
Engineering Education in India

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http://www.ese.iitb.ac.in/~rb/ORF/EnEduR_Dec1608.pdf

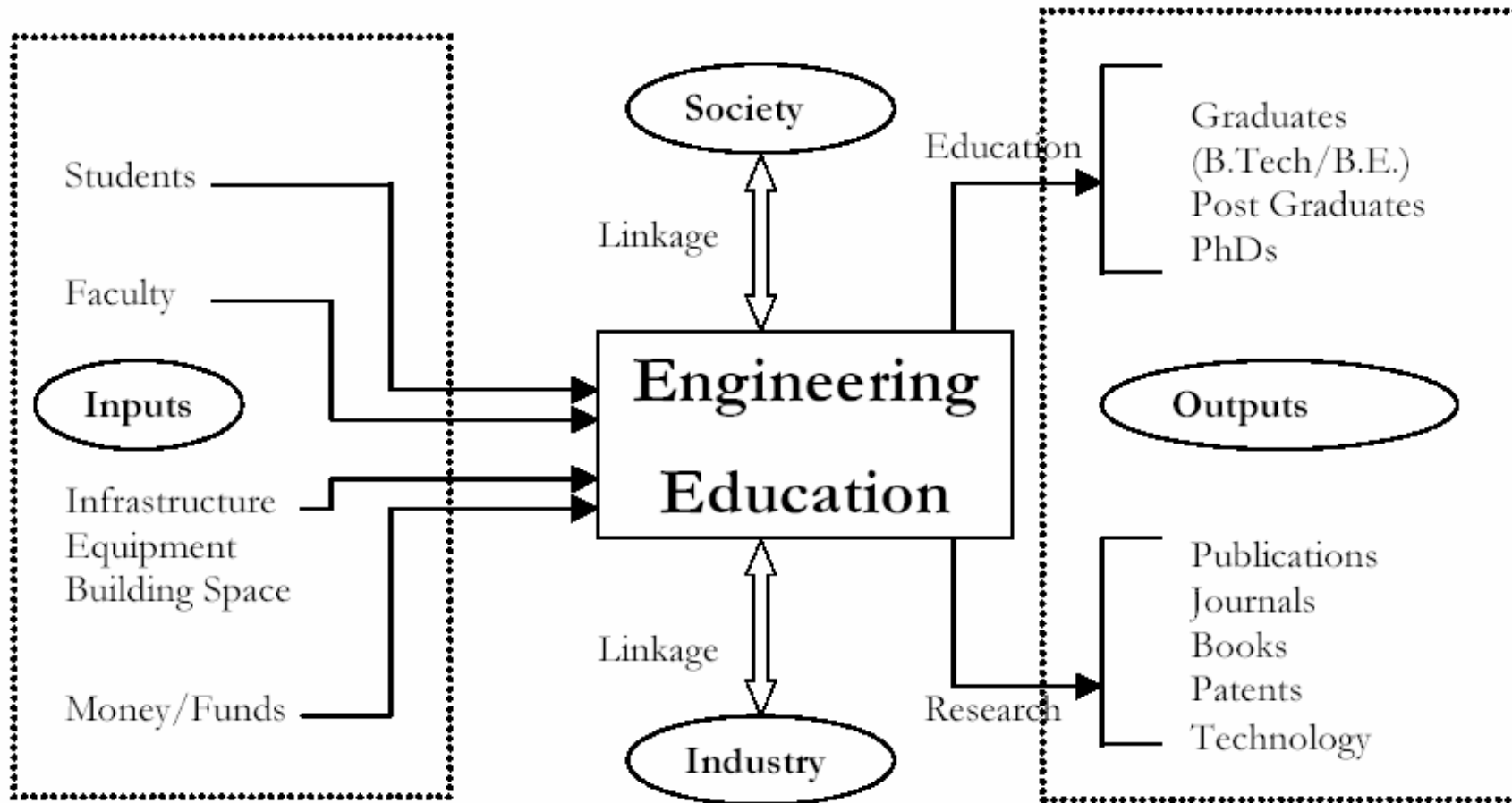
Motivation

Can our present Engineering Education system provide our industry with the necessary inputs to be globally competitive in future?

