



Cooperation for Technological Innovation:

Glimpse of opportunities from the case of India

Presentation at

文部科学省

科学技術・イノベーション政策にかんする懇談会

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Delhi

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INDIA

States and Union Territories



IIT Delhi(1963)

Map not to Scale

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IIT Delhi

A DREAM DESTINATION



Very Briefly @ IITD & DMS



- @ 5300 Students
- > 440 Faculty
- Residential Campus
- Facilities ++
- @ 1500 J-papers



Department of Management Studies (DMS)



- Management Education at IITD began in 1976, focus research / Ph.D.
- MBA Programs began in 1997; earlier M.Tech.
- We are small, but still ranked often among **Top 10-15** Business Schools in India; may be due to focus on R, T & K-contribution
- We have some unique nano-contributions; e.g. India-Japan cooperation New Areas (e.g. Flexibility, MoT, Competitiveness), Professional Societies (e.g. www.giftsociety.org), Journals (e.g. JAMR,..), > 80 J-papers

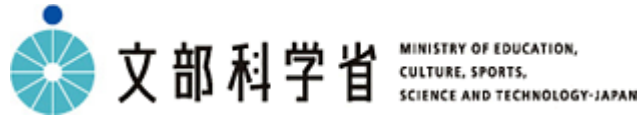


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- **Examples of HRD & Innovation**
 - **Opportunities in educational system**
 - **Higher education: a case of IIT**
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- **Q&A**



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for giving me an opportunity to share my views

DMS, IITD



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Institute of Innovation Research

- **Dr.角南 篤**, several professionals for help
- Note: Views expressed are indicative and personal views. They do not represent view of the Government of India or organization I belong to.



Glimpse of Innovations from India:

Mass Products

- **Passion**, a motorbike made by Bajaj.



- **Rewa**, an electric car.



- **Nano**, car for needs at the base of pyramid
e.g. Safety with economy



- More impactful have been one that involved grassroots such as green, while and ICT revolutions



Position on Innovation: select large countries

	China	Germany	India	Japan	USA
GII-08-09	37	2	41	9	1
Input Pillars	47	10	49	14	2
Institutions	56	7	44	21	17
Human capacity	38	9	28	11	1
Infrastructure	48	8	76	13	10
Market sophistication	46	10	39	16	3
Business sophistication	49	7	56	16	1
Output Pillars	29	2	34	3	1
Knowledge	28	3	23	4	6
Competitiveness	5	2	24	4	1
Wealth	74	36	90	31	10

Source: developed based on data from GII, 2009

- How does the picture look?
- Does it make much sense?
- **Several opportunities for India are apparent**
- We may not be very happy, but it is the most recent & detailed comparative picture on Innovation that I could get

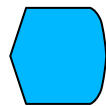


Trends in Competitiveness Ranking of India, Japan and Select Countries

Country	GDP Per Capita in 2004 (US\$)	Year						
		2005	2004	2003	2002	2001	2000	1999
U.S.A.	41,400	1	1	1	1	1	1	1
Singapore	24,220	3	2	4	5	2	2	2
Australia	26,900	9	4	7	14	11	10	11
Canada	28,390	5	3	6	8	9	8	10
Japan	37,180	21	23	25	30	26	24	24
China	1,250	31	24	29	31	33	30	29
Malaysia	4,650	28	16	21	26	29	27	28
Germany	33,100	23	21	20	15	12	11	12
India	620	39	34	50	42	41	39	42
Korea	13,980	29	35	37	27	28	28	41
No. of Countries		60	60	60	-	-	-	-

Source: Adapted from World Competitiveness Yearbook, 2005

- Who leads in World? Is trend & pace satisfactory?
- Where is India? Any comparison in per Capita? Innovation?





