Knowledge, Society and the Global Order

A development perspective

JNU

24th September, 2014

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CSE and CTARA, IIT Bombay
Agenda

- Knowledge, Society and the Development Question.

- The elite university and the IIT case-study.

- The easy problems and the hard nut: *legitimization*.

- Meritocracy and the the One-Science hypothesis.

- What to do.
Stylized Structure of Society

- **Key Sectors**: People, Civil or *Cultural* Society, the Environment.
- **Key Transaction**: Agents seeking Biological, Cultural and Environmental value.
Stylized Structure of Society

- **Key Sectors**: People, Civil or *Cultural* Society, the Environment.
- **Key Transaction**: Agents seeking Biological, Cultural and Environmental value.
- **Auxillary Sectors**: Market, State and Assets, i.e., historical accumulation.
Cultural Transactions: based on identity, class, prestige. Usually collective and historical.

Market and State: e.g., mediated by Power and Money.

Intricate competition and a dynamic equilibrium between sectors.
The web of interactions: individuals in many roles.

Fundamentally: Agents deliver value. This may be cultural, financial, security, and so on.
Pop Knowledge

Broad classification of knowledge:

**T1 Scientific or “Rigorous” knowledge**
- Data-gathering, theorization, verification, falsifiable.
- Output: Theory, language, laboratory methods ⇒ Technology

**T2 Knowledge of Good Practices**
- Agent driven loops: serve/present, observe and adapt. Seek to deliver value (cultural, economic, prestige).
- Empirical models and analysis. Borrow from other disciplines.
- Governmental: sadak, bijli, paani, or Para-statal: Urban administration, or Private: music, cars, chulhas
- Key activity: Empirical systems, i.e., data-gathering and memory.
The Two Loops

The usual method vs. output conundrum

The *process of accumulation* vs. *the accumulate itself*.

- In Science, it is usually the output which is taught and tested.
Motivation-The *concrete* development challenge

Superficially - poor Human Development Indices

- Extensive governance structure, cultural institutions, democracy
- asset poverty and social and asset inequality
- poor penetration of infrastructure
- malfunctioning markets and state
- large informal sector, unstructured, poor technical content
Practices...

- Poor process of accumulation of new practices
- Poor knowledge content in existing practices
Economically speaking

- Stagnant formal sector. Little job growth. Poor R&D
- Dropping share of industrial/manufacturing.
- Absence in strategic sectors such as Defence, Electronics/Telecom.
- Few technology and policy professionals.
- Poor participation of industry in core sectors such as water.
- Poor governance.
- Disconnect between knowledge systems and economy.
For example—Water
Sufficient Drinking Water year-round

<table>
<thead>
<tr>
<th>Year</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 (69th NSSO), per 1000</td>
<td>858</td>
<td>896</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>745</td>
<td>931</td>
</tr>
<tr>
<td>2008</td>
<td>862</td>
<td>911</td>
</tr>
</tbody>
</table>

- Old designs, technically unsound schemes, uneven service
- Groundwater failure, ill-managed surface water sources.
- Poor capacity of community to manage, mis-alignment between community expectations and government
- Poor monitoring and evaluation frameworks by state
- *Policy-fication* and NGO-fication of a key bio-physical sector.
- Retreat of regional socio-technical agencies.
- Rise of international economists, sociologists, WB etc.
Other areas...

Cooking energy: *similar*.

**Question**: How do we understand this *knowledge failure*?
Society and the University—a *virtuous loop*

**The Elite University**
- thought leadership, the arts, long-term research, *destiny*
- symbolic of what a society values!

**The University**
- repository of knowledge and practices
- training agents who deliver value

*serves*

*supports*
The Indian Elite University

- **Long history**—right after independence
- The IITs, IISc, ISIs, IIMs, TIFR, JNU, Delhi School of Economics
  - the new IISERs, new IITs

Typical features:

- **Key areas**: Science, Technology, Engineering, Economics, Mathematics
- Centrally funded, autonomous
- Research orientation, international faculty
- transparent and highly selective admissions
- focus on excellence and global standing
Just how elite are these? - *IITs*

Why only the IITs

- because we are here.
- Engineering and Technology key to development outcomes.
Just how elite are these?-\textit{IITs}

Why only the IITs

- because we are here.
- \textbf{Engineering and Technology} key to development outcomes.

Rough numbers (in Rs. crores)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Central</th>
<th>CFI</th>
<th>IITs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200K</td>
<td>60K</td>
<td>3K</td>
<td>2K</td>
</tr>
</tbody>
</table>

i.e., about Rs. 10-15 lakhs per student.