Observer Research Foundation Study 2007

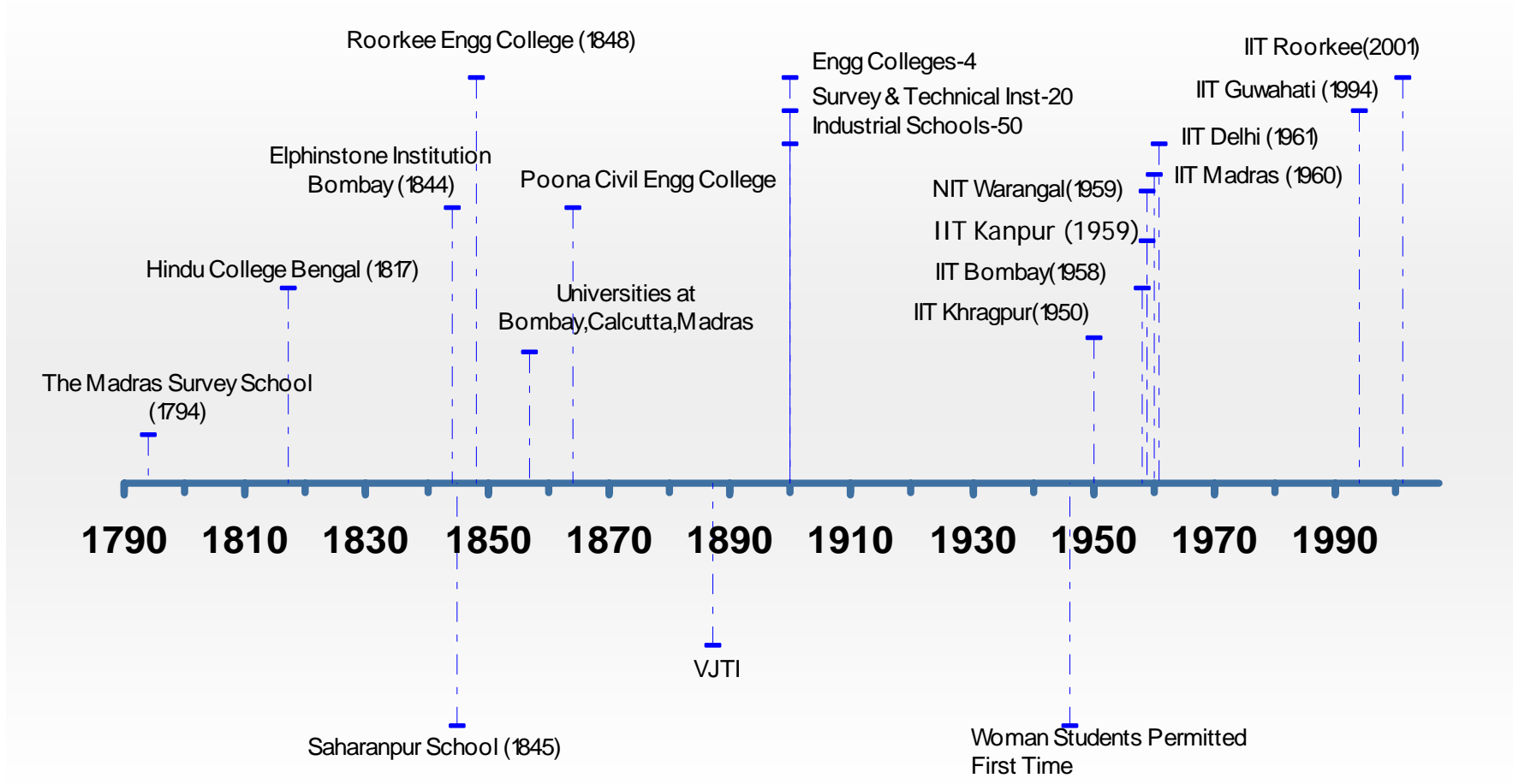


Input-Output for Engineering Education

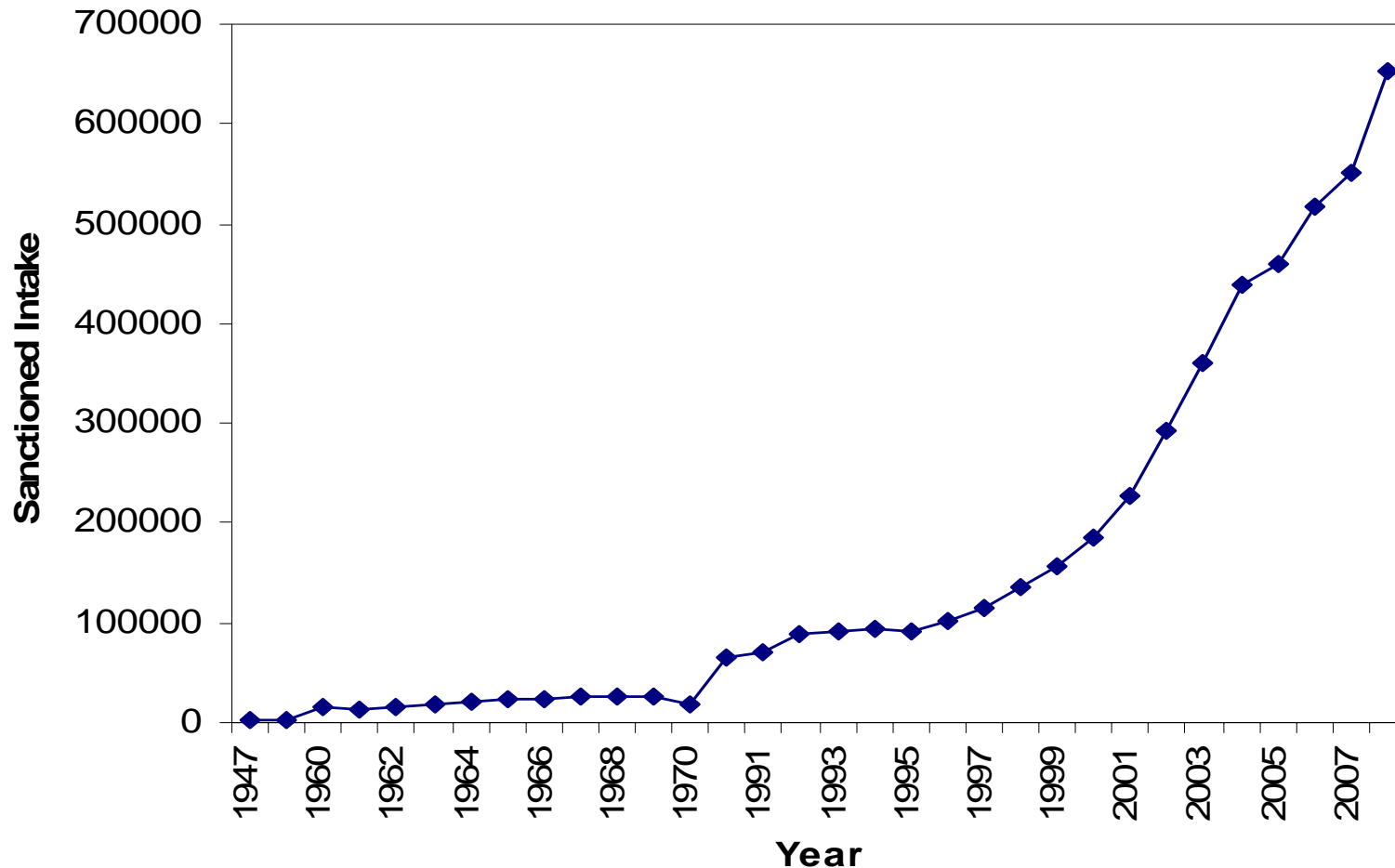


History of Indian Engineering Education

Indian Engineering Education Developments



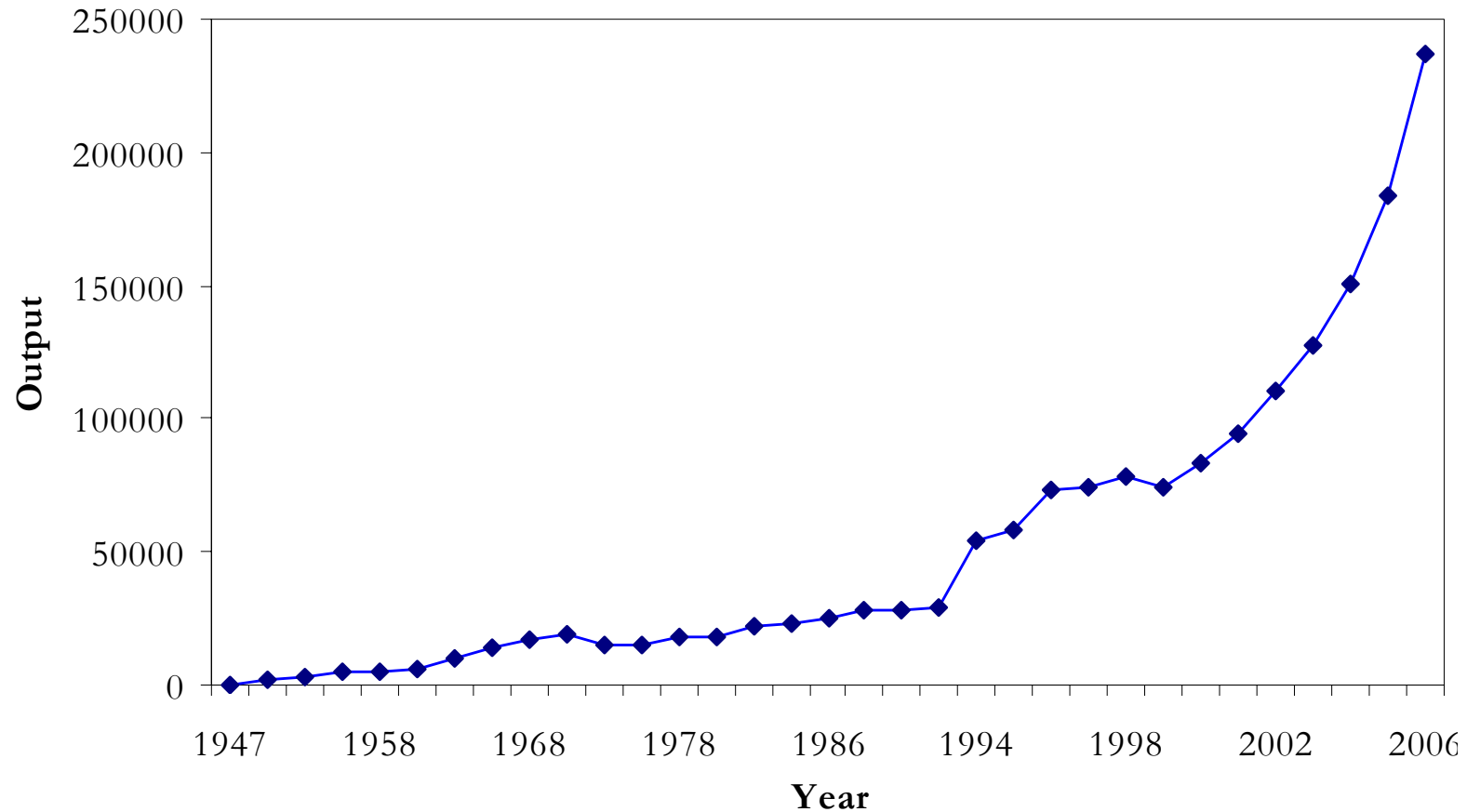
