The Rise of International University Research Ventures: Institutional and Policy Implications

Philip Shapira ¹,²,*

Workshop: STI In the Era of Uncertainty
Nanyang Technological University, Singapore
November 28, 2017

1. Manchester Institute of Innovation Research, Alliance Manchester Business School, University of Manchester, UK
2. Georgia Institute of Technology, Atlanta, GA, USA

Email: pshapira@manchester.ac.uk | pshapira@gatech.edu | Twitter: @philipshapira

*with Jan Youtie, Seokkyun Woo, Sergey Kolesnikov, Yin Li, Jon Schmidt, Juan Rogers, Zak Taylor. Supported by ARO award # W911NF-15-1-0322.
Evolving university contexts and missions: What’s next?

Traditional

Storehouse
of knowledge

Institutional context
Craft production

University elitist - “above society”

Present

Knowledge factory

Institutional context
Industrial mass production

University is “supplier” of inputs and outputs, technology developer

Evolving

Animateur of development
“Knowledge Hub”

Institutional context
Post-industrial age, knowledge-driven

University: integrated institution in an intelligent region. Promotes indigenous development, new capabilities

A rising pathway:
The International University Research Venture (IURV)

Georgia Tech – Lorraine campus in France, established in 1990, includes:
• Joint research lab with CNRS (French National Center for Scientific Research): GT-CNRS UMI 2958 since 2006
• Lafayette Institute for innovations in optoelectronics, advanced materials since 2015
Other prominent IURVs...

Fudan-Yale Biomedical Research Center (Fudan University, Shanghai, China)

First ever Chinese publication featured on the cover of “Cell” magazine (2005)

“So what Yale did was essentially outsource the lab work to Fudan [University] by creating the Fudan-Yale Biomedical Research Center”

T. Friedman “The World is Flat”, 2005
Other prominent IURVs...

- MIT – Skolkovo, Moscow, Russia
- Georgia Tech Ireland (NUI Galway, U Limerick)

CREATE – Campus for Research Excellence and Technological Enterprise, Singapore

- ETH Zurich
- MIT
- Technical University of Munich
- Hebrew University of Jerusalem
- University of California, Berkeley
- Shanghai Jiao Tong University
- Cambridge University
What are International University Research Ventures (IURV)?

- **IURV = Formal university initiative to establish long-term research presence overseas**
  - Institutional (or departmental) support & recognition
    - Not an individual research project
    - Not an inter-governmental research cooperation
  - Explicit emphasis on research activities including joint research and development activities

- **Organizational characteristics**
  - Identity (name) and purpose
  - Governance structure
  - Multiple individual researchers or participants
  - Identifiable affiliation and overseas host location or partner
State of Research

• Growing involvement of universities outside home location
  • Mapping of international branch campuses (C-BERT: http://www.globalhighered.org; 232 campuses found as of June 2016)
  • Spread and effectiveness (Dewey and Duff 2009, Fang 2012)
  • Motivations (Slaughter and Leslie 1997, Altbach and Knight 2007, Lane 2011)
  • Factors (Feast and Bretag 2005, Edwards, Crosling et al. 2013)
  • Focus on transnational education

• Trans-border scientific research & international collaboration
  • Internalization of Research Collaborations (Schubert and Braun 1990, Jones, Wuchty et al. 2008, Leydesdorff and Wagner 2008)

• Limited case studies: focusing on institutionalization of research collaborations
  • MIT (Pfotenhauer, Jacobs et al. 2013, Pfotenhauer, Wood et al. 2016), Singapore (Olds 2007, Sidhu 2009, Sidhu, Ho et al. 2010), Shenzhen (Chen and Kenney 2007)
Research Objectives

• **Main objective of the IURV project**
  • To understand IURV emergence and implications for knowledge production, development, innovation, and economic competitiveness

• **Key Questions**
  • What is the scale of IURV activities in the world?
  • What do IURVs actually do?
  • Whom do they partner with?
  • How do IURVs emerge, become institutionalize, and change in time?
  • What are impacts and implications for home and host organizations and countries?
Data

• **Data collection on IURVs**
  • Gathering public information by web scraping
    • Websites of universities, their partners, IURVs
    • Supplemented by relevant government reports and news sources
  • Topical focus includes STEM fields and social sciences

• **Types of information collected**
  • “Parent” university data
    • International strategy, missions, description of international offices, quantity and location of IURVs
  • IURV data
    • Names and locations, missions, activities, partners, research areas

• **Additional in-depth case studies**
  • Interviews in US, China, Singapore, Russia
Sampling: Two sub-samples

