic research spawned economic growth. The question became: “What do we need to do as a state to make ourselves attractive to start-ups?” Some of the answers were:
 - Create incubator facilities near universities that would provide attractive rents and services support such as legal, purchasing, shared instrumentation, and the like
 - Form seed funds or programs to take LP positions in venture funds to support the initial spinning out of

companies. State governments quickly realized that local sources of risk capital were critical

- Create incentives for venture capital formation in the state. This proved to be the most difficult objective, but in the process of recruiting venture funds to take up residence, the states learned that the real benefit of local capital and university spin-outs is that they “INDUCED” the flow of risk capital from other states or nations.

Governors and state legislators, sometimes against their instincts, passed legislation to promote business creation in concert with university technologies. *It is worth observing that the polity of many states does not readily see the benefits of universities and historically there is resentment of institutions, faculty and students who are seen to be an elitist or privileged at the expense of others. A variation of this sentiment may exist in Part II countries.* Nevertheless, new programs were created and funded in many states with the expectation of new economic opportunity – the measurement of which is still ambiguous.

Corporate licensees and investors in start-ups

Research-driven corporations are in a constant struggle to keep their product development pipe-lines filled with near-term and long-term projects. Generally, universities offer technologies and innovation at the earliest stages (this varies by industry) that will have the highest level of risk and require increasing levels of investment.

Discovery stage research in most industries is outside the capability or financial resources of companies; university research in part fills the need for fundamental discovery and the basis for new product lines or businesses. In a manner of thinking and on a risk-adjusted basis, university technologies are a “bargain” in the sense that the discovery is offset by the fact that the technologies came into existence through public funding, often over many years. Public support of research effectively represents a kind of leverage to the R&D activity of corporations; fewer, if any, of their own scarce R&D dollars must be allocated to basic research and discovery.

Corporations, therefore, actively scout new opportunities from universities typically looking at hundreds or thousands of projects annually in order to license a handful. The efforts of identification, scientific evaluation, assessment of commercial potential, forecasting of costs, designing a project management scheme are largely done prior to negotiating a sponsored research and/or licensing agreement with a university TLO. These are time-consuming and expensive efforts on the front end. In order to sure that these efforts will not end in the frustration of an impossible negotiation, companies must have the confidence that the TLO will offer manageable terms with reasonable economics. In those instances when a corporation has a prior history of successful negotiation with a

university the confidence level is higher. Time is a scarce resource at the TLO and the staff members are equally reluctant to invest time in a negotiation doomed from the start; confidence and trust are essential for both parties.

Mutual confidence is under constant threat. Although there may be a history of prior transactions, there are changes of prevailing economic or industrial conditions, company or TLO objectives and strategy, and staff on both sides of the table. This reality is a structural obstacle to the technology transfer enterprise. Managing this reality requires a number of measures and management styles by the TLO:

- expanding professional and personal relationships through organizations such as the Licensing Executives Society and AUTM
- developing well-organized marketing and pitching of new licensing opportunities to a corporation
- adequate preparation of research faculty in the nature of relationships with companies and in setting reasonable expectations
- responsiveness throughout the process
- evidence that the TLO has expended effort in assessing its own technologies in terms of patentability, marketability, value, development requirements and associated costs, and the like
- well-conceived and executed patent strategies up to the point of licensing and skilled preparation and prosecution of the patents to date; protection of the opportunity to file in foreign jurisdictions
- frequent communication before during and after particular deals
- hiring and developing professional staff at TLOs with relevant business and technical backgrounds such that there is a peer-to-peer relationship when negotiating
- retaining legal counsel on both sides where there is also mutual respect and trust (this applies to patent counsel as well as counsel in the license agreements)
- maintaining consistency in the non-economic provisions of sponsored research, license and consultancy agreements from one deal to the next. So that corporations new to the university technology transfer process often spend months coming to an understanding and acceptance of previously cited provisions such as university absolute right to own new inventions made with company sponsored research and the limited option rights when these inventions are made, publication rights, confidentiality, liability protection and indemnification requirements, the “non-exclusive” rights of the US government to an invention resulting for research that was funded by the government, the absence of warranties and other provisions, and the management of patent infringement or other litigation (and the sharing of proceeds from related judgments)
- appropriate expectations for the economics associated with a license. There are many economic elements and include: a license fee paid at the time of signing, royalties paid on the basis of sales, provisions for the