Priorities in Industrial Policies

- India attempted state-guided policies for many decades, but did not work & abandoned
 - **Industrial policies**
 - The industrial policy reforms (start 1991) have substantially reduced the industrial licensing requirements, removed restrictions on entry & expansion (incl. international firms) & **FDI**
 - **Government tries to give priority**
 - **E.g.** Ministry of Communications and IT
 - Department of biotechnology, but more for R&D
- **Large government, but effective?**
 - **Reasons are many; e.g. fragmentation, silos, quality**



Priorities in S&T Policies

- **Key milestones**
 - The Scientific Policy Resolution of 1958
 - Technology Policy Statement of 1983
 - **Science and Technology Policy 2003**
- **Glimpse of issues**
 - Optimal Utilization of Existing Infrastructure and Competence
 - Human Resource Development
 - Promotion of Innovation; innovation foundation, act,..
- **Good intentions, but effective?**
 - **Let us get a glimpse of performance by some examples**

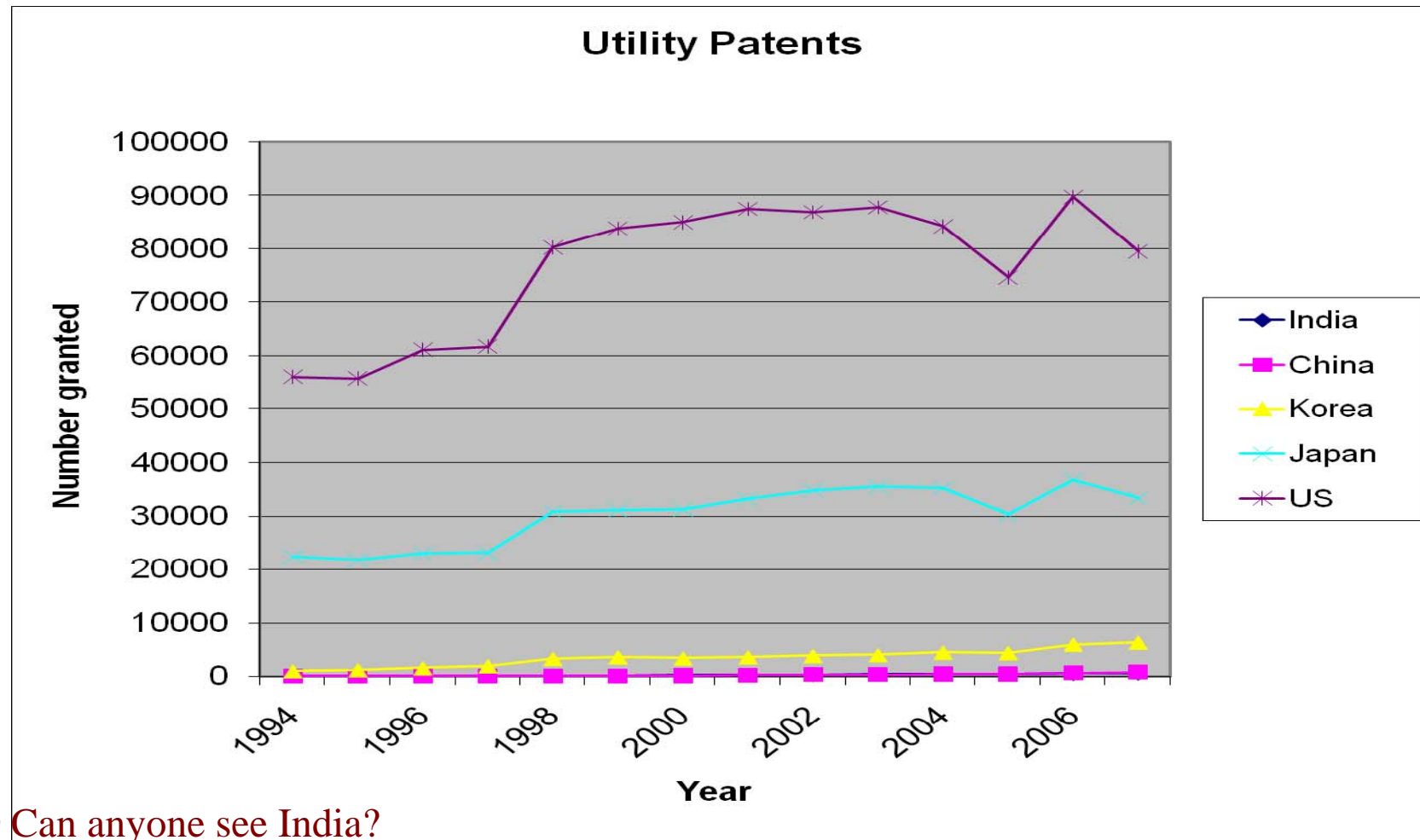


Public R&D System

- *Bulk of R&D was by public system*
- *Limited spillovers of strategic innovation*
- *Persistent problems in production/scaling-up/commercialisation*
 - **Nuclear power stuck at 250 MW for long,**
 - **LCA not yet in commercial production**
 - **+ Space has managed to move on**
- *CSIR is the largest holder of US patents from India but patent revenues are small*
 - **Several labs are under-performers**
 - **Emphasis on patents even if they have poor commercial value?**



Trends in Patents



- Can anyone see India?
- Anything significant for skills India has got?



Strength/Weaknesses of Innovation in India

- Network of public R&D labs with skills
- Lack of dynamism; weak @ industrial application
- Large industrial base; weaknesses in clusters
- Govt. recognition of importance of industrial R&D
- Limited impact of programs (@ \$ 30-50 million)
- Increasing FDI in R&D
- Mostly related to only software; less impact
- Large education capacity across levels (incl. IIT)
- Quality of such large system remains low