1. **“US”: 108 US “Very High Research Active” universities**
   - Based on “Carnegie Classification of Institutions of Higher Education” (2010)

2. **“International 80”: stratified sample of 80 prominent research universities outside U.S.**
   - 40 top non-US universities ranked by “Research” criteria in THE World University Rankings 2016
   - 40 additional top regional research universities outside Europe, Canada, Australia according to the same rankings
     - 8 Asian OECD; 8 Asian non-OECD; 8 Middle East; 8 Africa; 8 Latin America

**Coverage**

- US: Reasonably close to full coverage of IURV activities of all high research active universities
- International 80: Decent coverage of top research universities in each region
- Evidence was found for IURV establishment by additional 130+ universities – all outside the sample (i.e. we have a sample, not full population)
## IURVs & Locations

- **412 IURVs** created in **86 countries**
- Located in some of the most and the least developed / scientifically “powerful” countries
- **38** international branch campuses with research
- **115** joint labs

### Host Region | IURV Count
--- | ---
Asia | 280
Africa | 49
Europe | 42
Latin America | 28
North America | 8
Oceania | 5
**Grand Total** | **412**

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>With IURVs</th>
<th># IURVs</th>
<th>% with IURV</th>
<th>Mean # of IURVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>US “Very High Research Active” Universities</td>
<td>108</td>
<td>54</td>
<td>183</td>
<td>50.0%</td>
<td>1.7</td>
</tr>
<tr>
<td>Highly-ranked non-US universities</td>
<td>80</td>
<td>46</td>
<td>229</td>
<td>57.5%</td>
<td>2.9</td>
</tr>
</tbody>
</table>

### # of IURV per Country

<table>
<thead>
<tr>
<th>Country</th>
<th># of IURV</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>125</td>
</tr>
<tr>
<td>Singapore</td>
<td>26</td>
</tr>
<tr>
<td>India</td>
<td>21</td>
</tr>
<tr>
<td>Thailand</td>
<td>13</td>
</tr>
<tr>
<td>South Korea</td>
<td>10</td>
</tr>
<tr>
<td>Qatar</td>
<td>10</td>
</tr>
<tr>
<td>Kenya</td>
<td>9</td>
</tr>
<tr>
<td>Malaysia</td>
<td>9</td>
</tr>
<tr>
<td>USA</td>
<td>8</td>
</tr>
<tr>
<td>Vietnam</td>
<td>7</td>
</tr>
<tr>
<td>Ireland</td>
<td>7</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6</td>
</tr>
<tr>
<td>Russia</td>
<td>6</td>
</tr>
<tr>
<td>Brazil</td>
<td>5</td>
</tr>
<tr>
<td>France</td>
<td>5</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Australia</td>
<td>5</td>
</tr>
<tr>
<td>Tanzania</td>
<td>5</td>
</tr>
<tr>
<td>Pakistan</td>
<td>4</td>
</tr>
<tr>
<td>Chile</td>
<td>4</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>3</td>
</tr>
<tr>
<td>Portugal</td>
<td>3</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3</td>
</tr>
<tr>
<td>Spain</td>
<td>3</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>3</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>3</td>
</tr>
<tr>
<td>Germany</td>
<td>3</td>
</tr>
<tr>
<td>Uganda</td>
<td>3</td>
</tr>
<tr>
<td>South Africa</td>
<td>3</td>
</tr>
<tr>
<td>Mexico</td>
<td>3</td>
</tr>
</tbody>
</table>

---

**Note:** IURVs = International University Research Vouches
# IURV Activities and Partnerships

### Activities*
- **Research:** all 412 by definition
  - Only research: 69
- **Education:** 240
  - Including 38 international branch campuses
- **Economic Development:** 158
- **Commercialization:** 132
- **All four areas:** 36

* List is not comprehensive: there were other missions and activities observed (community outreach, security, etc.), but they were less commonly mentioned

### Host Partnerships
- Academic or healthcare institutions: 340
- National governments: 170
  - + Regional governments: 69
- International development organizations, charities: 99
- Industry, private corporations: 78
IURVs (N=183) Created by Top U.S. Research Universities

Data Description: IURVs Created by US Universities

- **183 US IURVs found in 57 countries (July 2016)**
  - 163 are still in operation,
  - 20 ceased operations or became independent
  - 21 branch campus

Countries hosting two or more US IURVs
US IURV cohorts

IURV Entry by Cohort

Cohort A
(1955-1999)

Cohort B
(2000-2007)

Cohort C
(2008-2016)