licensee to issue licenses to sub-licensees (these have significant importance in the case of emerging markets), payments on completion of product development milestones, minimum royalties that trigger at a negotiated time point (even before product release). Non-economic provisions include product development plans, and most definitions regarding the scope of the license, royalty bearing products, royalty stacking where patent licenses are needed from other parties in order to manage the “freedom to operate” issues, geographic domain and other critical definitions that ultimately affect the economics of the license but also have strategic implications for the timing of product development and of relevance to emerging markets, the loci of development, manufacturing and sales of products.

Failure of a TLO to meet any of the above can quickly give an office a negative reputation; reputations are not easily recovered.

Obviously, navigating through the soft and hard elements of the relationship and transactional process require significant credentials and experience. TLO staff should be qualified to work on either side of the table. This factor surfaces mightily in the recruitment needs of TLOs and generally the limited compensation that it can offer.

Box 7: Thresholds for funding or licensing a technology

Universities and companies have a common challenge for determining whether a technology is suitable for investment in patents and the costs of development. Universities make their own assessment upon Invention Disclosure; the corporations during license due-diligence. There are common elements. Some of these are:

- range of patent claims, their breadth, and defensibility
- “freedom to operate,” that is whether other patents from other parties will be needed to develop, manufacture or sell products based on the university patents
- availability of international patent rights
- potential licensees (from university point of view; sub-licensees from company point of view)
- full range of market factors including uses of the technology and its value in the marketplace, the market segments, pricing, competition, promotion and sales
- manufacturability and costs of manufacturing
- potential profitability

In the case of the formation of a start-up company and venture capital financing an additional critical issue to be resolved before licensing or as a goal of seed financing is “proof of concept,” that is, does the technology do what is postulated.

Despite the efforts and intensity of effort involved in marketing and licensing to an existing corporation, relatively few technologies at universities are at a point where most corporations can consider them as license opportunities. This puts TLOs on the horns of a dilemma. A possible strategy in response . . .

Venture Capital and the start-up option

TLOs often must consider the incubation of a technology in some type of start-up company or spin-out. It is important to make some distinctions at the outset. Prior to the 1990s, hundreds of companies were formed around university technologies, particularly in the Bay Area and Boston. These companies were typically formed through a collaboration of a venture capital fund with one or more faculty members. Entire industries were launched on the basis of these collaborations. If the universities were involved at all it was at such time that a license to the faculty members' technologies was needed. Essentially, the university was entirely passive in the process. It typically received fees and royalties, and sometimes an equity position in the company.

A shift began in the generation of spin-out companies in the early 1990s. In this shift, TLOs began to take an active role in identifying individual or groups of technologies that could be the basis of a new company. There were several reasons for this shift:

- in many industries the incumbent companies reduced their interest in early stage technologies
- venture capital funds had begun their move to later stage investment opportunities and reduced or eliminated their role in company initiation
- some alternative sources of seed capital became available directly or indirectly from state government backed seed-funds
- federal agencies were required to allocate a small portion of their grants to companies
- a shift in faculty culture towards entrepreneurial interests for a variety of reasons: additional sources of funding for their research, better personal upside through equity ownership, a sense of control over their technology and, candidly, bragging rights
- recognition by TLOs that start-ups were essential to creating some level of value for their university with the expectation that once incubated in a start-up the technology will be licensed at a much higher value or that the start-up might be acquired at a premium. The transactional structure also gave the university a chance for multiple forms of income: sponsored research, customary royalties, and an equity position. The latter could be a large infusion of cash in the future, and also was a means of risk management through the reasoning that even if a company ultimately abandoned the university's technology, the university still had a stake in the other activity of the company through the equity position

- an interest by TLOs and by the staff in the professional development associated with being instrumental in the creation of a company, even though their personal compensation would not be affected
- establishment of near-by incubator facilities that provided desirable locations for the start-ups. In some cases, the TLO resided in the same buildings.