Trend in Sanctioned Intake



2500 in 1947 → 6.53 lakhs in 2007 (CAGR of 9.7%)

Average sanctioned intake/institute: 74 in 1950 to 392 in 2007 (3% per year)

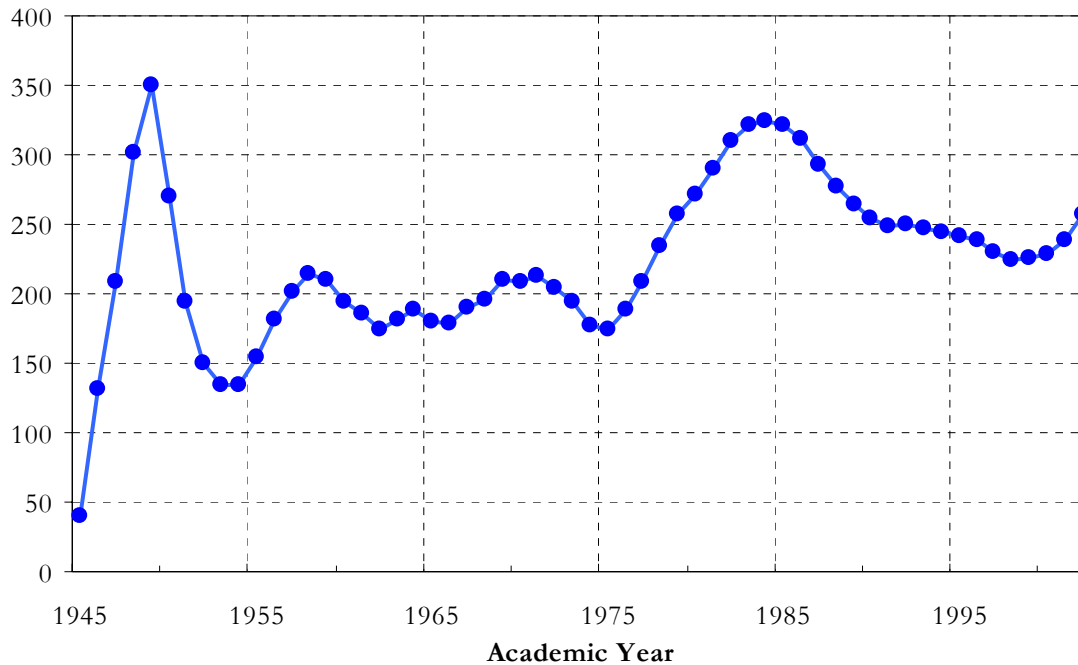
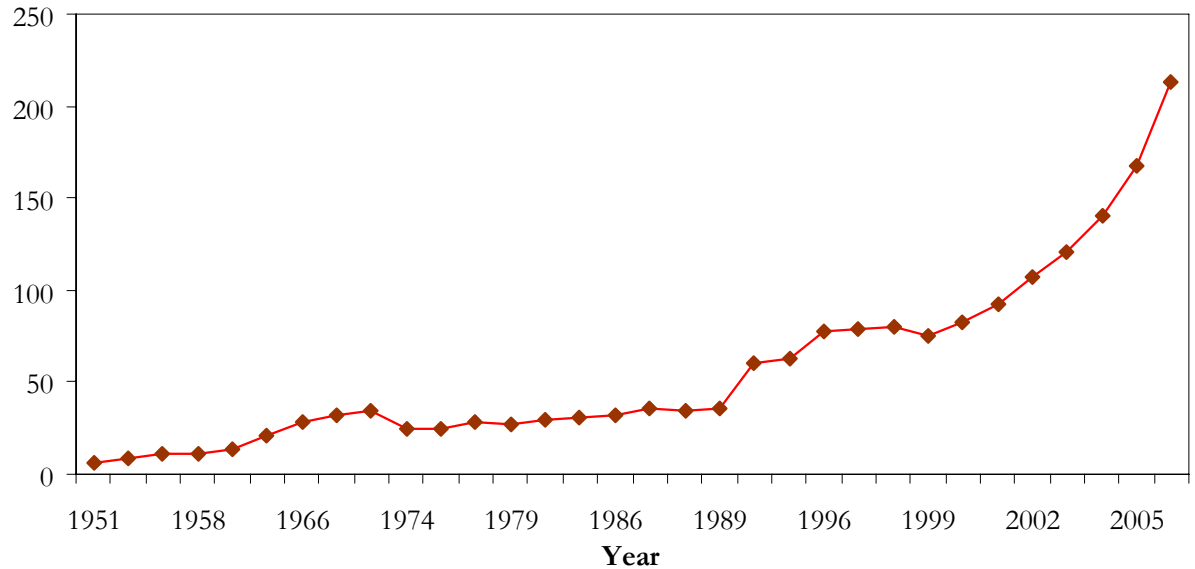
Engineering Graduate Output