 - **Let us get a glimpse of HRD & IIT**



Glimpse of Situation in Human Resources Development



Glimpse of Situation on HR

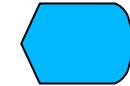
- India has advantages on HR dimension
 - Most can be attributed to factor conditions
 - **Demographic factors?**
 - Huge quantity;
 - **Labor force (> 460 man, 3rd rank, Japan > 66, 8)**
 - **incl. scientists & engineers, but too low / million**
- **What about scientists & engineers**
 - Quantity is large
 - **But still ranks 60 in terms of per million**
 - **Less number of institutes?**

Let us get glimpse of opportunities



Opportunities in Educational System

- **Quantity and quality**
 - **Spending on education quite high**
 - **Why poor ratio of pupils / teacher?**
 - **Can it lay foundations for HR India needs?**
 - **What @ enrolment rates in secondary/tertiary**
 - **E.g. Dilemma @ IIT**
 - **What shall we teach? Focus missing?**
- **Privatization of big help?**
 - **Spreading rapidly in urban areas**
- **Average schools in Japan far better?**





Example of Comparison of Educational System: Select large countries

	China	German	India	Japan	USA
Public spending on education	2.18	4.58	3.75	3.66	5.6
Pupils per teacher (Primary school)	18.25	14.12	40.2	18.9	14.13
Students per teacher (Secondary school)	17.55	13.88	32.7	12.63	14.94
Educational system*	5.36	5	7.08	4.64	7.08
Secondary enrollment rate	75.51	100.27	54.02	101.56	94.12
Tertiary enrollment rate	20.31	51.01	11.41	55.31	82.72
Public schools*	6.2	5.81	6.86	4.87	6.42

➤ **Can we say the efforts & performance are very satisfying?**



Opportunities for IITs:1

- Quantity and quality
 - Productivity stagnation
 - **Few innovative mechanisms**
 - Shortage of quality faculty
 - Case of IITD/DMS
- **K-contribution: marginal (even for papers)**
- **Contribution to economy**
 - **Fewer brilliant technologists/engineers/scientists**
 - **Relatively fewer entrepreneurs than managers**
 - **Case of teams may be even worse**
 - **Expected multiplier effect less visible?**
- **Tough times ahead for IITs in new era**
- **Can IIT with Japan cooperation make impact?**²⁰