Having said all this, the leadership of the TLO must periodically assess whether the strategy had shifted too far towards start-ups. There were a variety of consequences:

- start-ups consume a disproportionate amount of scarce staff time as the cost of reduced efforts in marketing or other traditional licensing strategies
- staff may have to be expanded to include skill sets needed for start-up activity
- the degree of involvement has to be determined on a case-by-case basis principally along the lines of: recruitment of an entrepreneur, development of a business plan (oftentimes MBA students are recruited to assist), the role in raising the initial venture capital, whether or not to take a seat on the Board of Directors, and the separation of the parties negotiating the license agreement on behalf of the parties (the default – and only workable – position is that the entrepreneur or venture capital fund represent the company)
- start-ups are less able to provide significant research support back to the laboratory of the involved faculty and may fail to meet the expectations of deans and departmental chairs in meeting corporate sponsored research goals
- the possibility for conflicts of interest increased markedly in the case of start-ups. The formation of policies and oversight committees quickly managed the problem, but the perception remains real. The management of conflict of interest continues to evolve, but two approaches emerged in the early 1990s in managing the relationship with start-ups.
 - One of the approaches became known as the Penn-Hopkins model wherein several simultaneous relationships were permitted, e.g., ownership of equity by the university and faculty, sponsored research back to the faculty lab, and a consulting relationship between the company and the faculty. The premise behind the Penn-Hopkins model is that multi-layered relationships are inevitable so it is best to put everything on the table and manage the conflicts.
 - The alternative is the Harvard-MIT model which stipulates that the relationships generally be single layered, e.g., if there is equity in the hands of the faculty, then there is no sponsored research. Both models ban any participation in clinical trials or product testing by the institution or the faculty.

- too often a lack of venture capital beyond the seed or start-up funding. This circumstance is commonly referred to the “Valley of Death,” a metaphor that isn’t much of an overstatement. Frequently the TLO has to step in to help with the funding efforts. Often when a venture capital fund does offer financing it often demands a re-negotiation of the original license, thus begging the question: “Is the TLO’s value-add recognized and rewarded?”

In addition to the above listed concerns *VCs share all the same concerns as corporate licensees as described in Box 7*. Obtaining venture capital financing is a high hurdle.

2.4 Human Resources in technology transfer: implications for Part II Countries

In the vortex: the Technology Transfer Professionals

TLO leadership is the agent through whom the stakeholder issues described for institutional senior administration, general counsel, the CFO, the faculty and corporate and VC licensees must be resolved.

Resolution of the concerns, however, is mere infrastructure or enablement of the existence and funding of an office. Management of the stakeholders becomes a significant part of the responsibilities of leadership of the TLO and is critical to securing resources for sustaining the TLO in its initial years of operation while it builds a stream of revenues, and later for expansion of the office.

Naturally, the TLO is itself a stakeholder, and its staff has a great deal at stake. There is a substantial range of talent required in a TLO:

- General and stakeholder management
- Scientific and technical knowledge and judgment
- Marketing research and program experience
- Intellectual property assessment and management
- Licensing and contract skills (business and legal)
- Business-plan development experience
- Technology and business valuation skills
- Deal structure knowledge
- Negotiating skills
- Project management skills
- Auditing and program oversight skills

Given the concerns of the IFC/WBG there is a conspicuous absence of insight into emerging markets, understanding principles of economic development, and outcomes measurement skills. These do exist in varying degrees in some TLOs based on the size and scope of staffing. In the opinion of this author, when a candidate for a position

presents such skills they would be recognized as “beneficial but not essential” if most of the above cataloged skills are not present.

