Internationally Competitive Technology Transfer and Commercialization in Practice: The Importance of Effective Technology Evaluation

Heath Naquin
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30 pm to 2:40 pm</td>
<td>Welcome Remarks &amp; Opening Addresses: Canan CAKMAKCI: Bilkent Cyberpark İhsan KARATAYLI: TTGV Department of State Representative</td>
</tr>
<tr>
<td>2:45 pm to 3:00 pm</td>
<td>Turkey BOOST Practical Technology Commercialization Program (PTCP) Program Description Dr. Greg Pogue &amp; Heath Naquin</td>
</tr>
<tr>
<td>3:00 pm to 3:30 pm</td>
<td>The Intersection of Research and Commercialization Dr. Greg Pogue: Deputy Director, IC2 Institute</td>
</tr>
<tr>
<td>3:30 pm to 4:00 pm</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>4:00 pm to 4:30 pm</td>
<td>Internationally Competitive Technology Transfer and Commercialization in Practice: The Importance of Effective Technology Evaluation Heath Naquin: Principal Investigator, Program Manager, IC2 Institute</td>
</tr>
<tr>
<td>5:30 pm</td>
<td>Close</td>
</tr>
</tbody>
</table>
Good Afternoon
Biographical Info

Heath Naquin BBA, MSTC, PMP

• Program Manager-Technology Transfer and Commercialization @ Ic2 Institute
• Commercialization Advisor in 16 Countries
• SBIR Commercial Reviewer for NSF and EPA
• International Business Mentor for CRDF
• Senior Principal Advisor for NSF CAP-1 Program
• Direct Start Up Experience with 3 Firms
• Co-Founder of Industry Focused Green Technology Alliance
• Editor Journal for Transition and Innovation Systems
Key Learning Topics

• Introduction to the Technology Transfer Office (TTO):
• TTO Basic Functions and Metrics for Competitiveness
• The Importance of Effective Evaluation
Brief History of Technology Transfer
Tech Transfer Overview

• So What is Technology Transfer??
Technology Transfer Defined

1. Assignment of technological intellectual property, developed and generated in one place, to another through legal means such as technology licensing or franchising.

2. Process of converting scientific and technological advances into marketable goods or services.

(www.businessdirectory.com)
History of Technology Transfer

First Time For Tech Transfer??

• Technology Transfer Began when man developed knowledge that was worth enough to other men that they would trade for its secrets.
Some Numbers

• FY 2007 Statistics
  – $48 billion in research at US universities
  – $3.4 billion in industry funded research, a 15% increase over FY 2006
  – Almost 20,000 invention disclosures
  – 3,622 newly issued patents
  – 555 new start-ups based on university technology
  – Approximately 13,000 active licenses
What is a TTO?

- TTO Stands for Technology Transfer Office:
  - AKA (Also Known As)...
  - Office of Technology Commercialization (OTC)
  - Technology Transfer Office (TTO)
  - Commercialization Office (No Known Acronym)
  - Licensing Office (LO)
  - Many Others
Core TTO Function/Mission

- Serve the Faculty
- Serve the University
- Perform Industry Outreach
- Be Self Sustaining
- Produce Return on Research (ROI)
Typical TTO Activities

• IP administration,
• Marketing and communications,
• Policy development,
• Legal advice,
• Compliance, and
• Financial management
• Operational engagement.
Organizational strategies for TLO offices

• Driven by Focus (i.e. Mission and Vision of TLO)
• Can Vary
• Usually have similar goals but very different execution
Example 1: Blended Commercialization Office

• This Organizational Strategy typically:
  – Conducts Licensing
  – Supports Incubation
  – Manages University IP
  – Manages Sponsored Research with Industry
  – Handles Entrepreneurial Projects
  – May interface with regional economic Development Programs
Example 2: Licensing Focused Office

- Manages IP investment for University
- Negotiates Royalties
- Negotiates Licensing Agreements
- Performs Faculty Outreach
- Manages Royalty revenues
- Does not typically engage with Start Ups
Example 3: University Incubator Group

• Focuses on Start Up companies with or without University IP
• Supports through Mentorship
• May or May not take Equity
• Usually Supported and Revenue Negative
Outsourced TLO Management Structure

• Outsources TLO activity to external groups
• Develops management plan for external groups working on University research commercialization
• Manages expectations on all sides
• Manages Contracts
Surprise!!
Real Interest...
Lets Talk Money
Budget is a Constant Concern for TLO

• High Overhead
• Long Time Between Return
• Often forced to Self Fund
  – Leads to lack of focus
• Unrealistic Expectations by Administration
Typical TLO Costs

• The expenses of running a technology transfer office can be broadly divided between:
  – Patent costs
  – Personnel
  – Other operating costs.