270 in 1947 → 2.37 lakhs in 2006 (CAGR of 12%)
3.5 lakhs in 2008

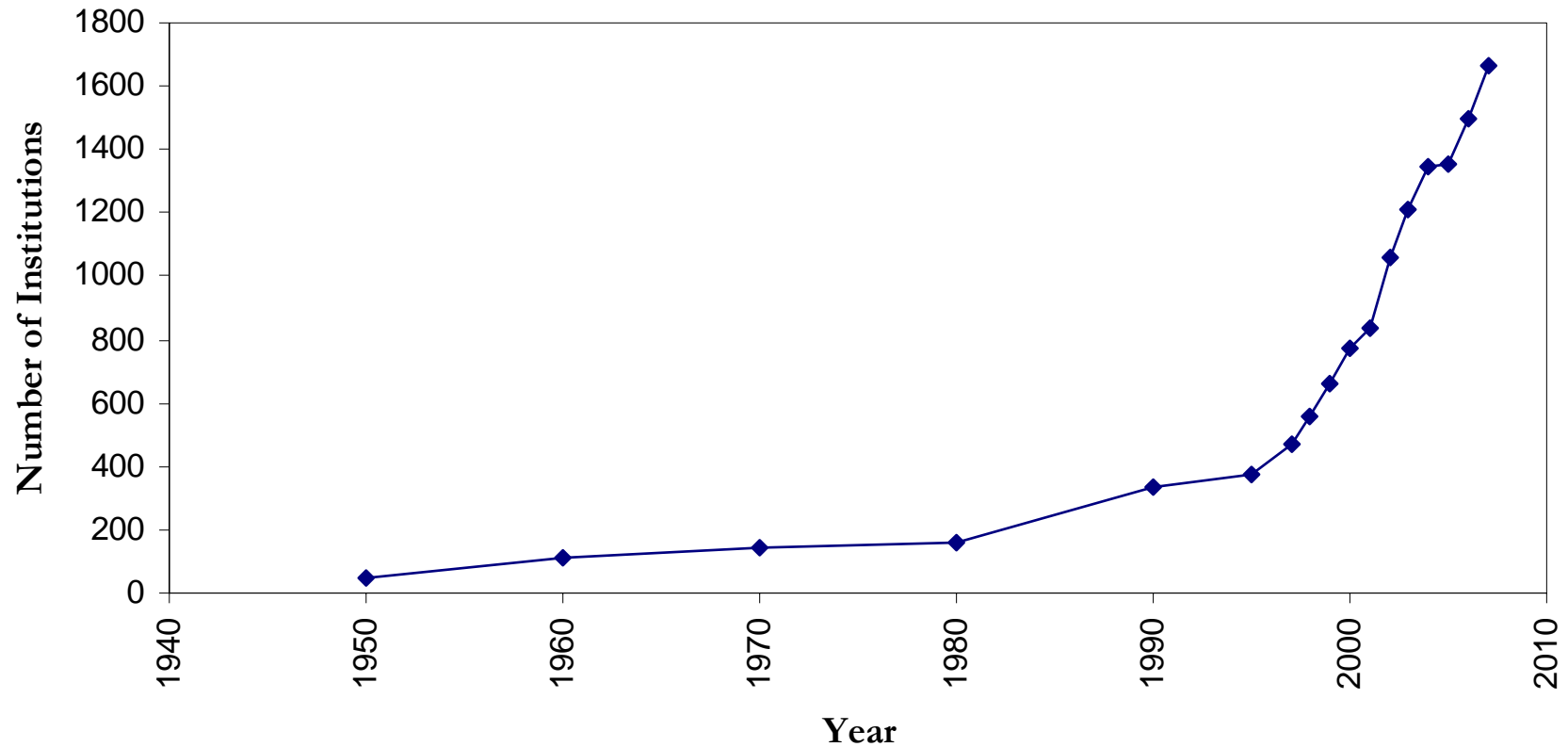
Engineers per million Population

**India: Increasing Pattern
Average ~220**



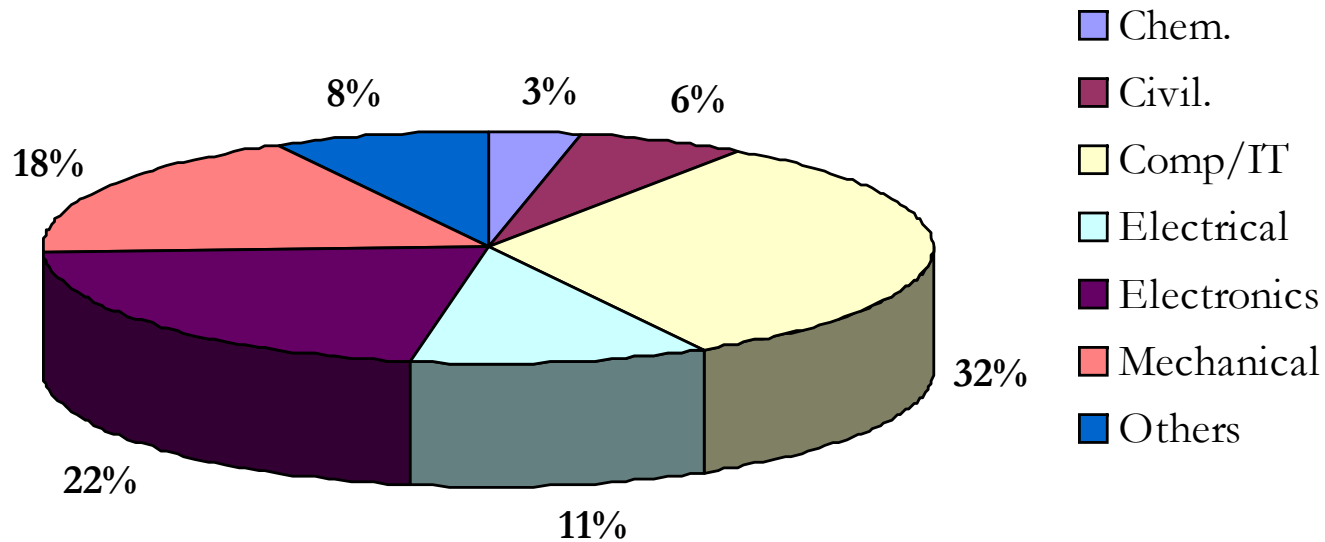
**US: Cyclic Pattern
Average ~250**

Number of Engineering Institutions



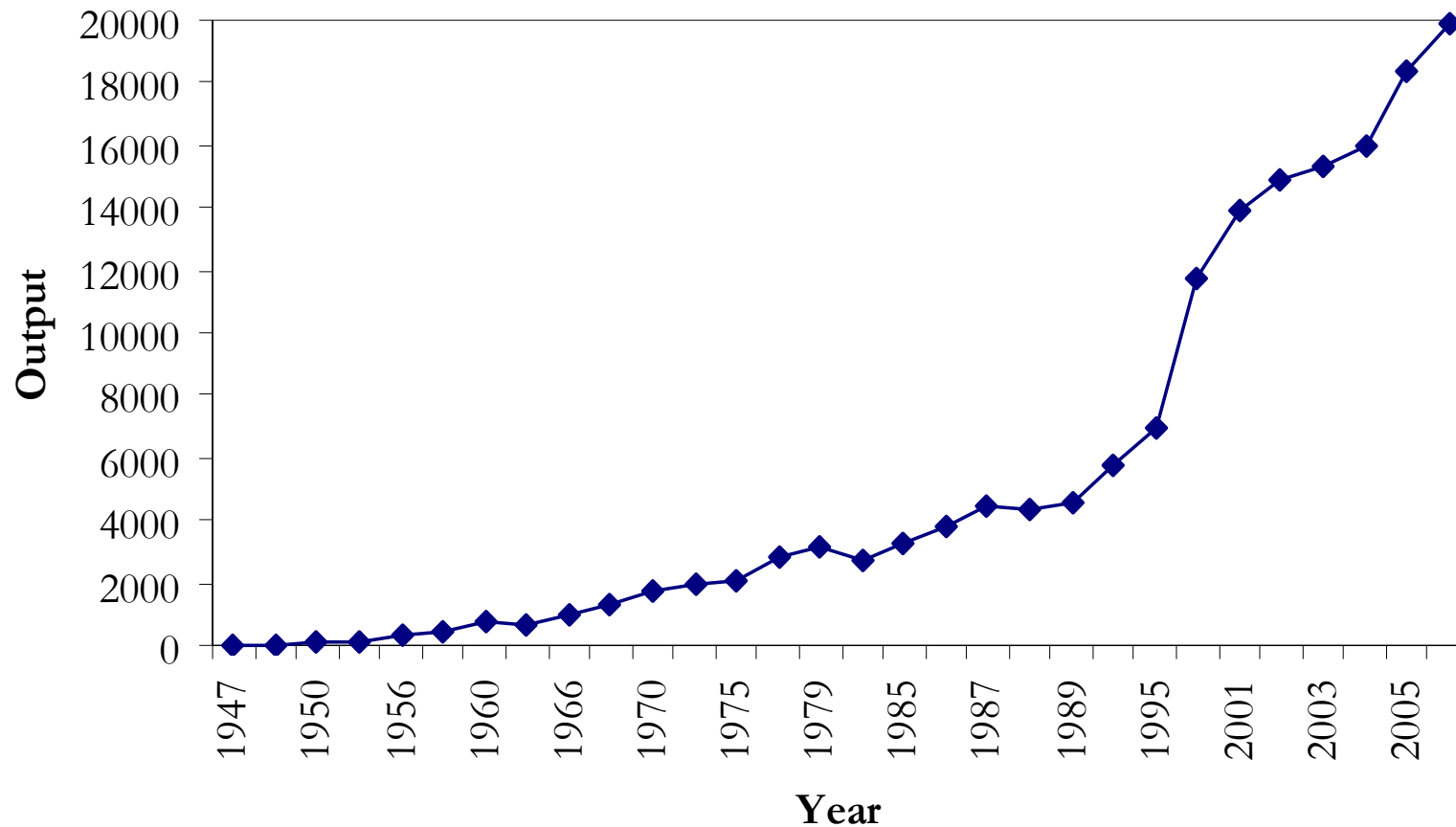
50 in 1950 → 1668 in 2007 (CAGR of 6.2%)