Finally, there is the critical question: “What constitutes commercialization experience?”

Smaller institutions in Part I countries share a major issue with institutions in Part II countries on the matter of human resources. The particular issue is the scale of activity needed to justify a staff with the full range of skills to manage the technology transfer process.

Comprehensive commercialization experience is rare in any one individual. The commercialization process in most corporations tends to be in silos. Most offices are adequately staffed with general management oversight and experience in research and general business development. Skill sets that are less well represented are: marketing planning and analysis, product development and testing, regulation, manufacturing and sales. General entrepreneurial and venture financing experience varies among institutions. Some of the professional staff may have experience in one or more of these silos. To the extent that the skills exist in a given TLO and depending on the collaborative style within the office, commercialization planning can be part of either the marketing activity for available technologies or part of the business plan for a start-up. The TLO, however, does not manage the commercialization of technology per se, but is responsible for initiating the process.

In order to have a TLO staff that encompasses this large range of skill, the inventory of technologies must be large. Smaller institutions, however, are often successful despite scale. They achieve effectiveness through collaboration with other institutions, cultivating close relationships with companies and venture capitalists and leveraging all available resources. Part II country institutions can emulate these practices.

Essentially, the role of the TLO, with some exceptions, ends at the time of the transaction. The opportunity to extend that role, however, exists through the rights in the license agreement to monitor progress towards development milestones.

Part II country inferences from TLO skill set requirements:

TLO professionals have skill sets unlike any other group within universities. Some of the implications are:

- Senior administration or oversight committees are sometimes ill-prepared to assess the quality of the staff or understand the challenges confronted by the TLO
- The skills and experience across the range of licensing strategies and other elements of the office are so diversified that the staff size can be a factor in the success of an office, but size is constrained by the overall size of the research enterprise of the university and the quality of the inventions that arise, the

- available resources (especially in the early years of the TLOs existence), and the available compensation structures
- TLO professionals are employable, often with better compensation, by industry, venture capital funds, start-up companies and, especially, other universities. Managing career development and staff retention is a major challenge.

We can not overstress that the above points are not meant to imply that small offices are destined to be unsuccessful or that smaller institutions are disenfranchised from successful technology transfer. Creative approaches can breach the differences.

Box 8: Staffing implications for TLOs in Part II countries

Well-managed offices at institutions with focused research programs can produce exceptional results. In Part I countries, smart and successful managers of small offices know how to:

- leverage all available internal and external resources, such as educating faculty to play a greater role in marketing their own inventions and working with IP counsel
- develop focused relationships with companies on the basis of interests and using those networks for referrals to other companies when a technology is not of interest
- encourage collaboration by their faculty with research groups at other institutions, thus sharing some of the technology transfer burden with a TLO at the other institution
- manage the relationship with oversight committees and knowing the areas of greatest sensitivity in order to facilitate approval of proposed transaction
- knowing the difference between facilitating and promoting/forming of start-up companies and allowing the entrepreneurs, venture capitalists and incubators to lead

This managerial approach can be replicated by TLOs in Part II countries, especially when additional resources are available, such as:

- technology transfer consortia
- value-add incubators
- international systems for marketing
- training manuals for faculty
- manuals on professional practice from AUTM, MIHR
- “tool-kits” from the IFC/WBG
- access to professional society meetings and networking opportunities with TLOs with similar circumstances
- mentoring relationships with professionals in Part I country TLOs

the offices can accelerate their development and manage with scarce resources.

Accelerating the process in Part II countries: learning from the Part I experiences

As universities formed offices during the 1980s and into the 1990s, they would typically study the programs in the leading universities, such as MIT or Stanford, but ultimately found that the best models were their peer institutions, e.g., universities with similar charters (Land Grant Act of 1883 institutions), size (faculty size or research base), scope (broad base of research), focus (medicine, engineering, etc.), or existing and historical relationships to particular industries (agricultural or extractive industries).

