R&D at IIT-Bombay
Another perspective

Milind Sohoni

www.cse.iitb.ac.in/∼sohoni/IFM.pdf

Outline

- **The current R& D paradigm.**
- **Limitations within and without.**
- **A possible paradigm.**
- **Two case studies.**
- **Conclusions.**

And all this in 20 minutes.

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Disclaimers

- complementary and incremental
- a perspective, and does not set specific departmental objectives
- not all that new, just a common thread

The current paradigm

The "international consensus" of visible research

- Research
  - report in international journals, conferences and workshops
  - on international research agenda
- Incentivize
  - identify and fund thrust areas
  - top-up faculty salaries
  - an omnibus of academic MOUs for students and faculty
- Acquire
  - crores of funding through govt., alumni, corporations
  - "international" faculty through FAN
  - infrastructure commensurate with research areas

Industry Interactions

- MNCs
  - Tons of MOUs, but true collaborations are few.
  - Support in terms of student travel, competitions, fellowships
- National level
  - large amounts of certifications and testing
  - traditional high-paying customers
  - limited research/technology output
- Govt./public sector
  - routine public sector collaborations
  - DST grants to support infrastructure
  - largely non-delivery research

Teaching and others

- Conventional programs
  - B.Tech/DD/M.Tech not very interested in our research agenda
  - Migrate away from material taught in their degree programs
  - valued highly by the industry but not for what we taught them
- Extramural programs
  - CDEEP: an important initiative finding its feet
  - Highly valued CEPs for local audience
  - SINE: many curious business models

What this model gives us...

- A metric to judge academic output
  - faculty research and promotions
  - evaluating graduate students
  - Our grade: BB
- a role-model
  - comparison with other "international" universities
  - conjectured corrective measures - funding
  - conjectured corrective measures - governance
  - conjectured corrective measures - infrastructure
  - Our grade: AB
- A belief that other problems areas of student dis-interest and lack-lustre collaborations will go away.

The excellence belief

That, with sufficient money, and strict adherence to the path of international research, we will reach the exalted club. That, we have everything else.

A Critique-Costs and Benefits

Benefits

- Fame and glory to us, our students, our alumni and our nation.
- An exciting research atmosphere and center of excellence.
- Incumbent growth in quality and quantity.
- Possible trickle-down to other national institutions.
- A national engineering revival.

Costs

- Hundreds of crores.

But what if we fail?

Why we may fail

- Misleading comparison with "international" universities
  - the importance of technological and institutional maturity
  - the presence of ancillary academic insitutions and industry linkages
  - an exacting governance structure with air-tight delegation and independence
- Faculty
  - why should "international" faculty come here
  - what are the strengths of our current faculty
- Students and Research Staff
  - very different student body
  - a glaring mismatch between stated agenda and student priorities
  - absence of adjunct research staff/faculty
- And a host of other reasons ...

What if we fail...

The most likely outcome is a pocket of arguable excellence and even more arguable national relevance.

This would mean that we would continue to

- soak up valuable national resources.
- define what engineering education in India means.
- bleed students.

Other players are not going to be idle.

- Other UG teaching colleges of repute may develop. This will erode our monopoly and branding.
  - RBI gave $ 3 billion this year for education abroad
- MHRD may cut our funding or may interfere in larger measure.
  - what is our charter

A closer look-abroad

- Caltech, Berkeley have large high-profile projects which must work. These serve as useful work-benches to apply and extend research. These projects are well-funded and have concrete objectives.
- Michigan, Illinois have concentrated on local needs in training, problem-solving and have served as a technical clearing house for the state and its industry. They check bridges, build GIS, argue policy, help manage cities and so on. They have played a vital role in technology percolation.
- MIT, Harvard have set a standard for discourse which is well rounded, in which technology is a small but important part of the solution space. They have key presence in government and multi-lateral agencies such as the World Bank.

A Proposition

Let us define our objectives as:

- Develop high-profile projects with concrete objectives and which must work. Build to Run.
- Act as a technological clearing house for our state and industry. Develop policies and systems which must be deployed in the field. Percolate technology.
- Develop a discourse of technology policy and achieve a standing in the government and multi-lateral agencies. Intellectualize.

But will this fly?

- Students: and their outlook.
- Faculty: and their views.
- And what about conventional research?

Lets look at Example 1 ...

Water for K-East ward

K-East is one of the larger wards of Mumbai (MCGM). Features:

- about 8 lakhs population
- many slums, 5 star hotels, 2 airports, several industries
- about 400 Mega-Liters-Per-Day water supply, and about 250 liters-per-capita-per-day.
- about 20 % non-revenue water and poor customer service

The Players

- MCGM
- World Bank and Castalia as consultant
- $ 600,000 project to Castalia

Terms of Reference

- Study the system and document.
- Propose a technical solution
- propose a management solution which will enable the technical solution.

