

Universities and Emerging National Innovation Systems – South Asian (Indian) Experience

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Two Major Trends

- ONE: Greater dependence of Indian economy on knowledge production and knowledge based services in the last decade
- More than 54% of India's GDP is from service and tertiary sector of economy in 2005-06. Half of this can be said to be based or related to Knowledge sector.
- TWO: Universities (360 and 17600 colleges) and Knowledge/R&D institutions(900) in different forms and levels come to play a significant part in the emerging knowledge economy (2)
- Ex: In 2006 HEIs enrolled 11 million students; and they accounted for 47% of total S&T output measured in terms of SCI based 35142 research papers in 2002.

Role of Universities & HEIs

- Universities in S Asian context are still undergoing First and Second Academic Revolutions at the same time.
- HEIs role in knowledge economy is still emerging
- About 25-30% of 360 universities can placed in the category of teaching and research; rest mainly for teaching.
- Historically three guiding posts emerged

Three Guiding Posts for Universities in NSI

- **Creation of Human Capital: Quality teaching, standards and excellence (1950s...)**

'to provide scientists & technologists of the highest caliber who would engage in research, design and development to help build the national towards self-reliance in her technological needs...' Jawaharlal Nehru

- **Creation of Knowledge and intellectual capital as S&T/Innovation base (1970s...)**

Reflected in the Vision of IIT Bombay but apply to all leading insitutions of HEIs

- **Creation of Wealth from knowledge(1990s)**

Commercialisation of R&D through Public-Private Partnerships (R.A.Mashelkar in CSIR and Ashok Jhunjuwala IIT Madras)

Manifestation of Triple Helix in the Context of Indian HEIs

- Most dominant form of relevance of Universities is through human resources (both targeted and non-targeted fields)
- Manifestation of Triple Helix can be found in different patterns and forms; Difficult to find the TH 'model' in its 4 institutional processes
- Biotechnology in Delhi region – our study indicated university-industry or government – university relations – two way rather than three way relations with its institutional processes
- IITs are experimenting with various entrepreneurial patterns
- Incubators, Spin-offs, TTOs, consultancy and IPR management are given high priority in IITs but universities are just waking up to these developments
- Since much of R&D and S&T system in India is in public research laboratories – here again one can find two way rather than three way relations between research lab and industry. IPR is given high priority in public research laboratories such as CSIR.

Relevance of Triple Helix and regional development – Two Developments

- Over all - Indian experience shows two developments in the context of HEIs and Public Research Systems (PRS)
- IITs/PRS demonstrate a global/general trend in terms of institutionalisation of TTOs, establishing incubators, IPR management and spin-offs
- However bulk of universities and HEIs including some PRS labs demonstrate a regional diversity for the relevance of Triple Helix
- Latter draws attention to regional innovation clusters where government-industry-HEIs/knowledge institutions entered into relations and partnerships in a unique way.
- Let us first look into IITs and PRS (Global Trend)

Case of IITs: Sponsored Projects in Rs million

IITs	1999-2000	2004-05	% increase
Bombay	145	280	92
Delhi	147	310	111
Kanpur	139	414	198
Kharagpur	99	312	213
Madras	45	351	681

IIT Patents (filed) US

Year	IIT B	IIT D	IIT Kh	IIT M	IIT Kan
1998-99	6	16	9	-	-
2001-02	9	13	15	13	1
2002-03	15	29	18	4	-
2004-05	23	24	10	12	1
2005-06	12	27	10	25	19

Consultancy Assignments in IITs in Rs millions

IITs	1999-2000	2004-05	%increase
Bombay	52	100	92
Delhi	38	75	97
Kanpur	27	53	94
Kharagpur	21	187	780
Madras	67	83	24

Direct and Indirect Spin-offs in IITs

- Direct Spin-offs
 - Through incubation
 - Technology Transfer and licensing
 - Govt. schemes supporting research-industry linkages
 - Start ups and entrepreneurial schemes
 - Not a very significant number compared to indirect form of spin-offs
 - 94 Firms so far have been incubated and formed
- Indirect Spin-offs
 - Via brain circulation and Silicon valley connections
 - Economic boom (ICT, biotechnology and telecommunications) and exit of personnel to become entrepreneurs
 - 150 of FORTUNE 500 companies are managed by ex IITians or other Indian Professionals
 - IITs and IIMs connection

