TEQIP-IITB Water Sector Workshop
12th September, 2014.

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Key Objectives and TEQIP

Key sub-agenda of TEQIP-I and TEQIP-II.

- institutions to be geographically relevant,
- develop engineering as an interdisciplinary practice which is aligned to the states objectives and programmes and
- to carry out demand driven research and innovation

What is required to do this?

- Examine the regional role of institutions.
- Examine what needs to be taught and researched.
- How is one to develop the requisite knowledge.
Organization of the talk

- Society and the university.
- Engineering in India and key problems
- Case-studies—rigour and research!
- New jobs definitions $\Rightarrow$ new jobs, better serve society
- Drinking water and the Project Proposal.
Society and the University—a virtuous loop

The Elite University

The University

Society

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

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

- Better nutrition for all, higher productivity in agriculture
- *sadak, bijlee, paani*
- More and cheaper buses, bridges.
- Better public transport, better sewage systems.
- Cheaper phones, better cars, less pollution.
- Quieter or more cultural *ganeshotsavs*.
- More authors, better books, more olympic medals.
- *Indigenous* helicopters, submarines.

- A more equal society. Well being for all!
Collaboration and Alignment

- Close collaboration between the Society, State, Industry and University.
- An alignment between faculty members, the students, and the design of the institution.
However, It may happen that there is a *disconnect*!

Two Questions?
- How are we doing?
- How do we get better?
How is India doing?

How do you measure?
- Number of scientific instruments in schools.
- Number of buses per 1000 people.
- Number of liters of water per person per day?
- Number of factories. Number of manufacturing jobs.
- Length of roads per 1000 people.
- Units of electricity per person per year.
### Engineering in Sectors and employment

#### Sector-wise GDP

<table>
<thead>
<tr>
<th></th>
<th>Agriculture</th>
<th>Industry</th>
<th>Services</th>
<th>Per capita (in USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>India</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP (2012) (%)</td>
<td>17.4</td>
<td>25.8</td>
<td>56.9</td>
<td>1.5K</td>
</tr>
<tr>
<td>Employment (%)</td>
<td>51.1</td>
<td>22.4</td>
<td>26.6</td>
<td>-</td>
</tr>
<tr>
<td><strong>GDP China</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP China</td>
<td>10</td>
<td>44</td>
<td>46</td>
<td>6.8K</td>
</tr>
<tr>
<td><strong>GDP S. Korea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP S. Korea</td>
<td>3</td>
<td>40</td>
<td>57</td>
<td>25K</td>
</tr>
<tr>
<td><strong>GDP Germany</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP Germany</td>
<td>1</td>
<td>28</td>
<td>71</td>
<td>43K</td>
</tr>
</tbody>
</table>

#### Top Formal Employers

<table>
<thead>
<tr>
<th>Industry</th>
<th>Food</th>
<th>Textiles</th>
<th>Metals</th>
<th>Apparel</th>
<th>Non-metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages (Rs. lakhs)</td>
<td>0.70</td>
<td>0.80</td>
<td>1.35</td>
<td>0.67</td>
<td>0.69</td>
</tr>
</tbody>
</table>
Formal vs. Informal: various definitions.

- About 75% workforce in informal sector.
- In manufacturing, the rule of 80%-20%.

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>
<tr>
<td>GI</td>
<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

So, why are our graduates not doing engineering?
Effects!

Steel consumption.

<table>
<thead>
<tr>
<th>Country</th>
<th>Steel Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>57</td>
</tr>
<tr>
<td>Other Asia</td>
<td>69</td>
</tr>
<tr>
<td>Egypt</td>
<td>95</td>
</tr>
<tr>
<td>UK</td>
<td>145</td>
</tr>
<tr>
<td>China</td>
<td>477</td>
</tr>
<tr>
<td>Japan</td>
<td>506</td>
</tr>
<tr>
<td>USA</td>
<td>306</td>
</tr>
<tr>
<td>Netherlands</td>
<td>200</td>
</tr>
</tbody>
</table>

Year-round drinking water availability.

<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>

similarly about Milk, Electricity, Cooking Fuel.
And this is how we are ...
Conclusion

- Mis-allocation! Our engineers are not doing what they are supposed to do!
- But are there adequate opportunities?
- And are they trained for these new opportunities?
- Has our training changed as per changing situations?

How can engineers deliver better value?