Discipline Wise breakup



2001 Sanctioned Intake

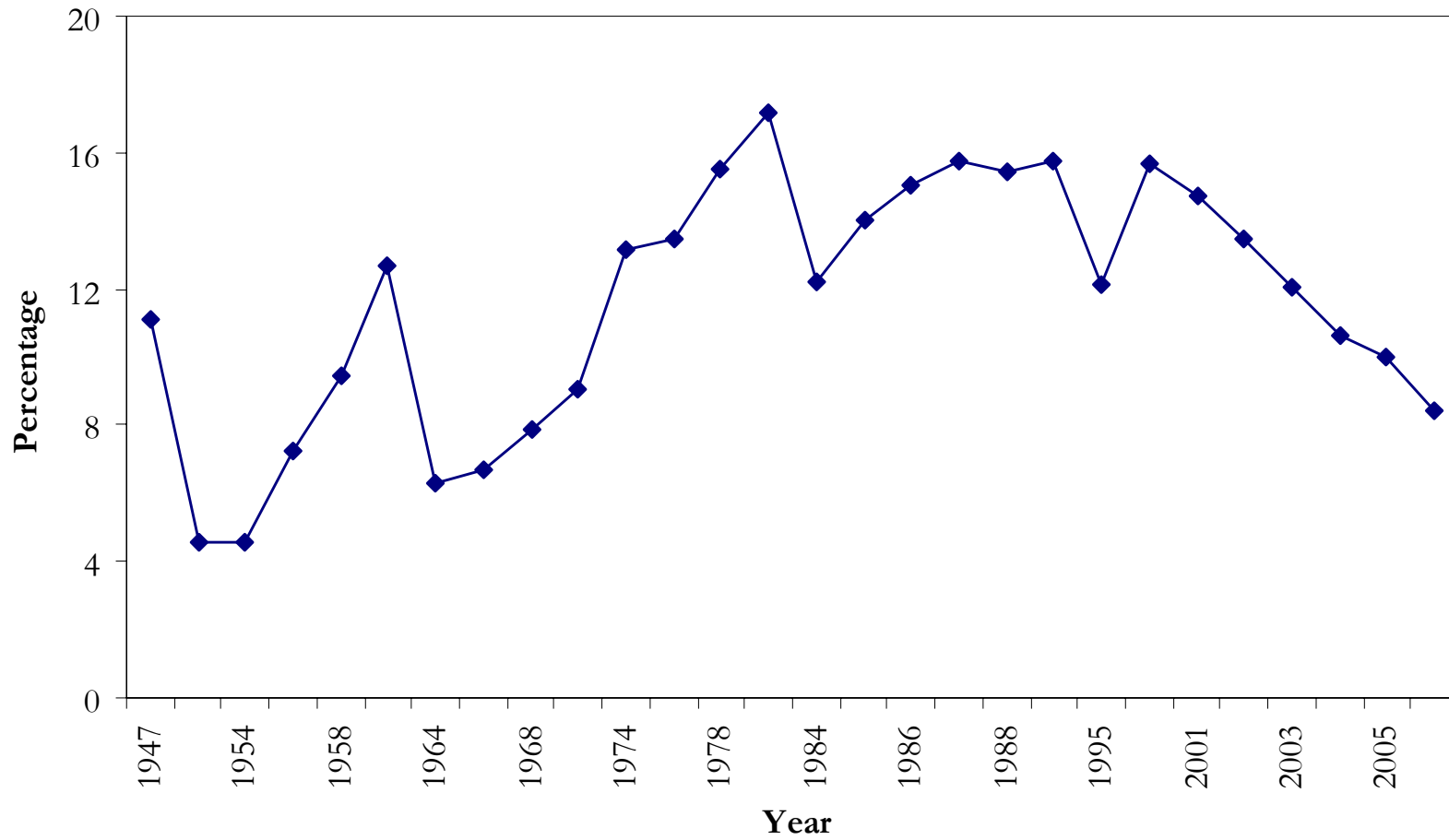
Masters Engineering Degrees



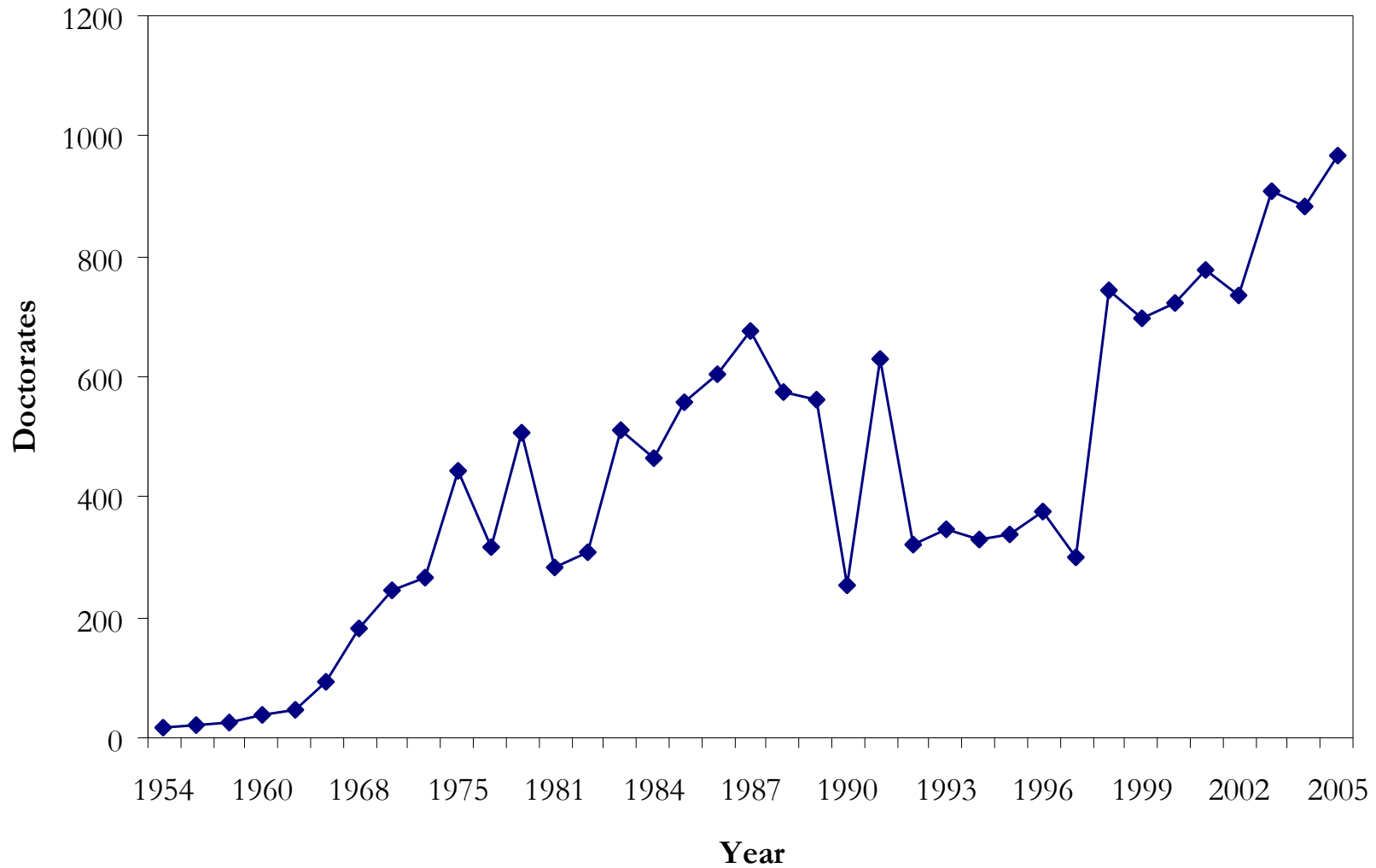
30 in 1947 → 20000 in 2007 (CAGR of 7.5%)

23000 in 2008

Masters to Bachelors Percentage



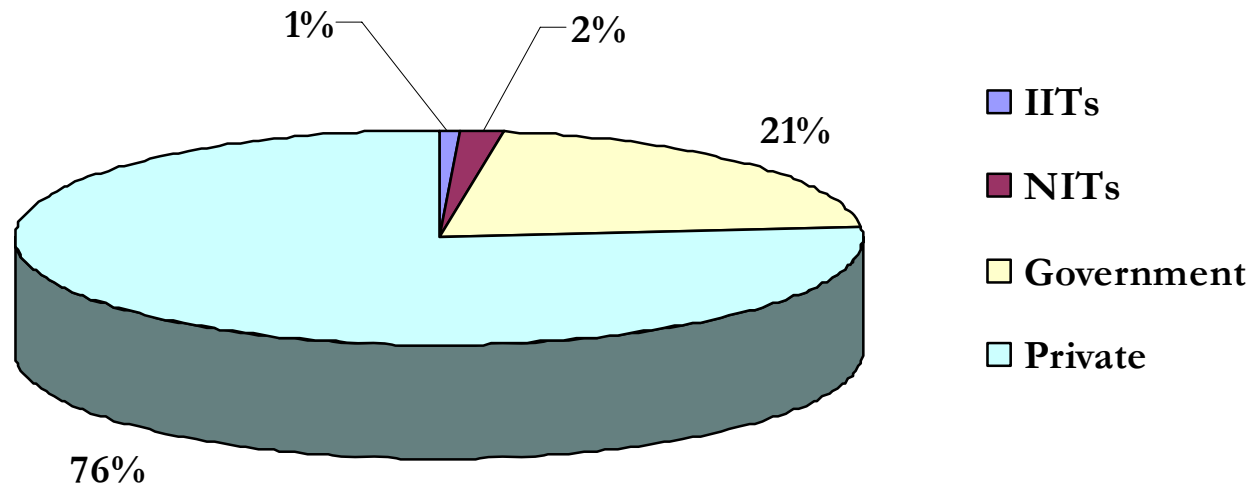
Engineering PhDs



International Comparison: Engg. Degrees

Year of Data		2006	2006	2004	2003	2003	2002	2002	2005
Country		India	USA	Japan	China	UK	South Korea	Germany	Australia
Academic Output									
Bachelors		237000	74200	98400	351500	19500	64900	32800	13500
Masters		20000	39000	--	35000	5000	13500	--	3100
Doctorates	Science	5500	14200	2900	32000	4800	1100	6800	1300
	Engineering	1000	8400	3900	4300	2000	1900	2000	600
	Total	6500	22600	6800	36300	6800	3000	8800	1900
Percentage	Masters/Bachelors	8.4%	52.6%	--	10%	25.6%	19.4%	--	23.2%
	Doctorates/Bachelors	0.4%	11.3%	4.0%	1.2%	10.4%	2.9%	6.2%	4.7%
Bachelors per million Population		214	246	770	272	331	1344	397	674