Firms owned or managed by IITians

* Other Engg. Colleges in India or Silicon Valley/USA connection

■ Sabir Bhatia	-	Hotmail (with microsoft)
■ Nandan Nilkeni	-	Infosys
■ Rajendra Pawar	-	NIIT
■ Shiv Nadar*	-	HCL
■ Ramalinga Raju	-	Satyam Computers
■ Ramadorai*	-	TCS
■ Azim Premji	-	WIPRO
■ Lakshmi Narayan	-	Cognizant Tech.
■ Gupta	-	Adobe India
■ Narendra K Patni	-	Patni Computers

CSIR Case: US Patents Granted

Year	US Patents Granted	Indian Patents Granted
1990-94	29	314
1995-98	71	532
1999-02	278	814
2003-04	212	275
2004-05	272	175

IITs and PRS labs

- TTOs and Innovation centres, IPR management
- Incubators and Entrepreneurship programmes
- Consultancy, Patent licensing etc
- PRS labs and NRDC for Technology Transfer
- Venture Capital and Technology Transfer schemes from government
- Developments in IITs and PRS labs reflect global trends in a large measure
- Let us briefly see the second development – Triple Helix and Regional Cluster Innovation Systems

Triple Helix and Regional - Cluster Innovation Systems – Indian Diversity

Region	Sectors/ Areas	Universities HEIs/PRS	Firms/Govt
Bangalore	- ICT Software - Bio-pharma - Space and Aerospace Industry	8 Universities 50 Colleges 20 PRS labs	PPP; STPs; Infrastructure, Tax incentives, high speed communication connectivity etc
Hyderabad	-ICT Software -Biotechnology and Biopharma -Pharma	9 Universities 45 Colleges 25 PRS labs	PPP –do-
Delhi (NCR, Noida and Gurgaon)	-ICT Software - Biotechnology	9 Universities 110 Colleges 18 PRS labs	PPP –do-
Chennai	-ICT Software - Telecom -- Automotive	8 Universities 55 Colleges 20 PRS	PPP –do-
Pune	-Automotive - ICT Software	7 Universities 35 Colleges 15 PRS	PPP –do-

ICT Software Technology Parks 2004 (*estimated)

Year	Cumulative Number of STP	Number of firms with STP	% of Share of STP in total exports
1990-92	7	227	8
2004	18	6000	70
2005	35	8000	70
2007*	42	9000	70

Pattern of Clustering of Top 675 ICT software Indian companies 2003

Region	No of Firms	% Share exports
Bangalore	182	21.8
Delhi NCR	182	18.5
Hyderabad	78	10.6
Chennai	92	9.1
Mumbai	142	21.8

Concluding Remarks

- Universities and HEIs are the main sources of human and intellectual capital feeding into the emerging knowledge based economy.
- Manifestation of Triple Helix in a large measure is embedded in regional - cluster innovation systems. 'new convergence' or embedding? (CIS and Triple Helix).
- As a part of global trend, entrepreneurial university model is emerging fast but in a marginal way confined to IITs, IIMs and some PRS labs.
- Relevance of Triple Helix in IITs is more meaningful in terms of spin-offs but in an indirect form.
- Entrepreneurial model is manifest in its varying forms but there are several institutional and policy constraints.

Concluding Remarks 2 – Institutional and Policy Constraints

- Universities and HEIs as public good vs market good is a big challenge in South Asia. Calls for a level playing field between the two competing domains. Mertonian ethos vs 'market models'.
- Universities and HEIs lack a uniform legislation to manage IPR and link it up with innovation. Need Institutional reforms and incentives to faculty to promote commercialisation of research. Needs policy attention.
- Basic elements of NSI are present in half dozen high tech. areas but a necessary enabling legislation or Indian version of Bayh-Dole Act is needed.
- R&D in academia is weak compared to GERD and PRS in national laboratories. This is the focus of policy in the current XIth Plan.
- Govt. schemes (half dozen which are there to forge triple helix relations) via DST/Banks/Depts but problem of co-ordination & implementation between universities, PRS and industry persists.