Besides this, roughly equivalent funding from DST, DBT and other agencies.

- \textbf{Mangalyaan}: about Rs. 400 crores. \textbf{ISRO}: Rs. 5000 crores.
- \textbf{Maharashtra Water Supply and Sanitation}: Rs. 1000 crores.
- \textbf{Mumbai University}: 400 crores.
More than money—intellectual space

- **JEE and GATE**: define engineering in the country.
- **TEQIP II**: Project document, Chapter 1, page 1: . . . gap between other colleges and IIT which needs to be bridged. . . IITs to act as a catalyst . . .
- Domination in research agenda and allocation.
- **Curriculum**: NCERT, Andhra Pradesh. What is science for schools.

- Bragging rights in a poor developing society.
The evaluation of the elite institution

- The conduct of research and its connection with society.
- The output. *Where do the graduates go?*
- The input. How does the selection determine the society?

All three aspects connected...
The Input side

At the UG level:

- Two layer process-JEE and advanced JEE.
- In 2013, 12 lakh students sat for JEE of which 1.5 lakh were allowed to write advance JEE.
- JEE admits to NITs (roughly 7000 seats)
- advanced JEE admits into IIT (another 7000 seats) JEE and GATE data
- odds of roughly 1 in 200. Selectivity varies dramatically with discipline.

At the PG level:

- Disciplinary GATE exams. Separate admissions.
- Roughly 10 lakh sat for about 5000 seats. Selectivity roughly more constant.
The Output side—*the intermediaries*

Analysis.

- **Placements**: The allocation of graduating students to jobs.
- **Sectors**: Which sectors of the economy.
- **Companies**: Who owns these companies and which society do they serve.
Research Objective—who joins where?

- This is done by looking at placement data of IIT Bombay for 2013 (upto April 90% of placements over).

Aeronautical & Aerospace (A)
Chemical (CHE)
Civil (C)
Computer Science and Engg. (CSE)
Electrical (EE)
Mechanical (Mech.)
Metallurgical (Met.)

- Excluded - 5 yr & 2 yr M.Sc., M.Des & Phd
- Energy Science, Environmental Science, etc.

3 Programs
B.Tech
DD
M.Tech
Data-Sample

Sample:
833 out of 1066 done (81% approx)
TOTAL APPLIED - 1421

- 324 B.Tech Students
- 180 Dual Degree Students
- 329 M.Tech Students
Detailed number-wise break-up and average annual salary in Rs. lakhs.

<table>
<thead>
<tr>
<th>Program</th>
<th>Aero</th>
<th>Chem</th>
<th>Civil</th>
<th>CSE</th>
<th>EE</th>
<th>Mech</th>
<th>Meta</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.Tech.</td>
<td>9(8.6)</td>
<td>45(9.5)</td>
<td>57(7.6)</td>
<td>65(33.4)</td>
<td>48(15.5)</td>
<td>65(10.2)</td>
<td>35(7.4)</td>
</tr>
<tr>
<td>DD</td>
<td>21(11.6)</td>
<td>32(11.0)</td>
<td>11(8.4)</td>
<td>-</td>
<td>44(16.4)</td>
<td>46(11.2)</td>
<td>26(8.3)</td>
</tr>
<tr>
<td>M.Tech</td>
<td>11(5.9)</td>
<td>17(6.7)</td>
<td>28(4.8)</td>
<td>93(14.8)</td>
<td>98(9.7)</td>
<td>50(8.0)</td>
<td>32(7.3)</td>
</tr>
</tbody>
</table>

Av. Salary highest for CSE be it B.Tech or M.Tech (100 and 50% more than next category).
For DD, it is EE (>33% higher then next category - Aero)
Table 2: % of students in different Sectors for 3 programs and Av. Annual Salary (Rs. Lakhs)

