



# **The role of regions in supporting the emergence and growth of Global Innovation Networks: The case of Bangalore, India**

**Balaji Parthasarathy and V Ranganathan**  
International Institute of Information Technology  
Bangalore, India

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# Envisioning India's future in Bangalore

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Now Bangalore,....is unlike the other great cities of India. Most of the other cities remind one certainly of the present,....but essentially of the past. But, Bangalore,....is on a picture of India of the future, more specially because of the concentration of science, technology and industries in the public sector here.

Jawaharlal Nehru, India's first Prime Minister,  
addressing the Bangalore Municipal Corporation, 17 April 1962





**Table 1: Electronics Production in Karnataka  
(as a percentage of national production  
and rank among states)**

Year	Consumer Electronics	Industrial Electronics	Computers	Telecom	Defense Electronics	Components	FTZs	Total
1971	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.		50.36%
								1
1981	1.86%	20.82%	1.02%	45.25%	41.02%	20.87%	0.00%	20.09%
	8	2	7	1	1	3		2
1990	11.02%	20.39%	27.52%	29.15%	31.63%	17.75%	0.00%	19.13%
	4	2	1	2	1	2		1
1994	14.43%	16.25%	32.23%	24.11%	32.83%	16.17%	0.00%	18.51%
	3	2	1	2	2	3		2

**Source:** Data Bank and Information Division, Department of Electronics, Government of India.





# The future as Silicon Valley

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- More recently, Bangalore has been described as “India’s Silicon Valley”, to suggest that it is leading the country into a world of information and communication technologies (ICTs) that lie at the heart of a third industrial revolution.
- But, while science and technology, especially ICTs, persists as the leitmotif in these visions, the handmaiden to the future is no longer the public sector occupying the ‘commanding heights of the economy’; instead, it is internationally mobile capital.
- I trace the trajectory of this shift and Bangalore’s emergence from the confines of an autarkic economy to its integration into production networks and, subsequently, into innovation networks of the global informational economy.





# The technological basis for “India’s Silicon Valley”

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- Unlike the mass production of electronic hardware, software production is a relatively craft-like, labor-intensive operation relying more on trial and error to achieve its goals.
- With growing demand for software, overcoming this “software bottleneck” required the deployment of professionals in numbers unavailable in advanced industrial countries.
- This created an opportunity for countries such as India – whose ICT service revenues grew from US\$81 million in 1985 to US\$58.7 billion in 2009, of which 80% came from exports.





## The skills supply

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- India had a pool of skilled labor that was underutilized in a sluggish economy and offered a ready resource.
- The annual output of graduates with a Bachelor's degree in engineering grew from 247 at the time of independence in 1947 to 237,000 in 2006 (the US figure for 2006 was 104,200).
- To handle global projects, if familiarity with English was a necessary condition, the sufficient condition was a knowledge of Unix – the most influential operating system ever.





## **National policy changes and entering global production networks**

- The software industry was an early beneficiary of India's retreat from Nehruvian policies in the 1980s.
- Industry given liberal access to global technology to encourage entrepreneurship and exports.
- But "exports" in the 1980s meant bodyshopping, or the practice of providing low value-added services at offsite (client) locations. This was little more than resume selling and labor-arbitrage, continuing the under- utilization of professional skills.







# The shift to offshore service provision

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- In 1990, the Indian government established the Software Technology Parks (STPs). As export zones dedicated to the software industry, the STPs offer data communication facilities which firms use to offer offshore services, i.e. service provision from India, instead of having to work at customer sites.
- STP firms were also exempt from import duties on computing equipment and taxes on export earnings.
- STPs have proven popular and grown from 3 to 48 between 1990 and 2007; and the share of software exports passing through STPs increased from 8.0% in 1992-1993 to 97% in 2006-2007.