Universities late to the technology transfer enterprise have had every reason to study the paths followed by other universities and use that experience to expose the issues and adopt the means, including the practices of the technology offices and the provisions of agreements, in order meet their responsibilities when engaging in technology transfer.

In short, the educational programs and procedure manuals developed by AUTM are not necessarily US-centric, *but generally advance a Part I country model*. The programs and materials – open and available to members and non-members alike – teach the best practices in university technology transfer, as well as provide sample agreements for research, licensing, materials transfer, equity relationships and others. These agreements were many years in the making and include the combined experience of many institutions. They represent millions of dollars in legal fees over hundreds of transactions in deriving language and provisions that will equitably serve the interests of all parties. While it is true that these agreements are based on US laws and commercial codes, the business principles and the underlying legal precepts have great relevance outside the US, especially when transactions are between a university outside the US and a US-based company.

International efforts, such as the currently un-operational MIHR (its manuals are still available on-line and can be downloaded at no cost), and the formation of national technology transfer groups in European countries, India, China and South Africa will further accelerate the professional growth of technology transfer globally.

The convening power of the IFC/WBG, its “Tool-Kits” and incubator programs can further accelerate the professional development of the field. Moreover, the strategic interests of the IFC/WBG and its network of relationships in life-sciences and health, agriculture, alternative energy and clean-tech, information technology and other industries can leverage the resources of TLOs in Part II countries.

Beyond establishing offices and instituting policies and procedures: Does the Part I country technology transfer model apply effectively to Part II countries?

The business model of technology transfer generally or TLOs in particular is difficult to define. Given the wide range of expectations of the offices from all of the stakeholders described above defies a specific definition and obfuscates the establishment of and measurement of performance. ***Consequently, the obvious question of whether the US model applies elsewhere borders on moot.***

One approach to an answer to define the technology transfer enterprise on the basis of TLO responsibilities. **Effectively, there is no one business model for technology transfer; it is a nest of inter-related models.**

Note that the row summarizing revenues is at the bottom of the table. This is not to suggest that revenues have the lowest priority, quite the contrary, but describing revenues outside of the context of the activities of a TLO bears little meaning.

Elements of the Technology Transfer Business Models in the US		
Responsibility	Value inflection points	Performance Metrics
1. Establish the policies needed to secure and administer rights	-- Foundational: binary function for value capture	+/-
2. Establish associated policies for license approval, conflicts of interest, start-up companies	-- Efficiency with which transactions can be executed -- Source of constructive recommendations	-- Tracking of time period from start of transaction -- Negotiation to completion. --Analysis of reasons
3. Contribute to the growth of overall research capacity	-- Origination of relationships that expand faculty research or facilities -- Revenue with indirect costs	-- Track trends in industrial relationships -- Difficult to assign responsibility
4. Assist in the recruitment and retention of faculty	-- Retention: Generate confidence among faculty that their interests are well served -- Recruitment: relative to particular candidate	-- Retention: Periodic satisfaction surveys -- Recruitment: Generally not measurable except by anecdote

<p>5. Facilitate the availability of tangible research materials</p>	<ul style="list-style-type: none"> -- Rapid processing of agreements -- In selected cases track inventions that might result for use of materials 	<ul style="list-style-type: none"> -- Track number and processing time
<p>6. Generate corporate sponsored research</p>	<ul style="list-style-type: none"> -- Close collaboration with faculty in defining projects and potential results -- Origination of opportunity -- Efficient processing 	<ul style="list-style-type: none"> -- Measurement issue driven by institutional strategy: quantity of deals vs. size of deals -- Securing IP rights and licensing them to sponsor
<p>7. Secure and administer ownership rights in all intellectual property</p>	<ul style="list-style-type: none"> -- Means of establishing duty to assign -- Monitoring invention disclosures year-to-year and establishing measures of quality and promptness of disclosure relative to planned publication -- Avoiding public disclosure of inventions prior to IP evaluation (function of faculty education) 	<ul style="list-style-type: none"> -- Reduction in lost rights through public disclosure -- Acting upon information that an invention has bypassed the office
<p>8. Protect the interests of faculty and the university in outside consulting agreements</p>	<ul style="list-style-type: none"> -- Establishing provisions that inventions made by faculty under an outside consulting agreement must be disclosed to and may be assignable to the university (Note: universities generally do not play the role of legal counsel to faculty member's private consulting agreements. Such agreements are reviewed on an exception basis or if in parallel to a research or license agreement 	<ul style="list-style-type: none"> -- Track the number of consulting agreements reviewed and successfully modified