Cumulative

# of Entries

1955-1999
2000-2007
2008-2016
Share of IURVs by Host Region
(China shown separately)
### Characteristics of US IURV Sending Universities by Cohort

<table>
<thead>
<tr>
<th></th>
<th># Entrance</th>
<th>% Private</th>
<th>Average Ranking (US News)</th>
<th>Average # IURVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort A</td>
<td>12</td>
<td>42%</td>
<td>54.2</td>
<td>6</td>
</tr>
<tr>
<td>Cohort B</td>
<td>21</td>
<td>48%</td>
<td>48.2</td>
<td>3</td>
</tr>
<tr>
<td>Cohort C</td>
<td>20</td>
<td>30%</td>
<td>60.6</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>40%</td>
<td>54.3</td>
<td>3</td>
</tr>
</tbody>
</table>

Rising role of US public universities in IURVs
Research Areas of U.S. IURVs

<table>
<thead>
<tr>
<th>Research Areas (mega discipline)</th>
<th>IURVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Science &amp; Technology</td>
<td>57</td>
</tr>
<tr>
<td>Health &amp; Social Issues</td>
<td>48</td>
</tr>
<tr>
<td>Biomedicine Science</td>
<td>45</td>
</tr>
<tr>
<td>Clinical Medicine</td>
<td>45</td>
</tr>
<tr>
<td>Computer Science</td>
<td>42</td>
</tr>
<tr>
<td>Business &amp; Management</td>
<td>32</td>
</tr>
<tr>
<td>Economics, Political Science &amp; Geography</td>
<td>30</td>
</tr>
<tr>
<td>Materials Science</td>
<td>23</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>21</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>17</td>
</tr>
<tr>
<td>Physics</td>
<td>17</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>16</td>
</tr>
<tr>
<td>Cognitive Science</td>
<td>13</td>
</tr>
<tr>
<td>Social Studies</td>
<td>13</td>
</tr>
<tr>
<td>Ecology Science</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics Methods</td>
<td>11</td>
</tr>
<tr>
<td>Geosciences</td>
<td>6</td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry</td>
<td>2</td>
</tr>
</tbody>
</table>

IURV Institutionalization

Why Institutionalization Matters?

- Institutionalization: establishing formal organizations (i.e. boundaries) & articulating social relations
- Institutionalization in organizational domain is a driver for scientific development (Rogers & Bozeman 2001; Youtie et al 2006)
- Scientific development is key to realize IURV goals for both universities and governments

RQ: How are IURV institutionalized?
RQ: Do various paths to institutionalization influence outcomes?
# IURV Institutionalization characteristics

<table>
<thead>
<tr>
<th>Nominal characteristics</th>
<th>Fully established IURV</th>
<th>Supporting characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Multi-country senior researchers</td>
<td>• Venture director(s)</td>
<td>• Educational function</td>
</tr>
<tr>
<td>• Multiple joint research projects</td>
<td>• Administrative support</td>
<td>• Government grants, other resources</td>
</tr>
<tr>
<td>• Formal agreement describing roles, responsibilities</td>
<td>• Multi-year resource commitment for joint projects on both sides</td>
<td>• Policy rationale</td>
</tr>
<tr>
<td>• Research venture identity (name)</td>
<td>• Target/agreed research areas</td>
<td>• Intellectual property mechanism</td>
</tr>
<tr>
<td></td>
<td>• Formal mechanism for convening/exchanging participants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Visibility to host and home institutions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Performance review</td>
<td></td>
</tr>
</tbody>
</table>

Method

• Cross-case analysis qualitative research (Stake, 1995; Yin 2013)

• Data Collection
  • IURV origin country: the U.S.
    • Web scrapping to examine global activities by 108 research-intensive US universities (Carnegie Classification)
  • Two host countries: Singapore and China
    • Large US IURV hosts: China (42), Singapore (10)
    • Variations in policy-options: centralized (Singapore) vs. decentralized (China)
  • On-site visits and semi-structured interviews
    • Case selection based on variations in scale, funding, policies
    • Singapore: CREATE campus incl. 10 IURVs $\rightarrow$ Focus on 2 US
    • China: 10 IURVs in Beijing, Shenzhen, and Guangdong $\rightarrow$ Focus on 3 representing greatest variation in IURVs
National Policies

Singapore

- Campus for Research Excellence and Technological Enterprise (CREATE) managed by National Research Found.
- $360m research facility next to NUS Utown campus
- 10 universities receiving $100m for 5 years (renewable), ~80% to NTU, NUS
- Rooted in Global Schoolhouse Project to attract international faculty and students (formal IURV policy)