Types of Engineering Institutes



Above distribution is for 2006 NOI =1511 (For 2007 NOI=1668)

Affiliated Colleges: affiliated to a university, no flexibility or powers related to curriculum or evaluation

Autonomous Colleges: academic flexibility for curriculum/evaluation but under university hence relatively less financial autonomy

Deemed University: maximum academic and financial autonomy

Analysis of Select Institutions

- IIT Bombay, all IITs.
- IISc Bangalore.
- SVNIT Surat, other NITs.
- College of Engg Pune, VJTI, Mumbai.
- Manipal Institute of Technology, Manipal,
Thapar University, Patiala,
Dhirubhai Ambani Institute of Information and
Communication Technology, Gandhinagar.

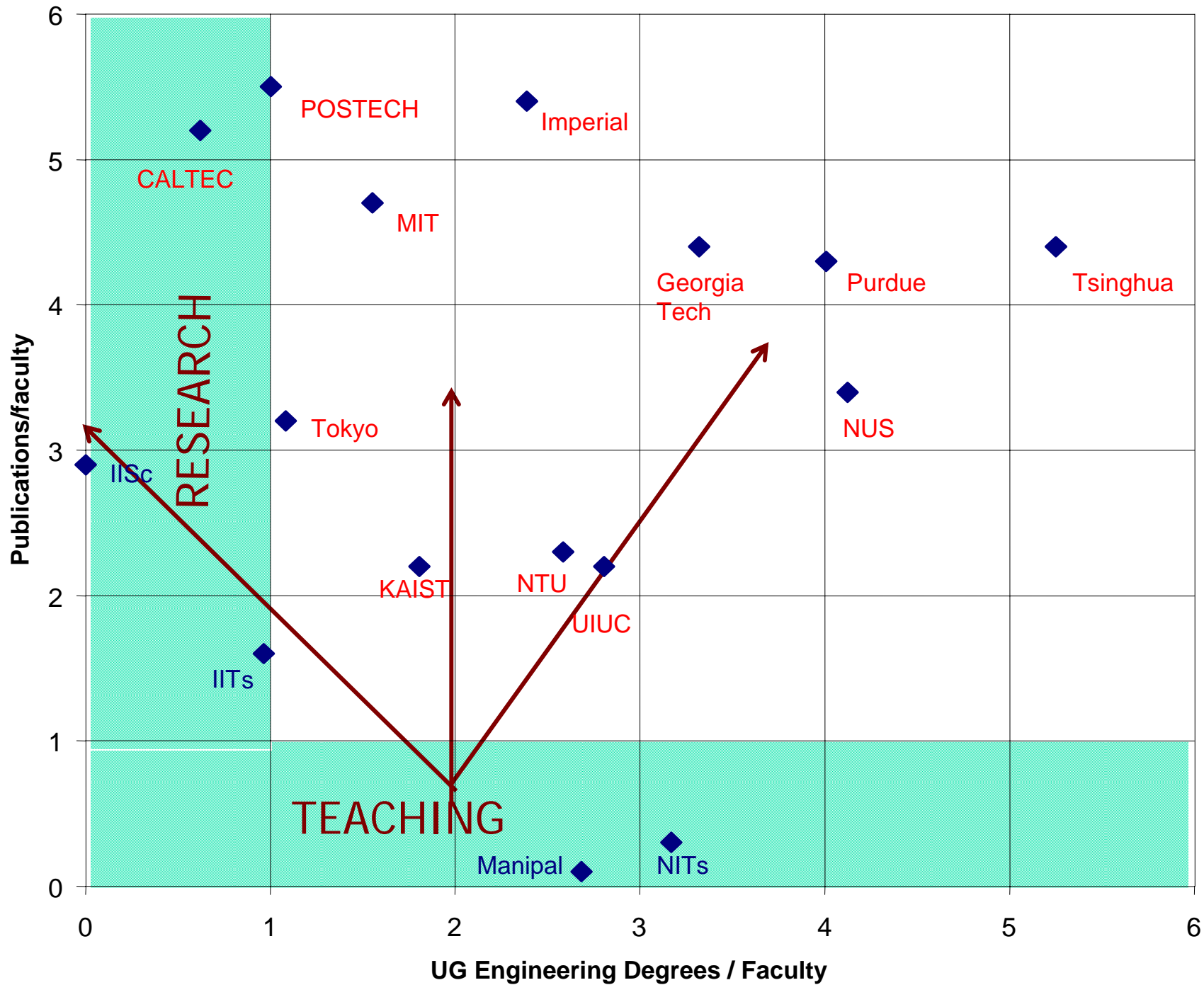
Placements IIT Bombay (2006)

Programme	Engineering	%	Finance	%	Consulting	%	Software	%	Others	Total
B.Tech.	88	35	56	23	45	18	45	18	14	248
D D	65	50	27	21	19	15	14	11	4	129
M.Tech.	164	57	11	4	13	5	78	27	21	287

Average salary	Programme	Engineering	Finance	Consulting	Software	Others
513000	B.Tech.	550000	661000	449000	509000	395000
591000	Dual Degree	614000	906000	515000	501000	421000
418000	M.Tech.	529000	521000	334000	387000	320000
458000	Ph.D.* (700000)	517000	400000			
517000	Average salary	539000	722000	424000	416000	351000