Opportunities for IITs:2

- **What shall be focus of IITs**
 - **PG-education**
 - **Few innovative mechanisms for creativity,**
 - **Research**
 - Case of IITD/DMS
 - International interactions
 - Only with English speaking world
- **Shall there be more balances?**
 - E.g. at least 5 % that can interact with Japan
- **What @ entrepreneurship / incubation**



Opportunities for IITs: Innovation & Technology Transfer

- **What mechanisms work in India?**
 - **E.g. Foundation for Innovation and Technology Transfer**
 - **Just a TLO / more?**
 - **Incubation**
 - A decade of experience
 - Glimpse of performance
 - Quite comparable? Not with leading US/EU ones
- **Many loose threads in long & increasingly complex process of innovation (lab to market)**

NEED for Cooperation for Innovation



KritiKal Securescan:

A Case of Venture led by IITD students/faculty

- **Mission: creating a secure tomorrow with cutting edge technology solutions**
- **Started as IITD incubated company**
 - **First product ZenScan, Advanced Vehicle Scanner System**
 - **a computerized and automated intelligent system, is more accurate, effective, efficient and secured tool for vehicle underside inspection**
- **Won NASSCOM Award for innovation**
- **Dr. Prem Kalra, Chairman, Dr. S. Banerjee, Chief Mentor**
- **Kapil Bardeja: Co-founder and CEO**
 - **A dynamic person, MBA,**