Requirements:
- Set up LLC in Singapore
- Director in Singapore
- 1 year residency requirement
- All projects joint with NTU, NUS researchers
- IP owned by Singapore Technology Licensing Office
- Metrics/KPIs

China

- 211 Program—create ~100 world leading universities in the 21st century
  - US$2b+ to top universities for expanding degree programs, centers of research excellence
- 985 Program, to increase global ranking of elite Chinese universities
- China Scholarship Council—international exchange through government funded scholarships + return to China through e.g., Thousand Talents Program
- Large market has attracted transnational educational campuses
- No formal national IURV policy
  - Efforts to attract foreign universities to locate are part of regional development strategies in a few coastal cities
  - IURVs hosted based on local and/or institutional “deals”
<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>US</th>
<th>Host</th>
<th>Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore-MIT Alliance for Research and Technology (SMART)</td>
<td>2007</td>
<td>MIT</td>
<td>NTU, NUS</td>
<td>Urban mobility, healthcare, infectious diseases, biosphere sensing, low energy systems</td>
</tr>
<tr>
<td>Berkeley Education Alliance for Research in Singapore (BEARS)</td>
<td>2012</td>
<td>Berkeley</td>
<td>NTU, NUS</td>
<td>Building efficiency, sustainability</td>
</tr>
<tr>
<td>University of Michigan Health System – Peking University Health Science Center (UMHS-PUHSC)</td>
<td>2010</td>
<td>Michigan</td>
<td>Peking University</td>
<td>Clinical research in pulmonary, cardiovascular, liver, renal diseases</td>
</tr>
<tr>
<td>Luminescent Materials and Device International Collaboration (LMDIC)</td>
<td>2014</td>
<td>UC Santa Barbara</td>
<td>South China University of Tech.</td>
<td>Organic Light Emitting Diodes</td>
</tr>
<tr>
<td>Tsinghua Berkeley Shenzhen Institute (TBSI)</td>
<td>2012</td>
<td>Berkeley</td>
<td>Tsinghua</td>
<td>Environmental/energy, data analytics, precision medicine</td>
</tr>
</tbody>
</table>
SMART

- MIT has a history of relationships with Singapore starting from the Singapore-MIT Alliance (1998)
- 2 generations of directors (reporting to MIT Research VP): 1st from MIT, 2nd air force chief scientist in Singapore
- ~100 staff (Singaporean)
- Interdisciplinary Research Groups
- Joint applied research projects, but done separately
- Funds support doctoral and postdoc students, travel, and facilities and equipment
- Benefits to MIT – funding, facilities, setting for applied research
- Benefits to Singapore – prestige, research capacity building
- Potential for tension – SG IP policy, but MIT has Innovation Centre
  - provides grants for prototyping, proof of concept
  - links to mentors
  - ensures IP disclosed to Singapore Technology Licensing Office
Tsinghua Berkeley Shenzhen Institute (TBSI)

• Longstanding relationships between Tsinghua and Berkeley since 1979
• Research on environmental & energy (6 labs), data analytics (6 labs), precision medicine (5 labs)
• Funding from Chinese side
  o Shenzhen municipal government $52 million for buildings, laboratories (real estate focus)
  o Tsinghua Education Foundation $22 million (5 years) for student scholarships, faculty, staff
  o No cash contribution from Berkeley
• Extensive governance
  o Executive Board: Shenzhen mayor, university presidents
  o Industry Advisory Board
  o Academic committee
  o Chairs, co-chairs of each cross-disciplinary field
• IP jointly held
• Benefits to Universities – access to Shenzhen resources, businesses (Berkeley – fundamental science; Tsinghua – implementation)
• Benefits to Shenzhen – raises university profile
• Issues
  o Faculty hiring (slow)
  o Uncertain ability to withstanding local government turnover
UMHS-PUHSC

- Peking University graduate on U Michigan faculty
- Each side invested $7 million
  - Peking from 985 special funding
  - Michigan from discretionary research funds
  - Supports up to $800,000 for two-year joint projects using peer review (25 total, 2 became NIH awards)
- Each side has a co-director, executive board, staff for international, research quality, grant admin.
- Core platform structure common in medical fields
  - Traditional: Bioinformatics, IRB
  - Untraditional: Science collaboration – for leadership videoconferences, proposal coordination, visits/exchanges, annual symposium
- Benefits to China – raise clinical research capacity
- Benefits to Michigan – access to large, homogeneous population
- Issues
  - China side: IRB
  - US side: active participation, time zone differences, language
4 Types of IURV Institutionalization