<table>
<thead>
<tr>
<th>Sector</th>
<th>ET</th>
<th>Fin</th>
<th>Consulting</th>
<th>IT</th>
<th>FMCG</th>
<th>non-IT</th>
<th>Edun</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.Tech</td>
<td>22(10.2)</td>
<td>24(13.0)</td>
<td>21(13.2)</td>
<td>24(23.2)</td>
<td>6(10.0)</td>
<td>2(15.0)</td>
<td>1(6.7)</td>
</tr>
<tr>
<td>DD</td>
<td>24(10.0)</td>
<td>24(13.2)</td>
<td>26(11.6)</td>
<td>14(12.9)</td>
<td>9(12.1)</td>
<td>3(16.4)</td>
<td>1(6.2)</td>
</tr>
<tr>
<td>M.Tech.</td>
<td>51(8.6)</td>
<td>4(9.4)</td>
<td>10(5.6)</td>
<td>29(15.0)</td>
<td>2(6.2)</td>
<td>1(11.0)</td>
<td>5(4.5)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Location</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super-GG</td>
<td>Globally owned, Global revenues</td>
<td>Abroad</td>
<td>Sony, Japan</td>
</tr>
<tr>
<td>GG</td>
<td>Globally owned, Global revenues</td>
<td>India</td>
<td>Goldman Sachs</td>
</tr>
<tr>
<td>IG</td>
<td>Indian owned, Global revenues</td>
<td>India</td>
<td>Infosys</td>
</tr>
<tr>
<td>GI</td>
<td>Globally owned, Indian revenues</td>
<td>India</td>
<td>Proctor-Gamble</td>
</tr>
<tr>
<td>II</td>
<td>Indian owned, Indian revenues</td>
<td>India</td>
<td>Tata Motors</td>
</tr>
<tr>
<td>Profile</td>
<td>Super-GG</td>
<td>GG</td>
<td>IG</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>B. Tech</td>
<td>15(46.8)</td>
<td>41(10.8)</td>
<td>14(7.1)</td>
</tr>
<tr>
<td>DD</td>
<td>8(34.7)</td>
<td>57(10.4)</td>
<td>7(6.8)</td>
</tr>
<tr>
<td>M.Tech.</td>
<td>7(38.7)</td>
<td>56(8.8)</td>
<td>16(6.4)</td>
</tr>
</tbody>
</table>
## CPI as measure of Training

<table>
<thead>
<tr>
<th>Profile</th>
<th>Sector</th>
<th>slope (vs. CPI)</th>
<th>p-value</th>
<th>Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super-GG</td>
<td>finance</td>
<td>0.013</td>
<td>0.311</td>
<td>0.209</td>
</tr>
<tr>
<td>Super-GG</td>
<td>IT</td>
<td>0.056</td>
<td>0</td>
<td>0.116</td>
</tr>
<tr>
<td>II</td>
<td>consulting</td>
<td>1.187</td>
<td>0</td>
<td>0.169</td>
</tr>
<tr>
<td>II</td>
<td>finance</td>
<td>0.768</td>
<td>0.11</td>
<td>0.086</td>
</tr>
<tr>
<td>II</td>
<td>FMCG</td>
<td>2.189</td>
<td>0</td>
<td>0.198</td>
</tr>
<tr>
<td>IG</td>
<td>consulting</td>
<td>1.053</td>
<td>0.08</td>
<td>0.213</td>
</tr>
<tr>
<td>GG</td>
<td>finance</td>
<td>4.287</td>
<td>0</td>
<td>0.311</td>
</tr>
<tr>
<td>GG</td>
<td>IT</td>
<td>1.566</td>
<td>0</td>
<td>0.18</td>
</tr>
<tr>
<td>Super-GG</td>
<td>ET</td>
<td>0.006</td>
<td>0.805</td>
<td>0.23</td>
</tr>
<tr>
<td>GG</td>
<td>ET</td>
<td>0.135</td>
<td>0.402</td>
<td>0.109</td>
</tr>
<tr>
<td>IG</td>
<td>ET</td>
<td>0.55</td>
<td>0.011</td>
<td>0.165</td>
</tr>
<tr>
<td>GI</td>
<td>ET</td>
<td>0.006</td>
<td>0.991</td>
<td>0.119</td>
</tr>
<tr>
<td>II</td>
<td>ET</td>
<td>0.051</td>
<td>0.826</td>
<td>0.108</td>
</tr>
</tbody>
</table>
### Engineering Placements 2013 (IIT Bombay)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Engg.</th>
<th>Finance</th>
<th>Consulting</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super-GG</td>
<td>25 (27.7)</td>
<td>10 (35.0)</td>
<td>8 (49.6)</td>
<td>41 (52.1)</td>
</tr>
<tr>
<td>GG</td>
<td>116 (7.9)</td>
<td>82 (11.7)</td>
<td>110 (9.6)</td>
<td>102 (10.0)</td>
</tr>
<tr>
<td>IG</td>
<td>52 (6.5)</td>
<td>19 (7.2)</td>
<td>11 (5.8)</td>
<td>28 (7.2)</td>
</tr>
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<td>24 (9.3)</td>
<td>10 (14.2)</td>
<td>10 (5.2)</td>
<td>5 (9.3)</td>
</tr>
<tr>
<td>II</td>
<td>64 (6.5)</td>
<td>13 (9.5)</td>
<td>8 (5.8)</td>
<td>22 (7.9)</td>
</tr>
</tbody>
</table>

**Table:** Numbers by sector and profile and average annual salary in Rs. lakhs
The Wage-Curves
IIT Placements - Key findings

- Global companies serving global consumers is the biggest winner. Super-GG, an increasing trend.
- Engineering is least paying among all major sectors. Service sector most paying. Indian Engineering least among Engineering.
- Most profiles do not need the engineering training that we claim to give.
IIT Placements - Key findings

• Global companies serving global consumers is the biggest winner. Super-GG, an increasing trend.