**Table 2: Software firms in Karnataka and exports  
(for firms registered with  
Software Technology Parks of India)**

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
<b>Number of firms</b>	1.521	1.721	1.885	2.001	2.085
<b>as a % of national number</b>	22,97%	22,39%	21,33%	20,59%	20,23%
<b>Exports as a % national exports</b>	37,29%	37,24%	33,77%	33,02%	33,70%
<b>Source:</b> Software Technology Parks of India, Bangalore (at: <a href="http://www.soft.net/perfanalysis.htm">http://www.soft.net/perfanalysis.htm</a> ) and Software Technology Parks of India (at: <a href="http://www.stpi.in/">http://www.stpi.in/</a> )					





# The regional innovation system - local labor market and skills

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- Besides being the first location of the STP, at the 348 hectare Electronics City, the skilled labor in the public sector also made Bangalore attractive for domestic firms and MNCs.
- Existing labor pool in Bangalore replenished from the adjoining states of Tamil Nadu, Andhra Pradesh, Maharashtra, which, with Karnataka, produce  $\sim 2/3^{\text{rd}}$  of the nation's engineering graduates.
- In 2001, after the dotcom bust, an estimated 35,000 Indian engineers returned from the US, where Indians have been the largest beneficiaries of the H1B (and, later, L1 too) visas. Most of them returned to Bangalore.





## Regional policies

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- Karnataka the first Indian state to have an Information Technology Policy (1997) and a Semiconductor Policy (2010) to promote the industry in various ways.
- A key element was the establishment of IIIT-B, in partnership with industry, as a graduate teaching and research school in information technology.
- A 28 hectare Information Technology Park (ITPL) established in 1998 partnership with Ascendas of Singapore, to provide infrastructure inside a new Export Promotion Park, to attract investments.

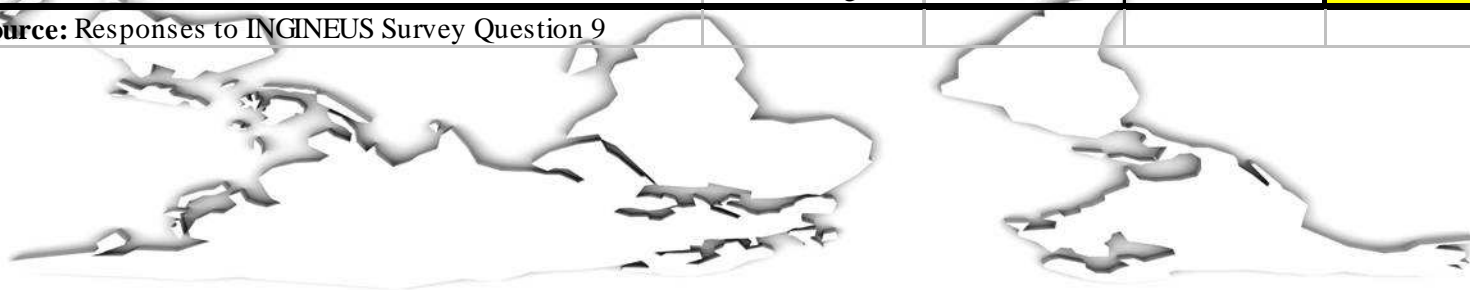




## Table 3: Regional factors motivating offshoring of production/innovation

Factors	Regions	Number of firms undertaking		As a % of firms that offshored	
		Production	Innovation	Production	Innovation
Availability of qualified, low cost, human capital	Bangalore	17	11	77,3	50,0
	All other regions	92	79	60,9	52,3
Access to knowledge infrastructure and services (R&D infrastructure, technical support services etc.)	Bangalore	13	19	59,1	86,4
	All other regions	89	83	58,9	55,0
Access to other inexpensive infrastructure, production resources and services (land, unskilled labour, ICTs, electricity, roads, airports, ports etc.)	Bangalore	18	14	81,8	63,6
	All other regions	77	69	51,0	45,7
Opportunity to sell existing products and achieve greater access into new markets	Bangalore	16	16	72,7	72,7
	All other regions	79	69	52,3	45,7
Regional incentives (e.g. favourable regulations, special tax regimes, testing facilities etc.)	Bangalore	16	10	72,7	45,5
	All other regions	70	59	46,4	39,1
Following clients who are outsourcing i.e. 'follow sourcing'	Bangalore	16	14	72,7	63,6
	All other regions	81	69	53,6	45,7

Source: Responses to INGENEUS Survey Question 9





## **Becoming a part of GINs (1): ODCs and organizational innovation**

- In the 1990s, firms pioneered a Global Offshore Delivery Model from offshore development centers (ODCs) established in STPs. ODCs replicated the infrastructure and technologies of the customer workplace, and brought professionals under one roof.
- Firms also adopted industry-wide certification norms, such as the Software Engineering Institute's five-level Capability Maturity Model (SEI-CMM), to codify quality procedures. By June 2002, there were more SEI-CMM certified firms in India than in the rest of the world.
- This, in turn, allowed firms to win turnkey contracts, forcing them to develop the management skills to take responsibility for the overall project schedule, quality and productivity.