NEED ways to scale-up such ventures



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India & Japan

Key question: **How can they cooperate more? In S&T?**





Glimpse of India-Japan Cooperation Opportunities

➤ Basics

➤ India can learn from rich experiences of Japan

➤ **Basic education**

➤ Higher education

➤ Infrastructure, e.g. laboratories are advanced, well maintained and upgraded

➤ S&T

➤ National labs, industry-institution

➤ Inter-firm cooperation, the real opportunity

➤ Learning from case of ICT

**High complementary resources can help with
strategic partnership**



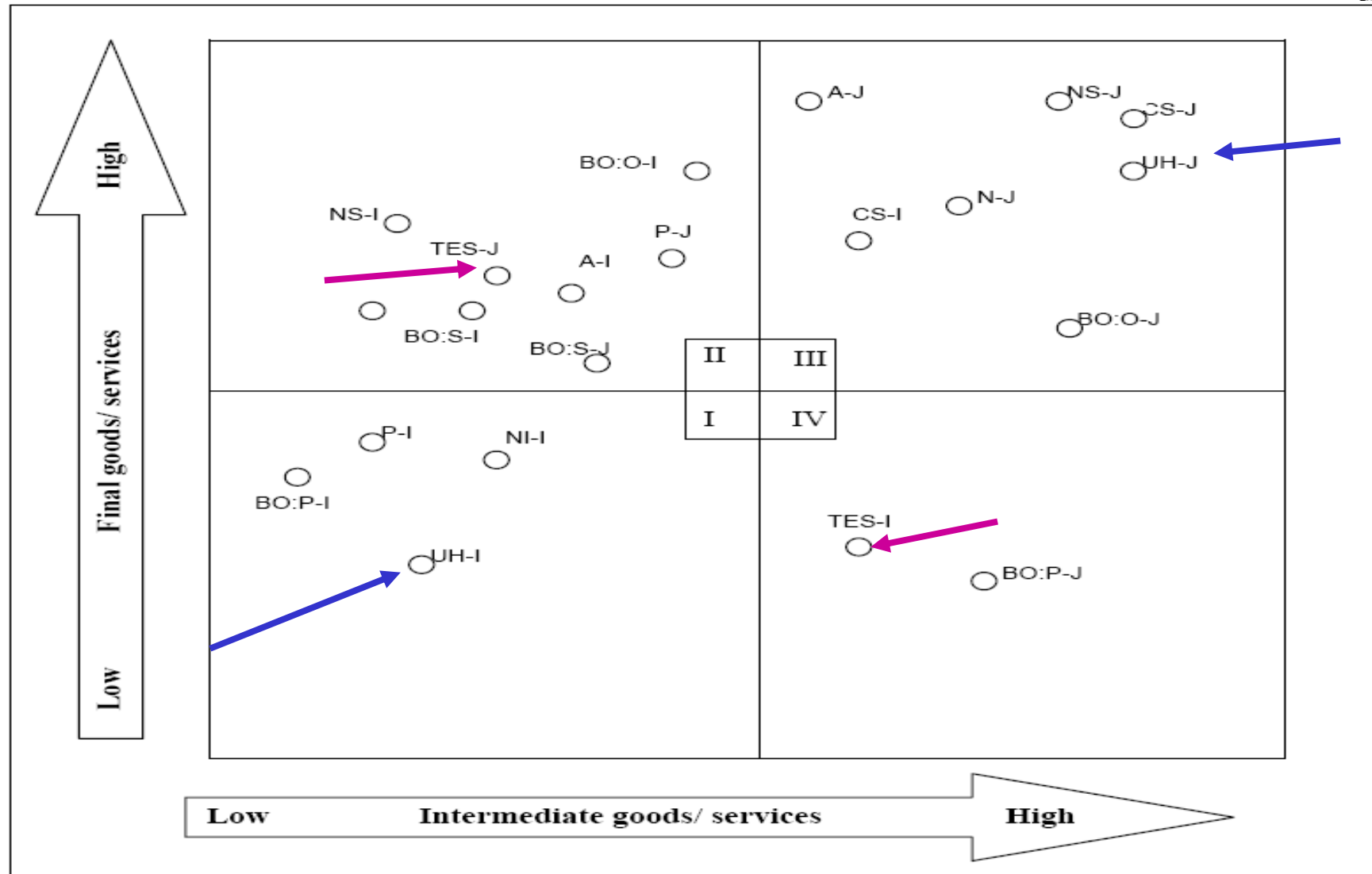
Learning from the case of ICT

➤ Basics

- There are several industries in which complementarity seems quite high
- Generic views such as Japanese hardware + Indian software may be too primitive
- Segment-level analysis can bring out key issues
 - Both countries over-focused on cooperation with countries in the West
- Innovation opportunities for India are much bigger
 - E.g. emerging industries,
- Without cooperative strategies both countries may lose
 - E.g. Madagascarization in ICT,,: excessive adaptation to local mkt.

BoP innovation from India can complement high-tech/end/cost innovations Japan excels at 27

Indicative Competitiveness Position of India and Japan on key layers of ICT



Examples: UH=User hardware, TES=Terminal equipment software

- **Being positioned quite far; hardly any direct competition between two**

An Example of Approximate Evaluation of Competitiveness of select Countries in Nanotechnology

Factors (Examples of Criteria of Competitiveness)	China	EU	USA	India	Japan
Investment (% private R&D funding, R&D invest./capita)	3	5	8	1	7
Cooperation (among various stakeholders)	8	7	6	4	8
Companies (No. of anchor firms)	5	6	7	2	7
Technological (patents, publications)	4	8	9	1	6
Market/Customer (No. of products)	5	6	8	2	7

Source: Adapted from Momaya, 2008

- **Developed countries are well positioned & China is quite fast**
- **Vast gap between India & Japan; high potential cooperation**



Prospect & problems of India-Japan Cooperation in Science & Technology

➤ Prospects

- With growing skills & resources in India, the prospects are increasing, if problems are addressed
 - Many S&T areas, most promising may be
 - Life sciences, chemicals & nanotechnology

➤ Glimpse of problems

- Inadequate people exchanges
- Slow learning processes due to differ. in languages

➤ Root causes

- Inadequate commitment from leadership
- Less willingness to take challenges

**High complementary resources can help with
strategic partnership**



Case of an Innovation for India-Japan Cooperation

➤ Situation for years

- Hardly anyone interested in learning @ Japan
- Why? Vicious circle, benefit/effort logic,..