• Engineering is least paying among all major sectors. Service sector most paying. Indian Engineering least among Engineering.

• Most profiles do not need the engineering training that we claim to give.

• mis-allocation. Away from engineering and away from the Indian economy.

• irrelevance of training. The IIT training does not seem to (i) help Indian engineering, and (ii) lead to better salaries.
The essential conundrum!

Key Stake-holders at Cross-Purposes!
Hyper-selectivity one of the causes.
The process of elitization itself is causing the problem.
The Three Questions

- Disconnect with the field and with practice.
  - *Do we have a solution?*

- Insufficient agency with State and Market.
  - *Will they adopt it?*

- The role of the Elite University in a developing society.
  - Global T1 *rigorous* knowledge and regional T2 *agent-driven* knowledge.
Problem 1: Loss of practice

- Much of engineering comes from *Practice*.
- This brand is too narrow for others to follow. IIT controls JEE and GATE. *Makes IIT the leader.* De-legitimizes practice by others.
- Entrance exams designed for ease of testability rather than for relevance to engineering.
- Vicious cycle of elite engineering colleges becoming recruiting grounds for non-engineering and global jobs.
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- Entrance exams designed for ease of testability rather than for relevance to engineering.
- Vicious cycle of elite engineering colleges becoming recruiting grounds for non-engineering and global jobs.
- **Technical inability to provide a DW solution.**
The Solution: Broaden engineering

10 year program to transform engineering.

- **Inclusion**: Greater common programs which are teachable at all levels.
- **Practices**: Each college to develop key areas of *regional interest*. 
Problem 2: How to embed the solution within the State or the Market

- Poor understanding of the processes of the State and Market.
- What is an innovation? What is a public good? What is economic efficiency?
- What is value and how is it delivered? How to define a new job profile?
- What is sustainability? What is equity?
OK, so we learn the structure of society
In summary–Steps I and II

Robust Trans-disciplinarity!

- Broader engineering curriculum which interfaces with society.
- *Strengthen Practice. Strengthen social science training.*
- Institutional skills of interacting with the state and the market.
- *A more robust role for the university.*
In summary–Steps I and II

Robust Trans-disciplinarity!

- Broader engineering curriculum which interfaces with society.
- *Strengthen Practice. Strengthen social science training.*
- Institutional skills of interacting with the state and the market.
- *A more robust role for the university.*

But this requires the concurrence of the Elite University!

- What is the philosophical basis for this transition? *Is it rigorous?*
- Is this on the road to global excellence? Does the state want it?
- Is DW really a Science and Technology Issue?

Fear of De-elitization. *Questions of Merit and Knowledge.*
The *global* theory of commodity production?

Biscuits

<table>
<thead>
<tr>
<th>Machine (Facility)</th>
<th>Production tons/day</th>
<th>Operator Ability</th>
<th>Other costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>10</td>
<td>0.3</td>
<td>low maintenance</td>
</tr>
<tr>
<td>M2</td>
<td>50</td>
<td>0.4</td>
<td>good overall support</td>
</tr>
<tr>
<td>M3</td>
<td>200</td>
<td>0.6</td>
<td>imported</td>
</tr>
</tbody>
</table>

- 0.6 is that the person should be in the top 40%.
- similar analysis for service sectors as well.
- may be aggregated for a segment, e.g., cycles.
- wages: depend on taxes, rents, training costs etc.
The Wages curves

Sorting and labelling

- Allocates the *better* to sophisticated machines.
- Improves social output.
- But there are losers too.
The Composite Wages curves

- Talent allocated by productivity in sector.
Meritocracy

- **Sorting**: The university *correctly* sorts and labels.
- **Production**: The state and the company utilizes these labels to improve outputs for the society.
- **Taxation**: Wages are redistributed so that everyone is better off.
- **Popular Support**: People make an informed judgement to support the university.
Hold On-Transfer of productive assets!