## **Becoming a part of GINs (2): Research and Development services (a)**

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- Central to the growth of R&D service provision from India is embedded systems design, with the vertical disintegration of the global semiconductor industry.
- The Indian embedded systems industry is centered on Bangalore. Thus, the India Semiconductor Association (ISA), which was formed in 2004 to meet the specific needs of the emerging sub-sector, is Bangalore-based.
- The ISA is distinct from the New Delhi-based NASSCOM, which caters to a broader defined software and services industry.





## Becoming a part of GINs (2): Research and Development services (b)

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- Texas Instruments (TI), a maker of digital signal processors, was the earliest ICT MNC to come to Bangalore in 1984. It drew on the skills in the public sector and has since designed many DSPs and obtained numerous patents.
- While TI retains DSP development, it has many independent DSP partners globally from whom it seeks design services and IP. In 2004, 31 of its ~600 global partners were Bangalore-based.
- Bangalore partner, Ittiam Systems, a local entrepreneurial initiative, was named the most preferred *global* supplier of DSP-based IP by the international DSP Professionals Survey of 2004.







## Becoming a part of GINs (3): Local market driven innovation (a)

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- After years of focusing on export markets, firms have taken another approach to innovation – based on interactions with local users who are typically poor and illiterate.
- India is a unique location from which to address the “bottom of the pyramid” market, thanks to infrastructural inadequacies, and the scale and socio-cultural diversity of its poor.
- The availability of the technical skills to generate a range of product and service applications for the BoP market in India led firms such as HP, Microsoft, Motorola and Siemens to establish research centers in Bangalore.





## Becoming a part of GINs (3): Local market driven innovation (b)

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- HP set up an “i-community” between 2002-06 in Kuppam as a “learning lab” to influence its innovation process since its products, such as scanners and printers, are currently unaffordable to most Indians.
- Beyond serving an untapped market, a segment of innovation and product development for the BoP market is exportable, and has opened up new markets even in the affluent world.
- Examples include an affordable, yet diagnostically precise, X-ray system developed by GE; ATMs that use a thumbprint recognition system originally intended by Citibank for illiterate, slum-dwellers; low cost cell phones, with longer battery life, developed by Motorola.





**Table 4: Innovation collaboration in the past 3 years  
(by percentage of firms)**

	<b>Your Region</b>		<b>India</b>		<b>North America</b>	
	Bangalore	Other regions	Bangalore	Other regions	Bangalore	Other regions
<b>Clients</b>	55.1	33.1	34.7	37.8	34.7	38.9
<b>Suppliers</b>	59.2	23.3	34.7	28.0	18.4	24.0
<b>Competitors</b>	59.2	17.1	36.7	35.3	22.4	23.6
<b>Consultants</b>	51.0	15.3	44.9	29.8	20.4	21.5
<b>Government</b>	46.9	14.9	34.7	33.5	6.1	8.7
<b>Local universities</b>	53.1	13.8	40.8	26.5	0.0	0.4
<b>Foreign universities</b>	0.0	0.4	0.0	1.5	24.5	10.2
<b>Other</b>	0.0	0.7	2.0	1.5	0.0	0.0

**Note:** Number of firms surveyed in Bangalore = 49; in other regions = 275





## Conclusions (1)

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- Bangalore has long been envisioned as India's future, and ICTs have played a dominant role in that imagination. But the public sector, which was once seen as the vehicle to realize the vision, has given way to the internationally mobile capital.
- A combination of demand conditions, technological change, the availability of skilled labor, and policies at the national and provincial levels inserted the ICT industry in Bangalore into global production networks.





## Conclusions (2)

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- The insertion into GPNs provided the basis for learning, and led to organizational innovation in the 1990s in the form of ODCs.
- The growth of high value R&D services since 2000 reflects an increasingly dense institutional structure in Bangalore to support innovation.
- The ongoing innovation that pays attention to the markets offered by the poor also capitalizes on this institutional structure. Simultaneously, the importance of proximity to these new markets, means that Bangalore's is increasingly occupying its own niche in the GINs of the ICT industry.





# Thanks for your attention/questions

**Balaji Parthasarathy**

International Institute of Information Technology  
Bangalore, India  
pbalaji@iiitb.ac.in

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