• May be combined or separated between patenting and operations.
How is Your Budget Structured?
### Typical Split in US TLO’s

<table>
<thead>
<tr>
<th>Budget Procedure</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate Patent and Operating Budgets</td>
<td>78</td>
<td>60%</td>
</tr>
<tr>
<td>Combined Patent and Operating Budgets</td>
<td>53</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Budgeting Procedures
Where does the Money Come From?
Speaking of Return on Investment

• How Many TLO’s in the US do you believe are profitable??
<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss Making</td>
<td>Total expenses exceed total income</td>
</tr>
<tr>
<td>Gross Profitable</td>
<td>Total income exceeds total expenses</td>
</tr>
<tr>
<td>Net Profitable</td>
<td>Total income less distribution to inventors exceeds total expenses</td>
</tr>
<tr>
<td>Self-Sustaining</td>
<td>Total income less distribution to inventors, colleges/labs, provost,</td>
</tr>
<tr>
<td></td>
<td>university etc. exceeds total expenses</td>
</tr>
</tbody>
</table>
A look at the Numbers

Table 11. Financial Contribution to Institution from Technology Transfer

<table>
<thead>
<tr>
<th>Financial Contribution</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss making</td>
<td>68</td>
<td>52.3%</td>
</tr>
<tr>
<td>Gross profitable</td>
<td>27</td>
<td>20.8%</td>
</tr>
<tr>
<td>Net profitable</td>
<td>14</td>
<td>10.8%</td>
</tr>
<tr>
<td>Self sustaining</td>
<td>21</td>
<td>16.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>130</strong></td>
<td>**</td>
</tr>
</tbody>
</table>
More Numbers
What About Size??

Profitability at University TTOs by Research Budget Size

- Loss Making
- Gross Profit
- Net Profit
- Self-Sustaining

University Research Budget

Very small, Small, Medium, Large, Very large
So how to Be Profitable

• The greater the age, FTE count, and research budget of a TTO, the more likely it was to be profitable.

• 100% profitable if:
  – TTOs 15 years old and;
  – had a research budget greater than $500 million and;
  – had a total staffing of 20 FTEs were all profitable
A Word on the Age of TLO

Learn from the mistakes of others.
You can't live long enough to make them all yourself.
What Does that Mean for New TLO’s

• Aid Faculty in Attracting New Research
• Make sure administration has realistic expectations
• Define Profit Carefully
• Retain Control of Patent Budget, but Done be Responsible for it if possible.
• Learn from Mistakes
• Use Tools and Process to Get smart Fast
This looks Hard...
Can a TTO be profitable??
Tech Transfer and ROI

• Which University System has the Most Research Dollars?
  – UC System - $3 Billion +

• Which University Provided the Best ROI on Research Dollars?
  – New York University--which pulled in $157 million in research-related income on $210 million in research and development (R&D) expenditures--tops the list with a 75% yield.

• Who is Better at Technology Transfer??
Top Earning TLO - 2011

1. Northwestern University, $161 million
2. Columbia University, $154 million
3. New York University, $113 million
4. University of California System, $103 million
5. Wake Forest University, $96 million
6. University of Minnesota, $95 million
7. University of Washington, $87 million
8. University of Massachusetts, $71 million
9. Massachusetts Institute of Technology, $66 million
10. Stanford University, $64 million
11. University of Wisconsin at Madison, $57 million
12. University of Florida, $54 million
13. California Institute of Technology, $48 million
14. University of Rochester, $46 million
15. University of Iowa Research Foundation, $43 million
TLO and the University

• Financial Returns - Cash
• Financial Returns - Assets
• Non-Financial Returns
University Return Vehicles