<p>9. Generate license agreements – existing corporations</p>	<ul style="list-style-type: none"> -- Thorough analysis of invention and its potential uses -- Involve the faculty member in characterizing and marketing the inventions -- Defining the faculty member's needs and preferences -- Efficient marketing of the invention -- Effective use of patent costs and resources -- Appropriate crafting of a license agreement with mutually beneficial terms -- Deriving performance milestones and monitoring completion after the deal -- Efficient transaction -- Efficient approval by oversight committee(s) 	<ul style="list-style-type: none"> --Has the company measurably accelerated product development relative to what another licensee or start-up would do? -- Is the company on schedule with development milestones -- Is the company exercising its sub-licensing rights (especially for the benefit for Part II countries?) -- What has been the equity yield? -- What has been the royalty yield?
<p>10. Generate start-up companies</p>	<ul style="list-style-type: none"> -- Formulating criteria for start-up companies -- Selecting appropriate technologies as candidates -- Defining the faculty member's needs and preferences -- Feasibility assessment and yes/no decision -- Recruitment of an 	<ul style="list-style-type: none"> -- Has the company stayed local? -- Employment? -- Use of incubators or other state or city supported facilities -- Has the company raised sufficient capital -- Has the company brought in federal research funds

	<p>entrepreneur</p> <ul style="list-style-type: none"> -- Development of business plan -- Securing start-up capital -- Effective use of patent costs and resources -- Appropriate crafting of a license agreement with mutually beneficial terms -- Deriving performance milestones 	<ul style="list-style-type: none"> -- Has the company induced investment from venture capital funds from outside the region -- Has the company entered strategic alliances --Has the company measurably accelerated product development relative to what an established licensee would do? -- What has been the equity yield? -- What has been the royalty yield?
<p>11. Overall income generation</p>	<p><i>THESE ARE NOT VALUE INFLECTION POINTS; THEY ARE INCOME SOURCES</i></p> <ul style="list-style-type: none"> -- Industry sponsored research <ul style="list-style-type: none"> -- Direct costs -- Indirect costs -- License fees -- License royalties <ul style="list-style-type: none"> -- Minimum royalties -- Running royalties -- Sublicense fees/royalties -- Milestone payments -- Equity liquidations -- Patent reimbursements -- Litigation settlements 	<ul style="list-style-type: none"> -- Track all revenue sources -- Breakdown by source and classification; plot growth/changes -- Analyze by college/school, department, research center, as applies -- Determine and track dispersion among entities within the institution -- Determine and monitor dispersion of sources or dependence on a small number of licenses or research sponsors -- Derive a model for returns to the institution for its investment in the TLO

Even after decades of operation, the establishment of goals and the determination of suitable metrics for TLOs at universities in Part I countries is still in its earliest stages. A major question for the IFC – TTF is whether and how to formulate a priori metrics for the performance of a TLO and the associated economic development impact or first test a variety of structures and support mechanisms, monitor results and trends, and then formulate metrics.

3.0 Research Methodology

3.1 Institutional/government selection and information gathering

Universities were selected on the basis of geographic distribution and presumed levels of sophistication and growth. In several instances it was known that certain countries were at the earliest stages of technology transfer.