➤ After years of efforts, could break in 2002

- Initiated language learning on campus
- + + seminars, training,..
- Glimpse of interest; > 20 %

Batch	Business Japanese Participants	Successes at Different Levels	
		J4	J3
2004	2	2	
2005	5	3	2
2006	>12	2	8
2007	>11	>3?	>4

➤ Sustenance difficult

- Couldn't help students with better opportunities

High institutional barriers (e.g. English), mindsets need interventions at higher levels₁



Future of India:

a perspective from possible rise of innovative class

➤ Pragmatic

➤ Future is bright, but needs people / partners with commitment & passion

➤ **Speed is not easy without good architecture**

➤ E.g. horizontal, modularization (silicon valley)

➤ But component factors can move fast

➤ E.g. skilled/knowledge workers

➤ Is not that quite matching to charac./ needs of Japan

➤ Long-term orientation

➤ Islands of excellence

➤ But can be easy targets of destabilizing forces (e.g. terrorism; several attacks)

In the long-term we need to think @ more equitable society



Concluding Remarks:

- Achievements of India are many
 - But, not true for tech. innovation & competitiveness
- S&T Policies; exist but impact is low
- HRD system is a key, but change is slow
 - Good for some needs, incl. in Japan
- **India-Japan partnership**
 - **Why coop.: Massive problems can't be addressed by a single country**
 - **India can complement better**
- **Despite strategic partnership, that processes are evolving too slowly**
 - **A root cause seems to be less understanding & confidence in leadership (in firms, institutions, governments)**

Hard work by professionals such as Dr. Sunami may bring a breakthrough



Concluding Remarks:

Implications for leadership

- Indian talent, efforts and desire to contribute to world are growing; e.g. Auto to Space
- Cooperation between India-Japan has seen successes in several industries such as automobile, electronics, energy & can succeed in many others
- Rapid scale-up needed
- That demands interventions at higher levels
 - Leadership that is aware, proactive and
- We also need to nurture young leaders
- To attract talent we need to create examples such as Dr. Gupta, Corp. VP, Microsoft; Mr. Khosla, Co-founder Sun Micro; Ms. Warrior, CTO, Cisco in Japan

We can say TOO LATE; Can we CATCH-UP?



ありがとうございました

ご清聴、誠にありがとうございました。
また、理解できなかったこともおおいと思いますので、
ぜひご質問下さい。

できるだけご説明できたらと思います。

Thank you very much for your patient listening.

Please feel free to ask questions.