- **Financial Returns - Cash**
  - *Royalty income*: the TTO licenses out technologies and receives royalty payments in return.
  - *Research funding from spin-outs*: the TTO establishes new spin-out companies which raise investments. Capital spent on developing early-stage technologies by funding research back in the university.
  - *Research funding from Translation Awards*: the TTO helps the university win later-stage research funding by: managing patents, providing inputs, and supporting translational activities.
  - *Government funding*: Government schemes to foster technology transfer are often tied to TTO type operations.
  - *Sale of spin-out shares*: the TTO will help establish new spin-out companies in which the university holds shares. As the companies in the portfolio grow, the university will receive cash from the share sale upon exit/flotation and from dividend payments.
<table>
<thead>
<tr>
<th>Date</th>
<th>Product</th>
<th>Licensor</th>
<th>Amount ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 1990</td>
<td>Neupogen</td>
<td>Amgen</td>
<td>$75</td>
</tr>
<tr>
<td>Dec. 1999</td>
<td>Zerit</td>
<td>Yale University(^1)</td>
<td>$125</td>
</tr>
<tr>
<td>Jan. 2001</td>
<td>Thalomid</td>
<td>Children’s Hospital</td>
<td>$5</td>
</tr>
<tr>
<td>Sept. 2003</td>
<td>Aldurazyme</td>
<td>LA Biomed(^2)</td>
<td>$25</td>
</tr>
<tr>
<td>Jan. 2004</td>
<td>Neupogen/Neulasta (U.S.)</td>
<td>Memorial-Sloan Kettering(^3)</td>
<td>$263</td>
</tr>
<tr>
<td>Jan. 2005</td>
<td>Macugen</td>
<td>University of Colorado(^4)</td>
<td>$45</td>
</tr>
<tr>
<td>Jan. 2005</td>
<td>Rotarix</td>
<td>Children’s Hospital Cincinnati(^5)</td>
<td>n/a</td>
</tr>
<tr>
<td>Jan. 2005</td>
<td>Rotateq</td>
<td>Wistar Institute(^6)</td>
<td>$45</td>
</tr>
<tr>
<td>July 2005</td>
<td>Emtriva</td>
<td>Emory University(^7)</td>
<td>$525</td>
</tr>
<tr>
<td>Aug. 2005</td>
<td>Remicade</td>
<td>NYU/Dr. Vilcek</td>
<td>$46</td>
</tr>
<tr>
<td>Aug. 2005</td>
<td>Neupogen/neulasta (Non-U.S.)</td>
<td>Memorial-Sloan Kettering(^8)</td>
<td>$142</td>
</tr>
<tr>
<td>Oct. 2005</td>
<td>Humira</td>
<td>Scripps Research Institute(^9)</td>
<td>$32</td>
</tr>
<tr>
<td>June 2006</td>
<td>Embrel (US)</td>
<td>MGH(^10)</td>
<td>$248</td>
</tr>
<tr>
<td>April 2007</td>
<td>Enbrel (Foreign)</td>
<td>MGH(^11)</td>
<td>$284</td>
</tr>
<tr>
<td>May 2007</td>
<td>Remicade</td>
<td>New York University(^12)</td>
<td>$650</td>
</tr>
<tr>
<td>July 2007</td>
<td>FluMist</td>
<td>U. of Michigan(^13)</td>
<td>$35</td>
</tr>
<tr>
<td>Dec. 2007</td>
<td>Lyrica</td>
<td>Northwestern(^14)</td>
<td>$700</td>
</tr>
<tr>
<td>Dec. 2007</td>
<td>Rotarix</td>
<td>Cincinnati Children’s Hosp.(^15)</td>
<td>$24</td>
</tr>
<tr>
<td>June 2008</td>
<td>RotaTeq</td>
<td>Children’s Hosp. of Phil.(^16)</td>
<td>$182</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>$3,451</td>
</tr>
</tbody>
</table>

* Estimate

** Sale by inventor
Equity Implications
Update on Stanford/Google

• In 2008, Google paid approximately $1,881,400 to Stanford University.
  – Approximately $426,950 of these payments related to the license by Stanford of patents, including the PageRank patent, to Google.
  – Approximately $1,246,000 of the total payment to Stanford represented donations for scholarships and other philanthropic endeavors.
  – Stanford shares a portion of the royalty revenues associated with some of these patent licenses with Larry Page and Sergey Brin.
University Return Vehicles

• **Financial Returns - Assets**
  
  – *Spin-out shareholdings*: over time the university will build up a portfolio of shareholdings in its spin-out companies, these shareholdings have an asset value to the university.
  
  – *New patents*: the TTO will file new patent applications and over time build a considerable portfolio of these patent applications and granted patents, which have an asset value to the university.
University Return Vehicles

• Non-Financial Returns (Good Will)

• Promote the university:
  – within the wider business community,
  – industrial and professional communities

• Enable the university to demonstrate to research funders commitment to transferring technology from its research activities.

• Assist with Staff Recruitment and Retention

Good Example of Indirect Return

5 Year $50 Million Dollar Drug Development Sponsored Research Deal. Established Center for Therapeutic Innovation (CIT)
Ultimate Goal of Technology Transfer

• Provide a return (not necessarily tangible) on the research produced at the university.
Questions??
Measuring the TLO
Table 12. Top-Ranked Drivers of Technology Transfer

<table>
<thead>
<tr>
<th>Driving Factor</th>
<th>Number of Institutions</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Service</td>
<td>51</td>
<td>39.2%</td>
</tr>
<tr>
<td>Translating Research Results</td>
<td>45</td>
<td>34.6%</td>
</tr>
<tr>
<td>Revenue Maximization</td>
<td>15</td>
<td>11.5%</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>11.5%</td>
</tr>
<tr>
<td>Research Support</td>
<td>4</td>
<td>3.1%</td>
</tr>
<tr>
<td>Risk Management</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td></td>
</tr>
</tbody>
</table>
Some Metrics to Remember