The process for acquiring information was as follows:

- Interview leading or representative institutions to review their internal processes, management issues, performance and needs
- See Discussion Guide in Annex
- Identify and review multiple studies of technology transfer activity and best practices texts and training programs exist
- Develop Hypothetical Interventions and possible roles for the IFC/WBG
- Identify agenda issues and invitees for 2009 Convocation

3.2 Countries/regions studied

Country	Institution	Interviewee	Type
Argentina	Ministry of Science and Technology	Ruth Rosenberg, Assistant Minister	Government policy and research funding source
Brazil	UNICAMP	Marcelo Menossi, Ph.D Professor and Director	Public University TLO
Chile	CORFO	Adrian Magendzo	National economic development organization
China	Tsinghua University	Dr. Tan Hongxing, Director, International Technology Transfer Center	Public University TLO

China	Tsinghua University Incubator	Li Tian, US Representative	University affiliated incubator
Germany	Humboldt University Commercial Development	Dirk Radzinski, CEO	University affiliated tech transfer office and commercial development organization
India	“STEM”	Mr. K. “Vijay” Vijayaraghavan, President	National professional development association and university representative
Israel	Yissum/Hebrew University	Nava Swersky Sofer, CEO	External company for tech transfer
Japan	University Technology Transfer Association	Takeshi Fukuda Secretary General	National Organization (AUTM-like) funded by METI
Japan	Waseda University	Masafumi Katsuta Professor and Director	Private University TLO
Japan	Nihonkai Innovation Tech Transfer	Harry T. Hirano, President	METI Program Ishikawa Prefecture
Japan	Shikoku TLO	Shingo Ohayama Chief, Technology Licensing	Prefectural TLO (Private/self-supporting)
Malaysia	Universiti Sains Malaysia	National University’s TLO	National University’s TLO
Malaysia	Universiti Putra Malaysia	Prof. Dato’ Dr. Mohamed Shariff Bin Mohamed Din, Director Innovation and Commer. Ctr	National University’s TLO
South Africa	Medical Research Council Innovation Center	Michelle Mulder, Ph.D. Technology Transfer Manager	SA’s NIH. TT Office handles intramural and TT from 24 universities in collaboration with their TLOs

Sub-Saharan Africa	Secondary readings See Annex		
UAE	UAE University	Ramadan ben Amer	Industrial relations office
UK	Cambridge University Technology Development	Teri Willey, CEO	University affiliated tech transfer and development organization
US	Cornell University Research Foundation	Richard Cahoon, COO	University affiliated tech transfer foundation
US	MIT	Lita Nelsen Director	University TLO
US	Stanford	Kathy Ku, Director	University TLO
US	Wistar Institute	Meryle Melnicoff, Director	Private research institution

3.3 Interview Guide

See Annex

3.4 Major Findings

The following are the general findings from the discussions. The *italicized entries* indicate that similar issues exist in Part I countries.

- **Capacity building implications**
 - Most countries have a Bayh-Dole type policy or are moving towards it; policies changes are within last eight years
 - *Funding of offices is complex; patents funded separately (no pattern)*
 - Largely understaffed
 - Recruitment and training of staff is an emphasis
 - Faculty outreach is a priority
 - Generally disclosures are increasing but from a very small base
 - Revenues are negligible
 - *Diligence and evaluation standards are high (“on paper”); implementation is questionable*
 - Identification of prospects and technology marketing are universal problems
 - Valuation of technologies is a problem
 - *Several offices at major schools carry a huge extramural training burden*

- **Investment/funding implications**
 - *Little to no capital for start-ups as well as “valley of death” gap*
 - *Scarce entrepreneurial talent for start-ups*

- **Economic development implications**
 - *International licensing is scant and cited by all as a problem*
 - *Corporate licensees seldom exercise their right to develop products or sub-license their rights for Part II countries*
 - Identification of local capability for commercialization
 - Policies that inhibit outflows of technology, e.g., Brazil, South Africa

4.0 Annexes:

- 4.1 Interview guide
- 4.2 Country and regional summaries

Annex 4.1: IFC Technology Transfer Project Discussion Guide:

Institution: _____

Person(s) interviewed: _____

Title(s): _____

Role of interviewee: _____

E-Mail: _____

Telephone: _____

1. Major role of the office in the view of the university, with general weighting (this question will guide the areas of emphasis for the interview)
 - 1.1. Advancement of internal research capacity
 - 1.2. Faculty recruitment and retention
 - 1.3. Research sponsorship
 - 1.4. Royalty revenue
 - 1.5. Start-ups
 - 1.5.1. Equity participation
 - 1.5.2. Job creation
 - 1.5.3. Incubator occupancy
 - 1.6. Build broader relationships
 - 1.7. Government relations
2. History and status of national policy (as relevant to the interviewee)
3. History of technology transfer at the institution (as relevant to the interviewee)
4. Composition of technology transfer office, i.e., professional staffing
5. Prevailing intellectual property policies of the institution
6. Ownership/title of inventions
7. Office budget resources: operational and IP costs
8. Financial incentives for faculty imbedded in policies or evaluation practices, e.g, royalty sharing, promotion, tenure
9. Faculty compliance with policies/freedom to elect participation
10. Current profile of research by faculty/investigators, e.g., by discipline
11. Approximate level of sponsored research: government, philanthropic, industrial, venture capital backed
12. Number of invention disclosures and trends
13. Office operational processes:
 - 13.1 System for identification of new inventions
 - 13.2 Faculty outreach and training
 - 13.3 Mechanism for IP management:
 - 13.3.1 Screening
 - 13.3.2 Prior art
 - 13.4 Technology assessment
 - 13.5 Commercial assessment
 - 13.6 Assessment of best options for development
 - 13.6.1 Traditional licensing
 - 13.6.2 Start-up
 - 13.7 IP related decisions
 - 13.7.1 Provisional criteria
 - 13.7.2 Domestic criteria
 - 13.7.3 PCT/National Phase
 - 13.7.4 Cost management

- 13.8 Marketing strategy, processes and execution
 - 13.8.1 Tie-in to technology and commercial assessment
 - 13.8.2 Reach-out programs
 - 13.8.3 Websites/searchable websites
 - 13.8.4 Conference participation
- 13.9 Role of office in creation of start-up companies around technologies:
 - 13.9.1 Screening frameworks
 - 13.9.2 Decision and approval process
 - 13.9.3 Special institutional procedures and issues
 - 13.9.4 Business plan development
 - 13.9.5 Securing seed financing
 - 13.9.6 Identifying management
 - 13.9.7 Governance/board role
- 13.10 Licensing structure (standard format?)
- 13.11 Negotiation process management and “style”
 - 13.11.1 “Standard” form agreements
 - 13.11.2 Terms with flexibility
 - 13.11.3 Areas of economic emphasis
 - 13.11.4 Terms with little to no flexibility
- 13.12 Approximate time from disclosure to completed deal, post-deal monitoring
- 13.13 Internal decision/approval process (reiteration)
- 13.14 Conflict of interest review/ethical review (reiteration)
- 14. Revenue (probably a very sensitive area for most institutions; may have to settle for a general characterization of description of mix and trends)
- 15. Domestic versus international transactions. For the latter a characterization of types of licensees and nature of the relationship
- 16. For international, practices or mechanisms in place for outreach; issues faced in international outreach, marketing, transactions and post-deal monitoring
- 17. Metrics by which the performance of the office is judged; institutional and government:
 - 17.1 Research revenues vs. royalties vs. company creation (and related factors, e.g., equity)
 - 17.2 Impact on local incubators
 - 17.3 “Induced” capital investment from outside country or region
 - 17.4 Role in bringing major corporate R&D facilities into region or country
 - 17.5 Impact on reversing brain-drain/repatriation of scientists
 - 17.6 Job creation
- 18. Obtain data on meeting metrics if available
- 19. Professional staff recruitment and development
 - Backgrounds
 - Staffing trends
 - Recruitment methods
 - Internal and external training programs