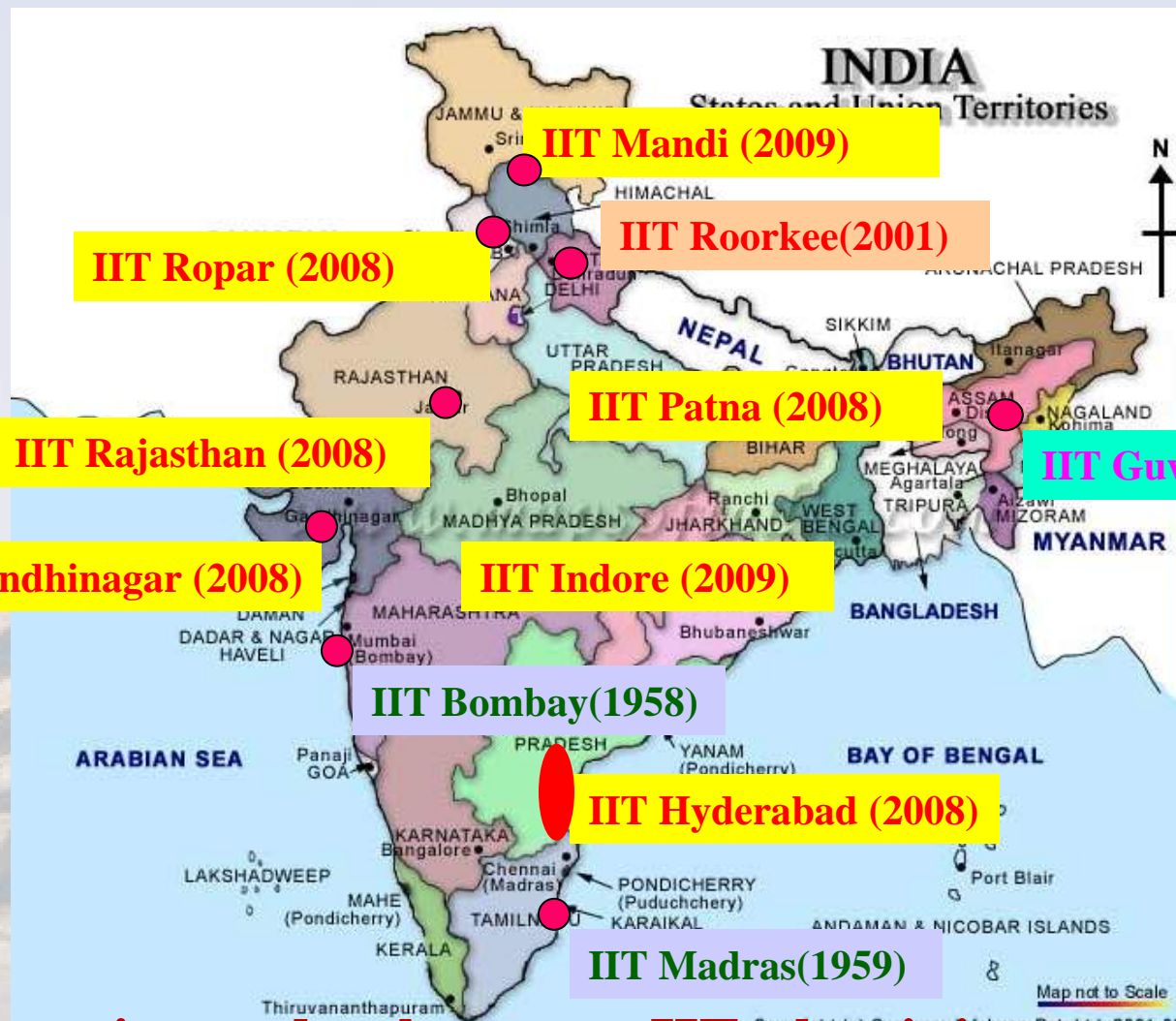
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Trying to build 印日 cooperative bridges for better future



Support Slides



- **India is trying to develop more IITs, but it is not easy**
- **e.g. Faculty who evolve innovative culture**
 - **Have been trying to search in Japan also; are there many?**

Eight Essential Functional Layers of ICT Industry with Focus on Telecommunications



<i>Layer</i>		<i>Description</i>	<i>Examples of Product/Service</i>
User hardware		User terminals, peripherals	Mobile, PC, Personal Digital Assistant (PDA), set-top-box.
End user / terminal equipment software and other software		Software for user terminal or peripherals, networks	Browser, plug-in software, Java, Home Audio Video interoperability (HAVI), JINI, Window CE, Symbian
Contents and related services		Information content, services	Information, services (mail order, finance, booking), Films, programs, music.
Aggregators		Arrangement of content and services by category, formation of a community	Multi-channel TV companies, I-mode.
Portals		Gateway to interactive digital media services	Search engine, on line service, Expanded Portland Group (EPG)
Network services		Network for traditional voice or data or value added (e.g. BB, interactive digital media) services	ISP, online service, data broadcasting
Network infrastructure		Construction and Management of communication network incl. base stations	Type-1 carrier, CATV, broadcaster, network owners, managers
Back office	Platforms	Overall system for managing interactive services	Media Serve Integrated Broadband Communications (IBC)
	Construction & operation	Construction and operation of systems for providing back office telecom and related services	Web hosting, e-business solutions
	Software	Software for telecommunications and related	Billing, authorization, security, content management (copyrights), customer management/ tracking, marketing, measuring the effectiveness of recommended advertising, choosing advertisements

Source: Adapted from Nagumo, 2000; Momaya, 2008

- Which layers Japan is & wish to contribute?
- Which layers India can contribute? Major competition?