Figure 9. Top-Ranked Driver of Behavior at Public vs. Private Universities
TLO Basic Functions and Metrics

• Core TLO Function
  – Licensing of Technology
  – Faculty Engagement
  – IP management

• Metrics
  – IP Generated
  – Patents Awarded
  – Licenses Negotiated
  – Revenue Generated
People

• Effective People are key to Success
  – Core Functions of importance
    • Faculty Interface
    • Legal Competency
    • Project Management and Execution
    • Grant Writing
    • Don’t Forget…
Technology Scouting
Process Importance

• Effective Processes are key to allowing efficient Operations
• Process preserves transparency and encourages appropriate communication
• Successful Process can enhance productivity
• Poor Process can kill an office
Example TLO Process
A Word on the Value of Time
So if Time is Key??

• How to get better faster??
  – Learn from others mistakes
  – Be Innovative with your processes
  – Be Open to Collaboration
  – Do the Deal, Whatever it is
  – Know People
  – Raise Awareness International
  – Assemble Partners
  – Love your Researchers
### By the Numbers

<table>
<thead>
<tr>
<th>Profitability</th>
<th>No.</th>
<th>Research Result Trans.</th>
<th>Faculty Service</th>
<th>Revenue Maximization</th>
<th>Industrial Sponsored Research</th>
<th>Risk Management</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss-Making</td>
<td>58</td>
<td>31%</td>
<td>45%</td>
<td>12%</td>
<td>9%</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>24</td>
<td>33%</td>
<td>38%</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
<td>13%</td>
</tr>
<tr>
<td>Net Profit</td>
<td>12</td>
<td>33%</td>
<td>42%</td>
<td>25%</td>
<td>0%</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>Self-Sustaining</td>
<td>18</td>
<td>33%</td>
<td>39%</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td>17%</td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>32%</td>
<td>42%</td>
<td>13%</td>
<td>4%</td>
<td>0%</td>
<td>10%</td>
</tr>
</tbody>
</table>
The Most Important Part
Invention evaluation
A Word on Evaluation of Technologies

• Assertion 1: Tens, and perhaps hundreds, of hours are invested in technologies or teams not ready to take the next step in commercialization.

• Assertion 2: Commercialization throughput can be substantially increased through rapid, effective early screening.
TTO Metrics for Evaluation

- Patentability
- Likelihood of Commercial Return to University
- Applicability to Solving Social Ill
- Amount of potential return to University
- Inventor Cooperation
Method to Evaluate Invention

• Variety of Methods
• Must Align with Institutional Goals and Mission
• Must be consistent
• Must take into account resource constraints of institution
A word on Constraints

• How many of you deal with only one invention at a time??
• How much time do you typically spend on evaluating a new technology or innovation??
• Where is most of the time in your TLO spent??
The Evaluation Matrix

<table>
<thead>
<tr>
<th>Low Licensing Risk</th>
<th>High Licensing Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Reward</strong></td>
<td><strong>Cost Drivers</strong></td>
</tr>
<tr>
<td>High Value-Added (Prioritize)</td>
<td>(Make a few smart picks where risk can be reduced; close the rest.)</td>
</tr>
<tr>
<td>Low Reward</td>
<td><strong>Non Value-Added</strong></td>
</tr>
<tr>
<td>Low Value-Added (Maintain low risk, increase reward if possible)</td>
<td>(Waive/Release to Inventors)</td>
</tr>
</tbody>
</table>
Building your Office
A Metric Related to Size

Table 7. Cohort Definitions and Populations (Universities Only)

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Research Expenditures ($ million)</th>
<th>Number in Cohort</th>
<th>Total FTEs</th>
<th>Number in Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Small</td>
<td>Up to $50</td>
<td>20</td>
<td>1–3</td>
<td>9</td>
</tr>
<tr>
<td>Small</td>
<td>$51–100</td>
<td>23</td>
<td>4–5</td>
<td>33</td>
</tr>
<tr>
<td>Medium</td>
<td>$101–250</td>
<td>45</td>
<td>6–10</td>
<td>42</td>
</tr>
<tr>
<td>Large</td>
<td>$251–500</td>
<td>24</td>
<td>10–24</td>
<td>36</td>
</tr>
<tr>
<td>Very Large</td>
<td>&gt;$500</td>
<td>39</td>
<td>&gt;25</td>
<td>34</td>
</tr>
</tbody>
</table>
Examples from the Field

- Portugal
- Mexico
- Colombia
Well, until tomorrow.
Contact Details

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