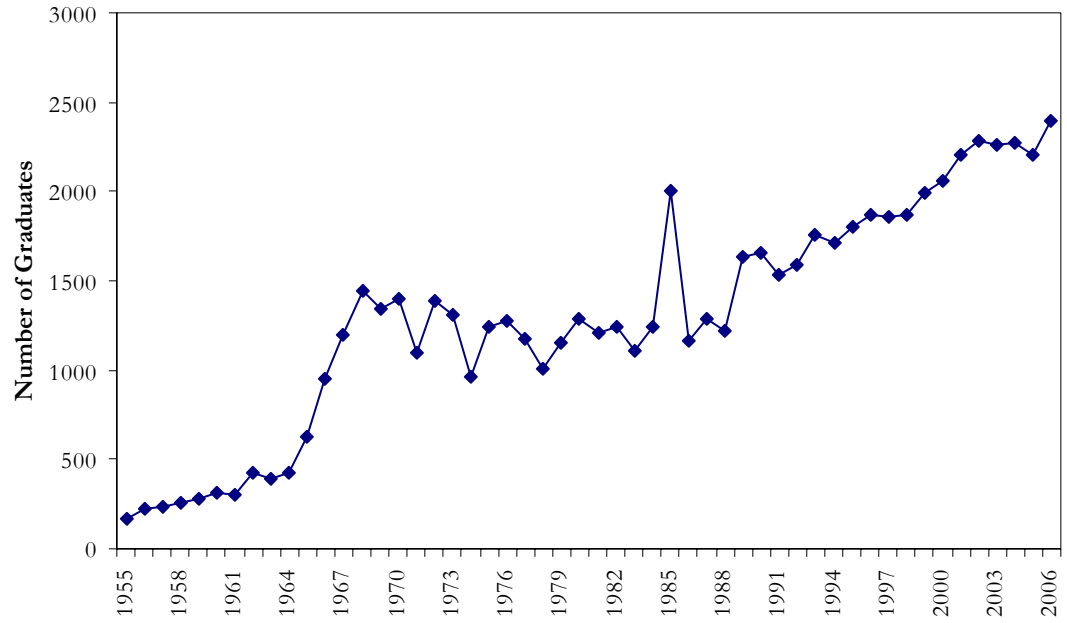
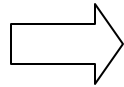
Placement Analysis of SVNIT and MIT Manipal

Institute	Sector	2000-1	2002-3	2003-4	2004-5	2005-6	Average Salary
Manipal Institute of Technology	Core Engineering (%)	48	36	26	25	--	2.5 Lakh
	Software (%)	52	61	74	75	--	
SVNIT, Surat	Core Engineering (%)	44	65	52	41	33	2.1 Lakh
	Software (%)	56	35	48	58	67	

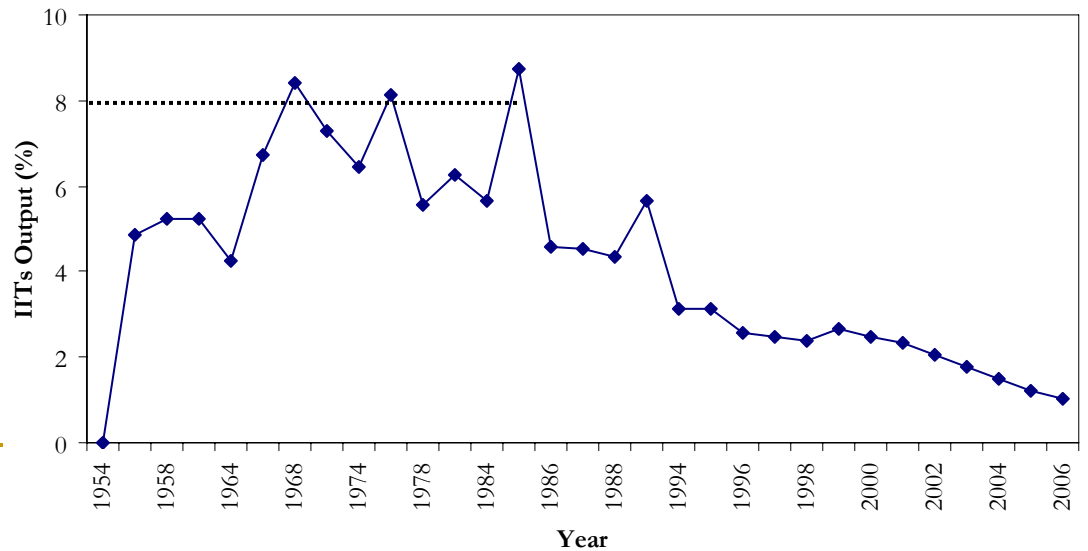
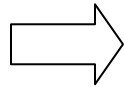


Share of IITs in National Engg. Graduate Output

Graduate Output of IITs



Share of IITs in National Engineering Graduate Output



National trends/ Issues

- Tier 1 institutes-High selectivity (1-2%)
- Share of tier 1 Institutes marginal
- Small percentage of Masters/PhDs
- Faculty constraint
- Software jobs predominate (except IITs)
- Large number of small institutes
- High growth rates, Quality?
- Faculty constraint? No of PhDs?

Scenarios: BAU & Normative for 2017

	BAU			Normative		
	Graduates	Masters	PhDs	Graduates	Masters	PhDs
Tier 1 (IITs and IISc)	5460	11000	1100	14000	28000	8000
Tier 2 (NITs....)	12630	2670	100	35000	14000	1000
Total	901600	54700	2300	700000	70000	10000

Faculty Constraint- estimates

	2006	BAU 2017	Normative 2017	
			Total	New
IIT	2150	5890 (1:9)	12000 (1:12)	10300
NIT	2220	3730 (1:15)	11200 (1:15)	9500
Other	75400	233000 (1:15)	147800 (1:18)	88200
Total	79500	242620	171000	108200

Faculty Shortage ?

Faculty Constraint?

Institute	B.Tech	M.Tech	TED	Faculty	ME/TED	% of Faculty with PhD	S/F
NIT Durgapur	373	70	443	106	16	44	15
NIT Hamirpur	225	NA	225	67	NA	52	13
SVNIT Surat	393	38	431	91	9	34	21
NIT Warangal	324	183	507	179	36	55	11
NIT Rourkela	325	73	398	--	18	NA	-

Recommendations:

1. Quality Output:

- Target -2% Engg grads(Tier 1), 5% Tier 2 in 10 years
- Enhance the output of existing Tier 1(IITs) institutions
- Upgrade quality Tier 2 institutions (NITs)
- Create new Engineering colleges through Public-Private Partnerships
- Enhance the output of existing Tier 2 institutions

Recommendations:

2. National PhD Initiative

- Target -10,000 Engg PhDs / year in 10 years
- Attract good students to the PhD programme
- Industry fellowships
- Improve / Enrich the PhD experience
- Facilitate challenging jobs/careers after Ph.D.

Recommendations:

3. Faculty shortage

- **Attracting Quality Faculty**
- **Faculty Numbers**
- **Incentivising Performance**
- **Adjunct faculty from industry**

National Engineering Faculty Initiative

Recommendations

- 4. Strengthening Masters Programmes**
- 5. Industry linkages**
- 6. Strengthening Science Departments**
- 7. Curriculum Reform**
- 8. Societal Linkages**
- 9. Periodic Review Mechanism**

Recommendations

- 10. Faculty Quality Improvement**
- 11. Continuing Education – Engineers**
- 12. Engineering Education Database**
- 13. Engineering Schools in Quality Universities**
- 14. Journals, Conferences and Academic Press**
- 15. Administrative Structures**
- 16. Strategy and Vision**

End- Note

Providing a “fix” for engineering education in today’s university is like trying to perform open heart surgery on a marathon runner during the race.

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Thank you