In effect, meritocracy in the presence of another society is a bit complicated!
Globalization ⇒ The single scale

- There is a roughly universal scale of measuring skills which are economically useful.
- Job allocations happen globally based on your being identified on this scale.
- There is no option. *Have more global Indian companies!*

```
<table>
<thead>
<tr>
<th>Others</th>
<th>NITs</th>
<th>IITs</th>
</tr>
</thead>
<tbody>
<tr>
<td>wages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>global service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>domestic engg.</td>
<td></td>
<td></td>
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</tbody>
</table>
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Deeper still...Knowledge in Globalization

- **Convergence.** Societies of the world will converge into a *global society*.

- **One Science.** There is one science, one economics and one knowledge system. It is the science of the global society.

- **Efficiency.** This system is a meritocracy and will be just and bountiful. It will eventually benefit all.
One intermediate outcome

- A *shear* in the our society and its economic processes.
- A common abstract *Merit* is deciding wages.
A merit of coaching classes, objective questions which must be fair, i.e., without context, entrance exams of fantastic odds.

A job-allocation process which is at best a fair lottery. In reality, negative sum game.

An education system of English-speaking courses and the testing of science through multiple-choice questions.

Aspirational dysfunction. Loss of scientific temper and culture.
The Policy-fication

- Delegitimization of local knowledge institutions
- Poor development outcomes
But do our elite buy this argument?

YES! And they benefit from it.

- Design of IITs. MIT, Manchester as role models. Same situation with economics, sciences and even high school education.

- Increasing use of global indices for measuring progress. Acceptance of elite agencies as arbiters of knowledge.

- Increasing use of a common global abstraction to justify policy. A new *objectivity*.

- The theory of World Class Institutions!
What to do?

- As Thinkers-The Research Agenda
  - Cultural and politics of production of T1.
  - The Social Imagination of natural and social sciences.
  - The Science loop as a political process. "Advanced" science.
  - The global knowledge elite and One-Science.
  - Cultural views and cultural diversity.

The Question of Rigour. T1 vs. T2.
- Global rigour vs. a plural and democratic science.
- Practical Rigour and its features.
- History of Practices and its institutionalization within/without the university.

Economics-Elitization and Rents. The processes of production and wages
- Must we make biscuits this way? Is French wine valued similarly? What's wrong with cultural production?
- Intrinsic inefficiency of a converged system.
- Can there really be an equitable outcome?
What to do?-As Thinkers-The Research Agenda

- Cultural and politics of production of T1.
  - The Social Imagination of natural and social sciences.
  - The Science loop as a political process. ”Advanced” science.
  - The global knowledge elite and One-Science.
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- The Question of Rigour. T1 vs. T2.
  - Global rigour vs. a plural and democratic science.
  - *Practical Rigour* and its features.
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  - Must we make biscuits this way? Is French wine valued similarly? *What's wrong with cultural production?*
  - Intrinsic inefficiency of a converged system.
  - Can there really be an equitable outcome?
More research on the Indian knowledge systems

- The input, the output and the conduct of research.
  - The situation of the university, T1 vs. T2.
  - Elite institutions and their impact.
  - MHRD, UGC and other bodies. Accreditation.

- The Competitive Exam and the *social imagination* of knowledge
  - The definition of basic sciences and social sciences.
  - The race to the bottom. The gender, the urban-rural divide.
  - The impact on wider knowledge formation.

  - The appropriate size and roles for the public sector.
  - Sites for good practices, their codification and adaptability.
  - Jobs, new professions and job descriptions and institutional capacity.
Situating the University for a developing society

- **CENTRAL** to the counter-view which legitimizes local knowledge production.
- as a nurturer of *civil society* and a steward of the development agenda and its outcomes.
- Rehabilitation of the vernacular and also the *modern* and *humanist*. Culture and Society as a back-drop to the pursuit of Science.
And As Doers-Development, pedagogically the simplest!

- Re-legitimize practice and agency at all levels.
- Develop case-studies and new job-definitions.
- Examine the public sector and its institutional practices.
- Open up assessment and evaluations as legitimate research.

**The CTARA agenda**
In conclusion...

- Knowledge is once more a battle-ground for contestation.
- Global knowledge frameworks, though appealing and possibly highly productive, have grave dangers.
- Our elite institutions will be ambivalent to this danger.
- Broader knowledge formation and its legitimacy is developmentally important. The University should be a key agent.
In conclusion...

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- Global knowledge frameworks, though appealing and possibly highly productive, have grave dangers.
- Our elite institutions will be ambivalent to this danger.
- Broader knowledge formation and its legitimacy is developmentally important. The University should be a key agent.

- However, there is much to be travelled!
Some References


1. Sohoni, Milind, *Knowledge and practice for India as a developing country*, working paper. Also at http://ssrn.com/abstract=2210323


Thanks