The battle

- Castalia operates within the WB framework.
  - Holds stake-holder meetings
  - Produces report and host web-site (`www.keastwardwater.org`)
  - Report proposes various privatization options
- Civil-Society Organizations alarmed
  - shout at stake-holder meetings
  - ask uncomfortable questions
- Current status: Stalemate

What does the report say

The report is available at:

`http://www.keastwardwater.org/FTP/ProjectBrief.pdf`

The report is about 50 pages and reads like an excellent MTP report!. It has the following parts:

- System Documentation and Analysis outlines the basic system, its parameters, its good and bad points.
- Technical Analysis outlines the various procedures executed and outlines possible solutions.
- Management Analysis outlines the current management system and suggests possible alternatives to implement the solutions above. This includes a policy analysis and suggests various privatization alternatives.
- A financial analysis is curiously absent.

The Technical Analysis

Key Procedures

- Metering problems and design of meters for various situations.
- Simulation of the whole K-East network and alternate pressurization regimes.
- An alternate design of two slum networks.
- A recommendation for GIS support.

In other words, the above procedures

- are full of technical promise with research potential
- provide a concrete objective, which must work
- seem to be within our technological capabilities
- and appear remunerative enough!

Castalia's strengths

- A collection of manpower trained in various aspects of engineering.
  - We have that!
- An ability to picture the system as a whole-engineering, management and policy .
  - We must learn that!
- Access to various agencies, liaisoning with local engineering firms.
  - We expect our administration to provide that
- A system of protocols and a desire to deliver.
  - This is the key!

That was this project.

Another example

Early in 2005, CTARA launched a project to examine:

- the relationship between technology and society
  - and development
- can IIT reach the last man or woman
  - the project has concrete deliverables
- is there sufficient formal research and teaching content
  - is this only an emotional project?
- should IIT be doing such projects?

Water

We set ourselves the goal...

Solve the drinking water problem of a village

We did the following:

- Select ADS, an NGO
  - Social Mobilization
- Select Gangotree
  - Technical Executor
- Select faculty as experts
  - Profs. Singh, Eldho, Partha and others
- Raise 25 lakhs from alumni
  - Dr. Shridhar Shukla

Gudwanwadi-in Karjat Tribal Block

- 380 Thakar people.
- 200 animals.
- 40 households.

And an acute shortage of water for 5 months.

Technology Choice

Build a check-dam.

Students..

Faculty..

People

Our Director

Machines

On July 1st, 2006

Full!

Proof of the Pudding ...

What is the situation as the summer approaches?

Proof of the Pudding ...

What is the situation as the summer approaches?

Did the project succeed?

Mixed answer

- Water in check-dam till only Jan 15.
- Running water (for washing etc.) till about Feb 10th.
- Drinking water in borewells till about March 15.
- Acuteness of problem reduced by 2-3 months

See www.cse.iitb.ac.in/~ctara

Where did the water go?

- The check-dam structure is sound
- Water may be percolating through the ground
  - unlikely as a major cause
- There are underground channels
  - likely

So then:

- Identify the channels ..
  - Geology
- And fill them.
  - Civil Engg.

Should'nt IIT know this?

Wider Goals

Rural Water Solutions-Jal Swarajya

- 2000 villages in Maharashtra alone
- No technical solutions seem available other than
  - lifting from existing reservoirs and
  - ground-water
- Many slated to fail!

We need

- Hydro-geology modelling in the small
- Protocols for geological investigation and design

In short ..

Such projects

- do serve as good platforms for research and teaching
- match our strategic agenda for visibility

IIT should indeed do such projects

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But will this approach fly with our students and faculty?

- Students: My hunch is yes.
  - "real-life" problems and solution driven
  - After all it may land them jobs at McKinsey or Castalia.
- Faculty: Yes, again. It matches our stated applied research objectives.
- Research: Should fly.
  - After all, deep problems here too
  - Proposal does not intend to define basic research

What can the administration do?

- Identify strategic thrust areas
  - such as Water -urban and rural
- Define deliverables
  - a full Mumbai water system simulator
  - water for Gudwanwadi
- Engage with the outside
  - Position our perspective and objectives
  - Develop liaisons with agencies, experts and govt. bodies
- Incentivize and facilitate the inside
  - faculty : recognition, funding
  - students : stipends, UROPS
  - hire suitable adjunct/faculty and research staff

In other words, something we already plan to do.

Thanks!