- **Non-Government Collegial**
- **Non-Government Contingent**
- **Government Directed**
- **Government Facilitated**

**Governance Structuring**:
- **Tight**
- **Loose**

**Government Involvement**:
- **Weak**
- **Strong**
<table>
<thead>
<tr>
<th>Types</th>
<th>Government Directed</th>
<th>Non-government Collegial</th>
<th>Government Facilitated</th>
<th>Non-government Contingent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong government, Tight structuring</td>
<td>Weak government, Tight structuring</td>
<td>Strong government, Loose structuring</td>
<td>Weak government, Loose structuring</td>
<td></td>
</tr>
<tr>
<td>Government-imposed rules</td>
<td>Institution-negotiated rules</td>
<td>Mix of Institution- &amp; Gov.- imposed rules</td>
<td>Norms and culture</td>
<td></td>
</tr>
<tr>
<td>Gov. targeted research areas</td>
<td>Areas with complementary capabilities</td>
<td>Gov. designated research areas</td>
<td>Project-based collaborations</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Formal Director</td>
<td>Formal co-director</td>
<td>Formal co-directors</td>
<td>Informal Co-directors</td>
</tr>
<tr>
<td>Extensive</td>
<td>Partitioned administration</td>
<td>Extensive</td>
<td>Minimal</td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Stable funding from gov.</td>
<td>Shared funding</td>
<td>Stable funding from gov.</td>
<td>Funding for research-related activities, i.e. personal exchange</td>
</tr>
<tr>
<td>Outcome measures</td>
<td>Rigid measures (i.e. IPR retentions and residency requirements)</td>
<td>Negotiable (i.e. Sharing IPRs)</td>
<td>Negotiable (i.e. Sharing IPRs, flexible residency)</td>
<td>Minimal</td>
</tr>
<tr>
<td>Examples</td>
<td>SMART, BEARS</td>
<td>UMHS-PUHSC</td>
<td>TBSI</td>
<td>LMDIC (Lum Mat)</td>
</tr>
</tbody>
</table>
1. IURV Emergence

• IURV proliferation is a global and growing phenomenon
  • OECD-led to date (US, W. Europe, Japan)
  • Growing role of China as IURV exporter?

• IURVs are a particular and previously overlooked type of intermediary node in global knowledge networks

• IURVs vary in strategic intent of home (sending) and host (receiving) institutes and locations
  • Home (sending): IURV often results from evolutionary development of individual research collaborative links – then incorporated strategically by universities
  • Host (receiving): also evolutionary, but includes mix of national, local, and institutional goals, including building research capacity, knowledge spillovers, reputation
2. Institutionalization

- Institutionalization is a critical stage in the development of IURVs
  - Becomes an object: raises visibility, access funding, development of longer-run perspectives
  - Enables scale-up of research, development of multiple labs and projects
  - Potential to apply science directed toward societal challenges
  - Supports attraction of early-career researchers
  - Enables strategies to develop human capital
  - Facilitates retention of knowledge in host region
3. Differences by IURV types

- Institutionalization is not without limits – challenges in addressing multiple partner objectives, administrative responsibilities, and research objectives

- Comparative pathways
  - Strong government + tight structuring IURV
    - Effective in meeting specific government targets
    - Rigid measures thus potentially less innovative
    - Vulnerable to policy changes
  - Weak government + loose structuring IURV
    - Flexible and resilient
    - Unpredictable in outcomes
4. Management

• IURVs have tensions from “dual embeddedness”*
  • Navigating research practices and administrative systems of two countries
  • Navigating host governmental expectations and IURV capabilities
  • Problematic cases include: MIT Skolkovo (RU); Cambridge-MIT Institute

• Challenges
  • Human capital
    • Finding researchers (esp. senior, beyond founders) able to commit
    • “Rootless” international scientific labor and integration in home institutions
  • Knowledge flows, IP management, innovation spillovers
  • Mission expansion and shift

*Shams and Huisman, 2016; Klerkx and Guimon, 2017)
5. Policy and Assessment

• Policy insights:
  • Government-led (directed, facilitated)
    • Focus on enhancing and expanding substantive applied science v. more administrative requirements
    • Encourage spillovers, e.g., training students, promoting collaborations, and sharing results with other domestic and foreign research organizations
  • Non-government-led (contingent, collegial)
    • Foster greater institutional processes (e.g., professional staff, stable funding, formal routines)

• Assessment
  • Move beyond narrow input/output measures
  • Probe broader portfolio effects, nature and directions of knowledge flows, impacts on careers, identification of effective practices
Publications (to date)