- Create Opportunities!
- Explore under-represented sectors which are likely to be important?
- Develop new processes, products and protocols which deliver value.
- Create new job profiles and train for them!
The areas of the future

- **SME and Informal Enterprises.** Bringing the benefits of technology, increasing efficiency, improving market access.

- **City and District Administration.** Improving planning, transport, infrastructure, logistics, optimization.

- **Core Sectors.** Water supply and sanitation, Electricity grid, Solar, Food, supply chains.

This would in turn create the demand for new instruments, gadgets, machines, tools for analysis and design, simulators ⇒ better engineering, better efficiency, better value
Solar-steam based *Istry* in Parbhani
Optimizing Irrigation in Shahpur, Thane
Processes at Ganapaty Factory in Pen
The Old Institution

- **People**
  - State, district, taluka, GP
  - CEO, Collector

- **Government**
- **Companies**

**serve** University

**support**

**employees**
New jobs!

- Energy expert. Drinking Water consultant.
- District Public Transport Manager. Taluka-level planner.
- Access to research. Access to rigour!
The New Institution

People
- State, district, taluka, GP
- CEO, Collector

serve

Government
- Companies

support
- advise, plan, assess

employees
- new job descriptions
- knowledge products

University

New jobs!
- Energy expert. Drinking Water consultant.
- District Public Transport Manager. Taluka-level planner.
- New research. New definition of rigour!
- Research which is accessible by society!
The New Institution

The Mechanism: The Engineering Case-Study

- End-user defined, quickly usable and deployable.
- Concrete context and clear processes and protocols.
- **Rigorous!** Repeated case-studies in different situations.
- **International-quality Research!!** Development of practices as sites for innovation.
The concrete cycle-I

- Energy bill reduction through the use of solar dish.
- How to make leaf-plate making more efficient.
- Temperature regulation in poultry farm.
- Supply chains for bio-mass power plants.
The concrete cycle-1
The concrete cycle-I

- Power quality meter-3-phase, voltage, power factor, harmonics
- Measurements at irrigation pumps
- Mapping of *taluka* grid.
Simulation and Analysis

Analysis of a failed rural regional (RR) Water supply scheme. Designs for many other.
Rooftop solar plan for a complete gram-panchayat (Kerala).
State-wide policy research

Groundwater models for all watersheds in Maharashtra.
This year, this project... Drinking Water

- Crucial and increasingly under stress.
- Largely scientific and analytical.
- Rich in inter-disciplinarity, region-specificity.
- New professions, PPP, managers.
- Clear stake-holders and partners.
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Coming back...Key Objectives and TEQIP

- institutions to be geographically relevant,
- develop engineering as an interdisciplinary practice which is aligned to the states objectives and programmes and
to carry out demand driven research and innovation

What is required to do this?: Use the drinking water sector as a vehicle!

- Examine the regional role of institutions.
- Examine what needs to be taught and researched.
- How is one to develop the requisite knowledge.
Our Proposal

A structured collaborative project between IIT Bombay and participating TEQIP institutions.

To start with: Water Sector, esp. Drinking Water and Sanitation

- to strengthen the outcomes of the TEQIP II programme, and
- bridge the gap between class room learning and field experience in the engineering curricula
- to develop a shared ability to undertake relevant research and training in the field of drinking water
- develop a state-wide knowledge network of regional institutions working in the drinking water sector and all its components
- provide for well trained professionals in the water sector
...and Today

- An overview of the Drinking Water sector and its components.
- Case studies in various components.
- Academic programs to support project-based/case-study research.

LUNCH

- Structure of Govt. of Maharashtra programs.
- From TEQIP institutions.
- The way ahead and wrapping up.
The Steps

Step I. Is your institution interested?
- Familiarity with the sector?
- Will such academic and research programs be valuable?

Step II. The Research Agenda.
- Design of research program. Selection of tools, case studies.
- Budgets, outcomes, people, liaisons.
- TEQIP related issues. Implementation and documentation.

Step III. Academic Programs and Regional Presence
- UG and PG project based course-work.
- Seminar series, support cell, publications.
- Empanelment in state-level and district level programs.
How can IIT help

- Joint training programs on special topics, e.g., Rural Drinking Water.
- Joint offering of courses, esp. project courses in the summers.
- Starting a Case-Study series and selection and publication of good projects.
- Provide coordination help with institute’s Technology and Development programs.
- Share data. Initiate joint projects.
- Networking with other colleges and institutions to work with GoM and GoI.

Workshop website:
http://www.ctara.iitb.ac.in/water/teqip-iitb-water-2014
Thanks