

Trends in the ICT industry and ICT R&D in India

ASIAN RISE IN ICT R&D – Looking for evidence
Debating collaboration strategies, threats and opportunities
IPTS, Seville, Spain, European Commission

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Agenda

- **The ICT Industry**
- **ICT R&D**
- **Conclusions**

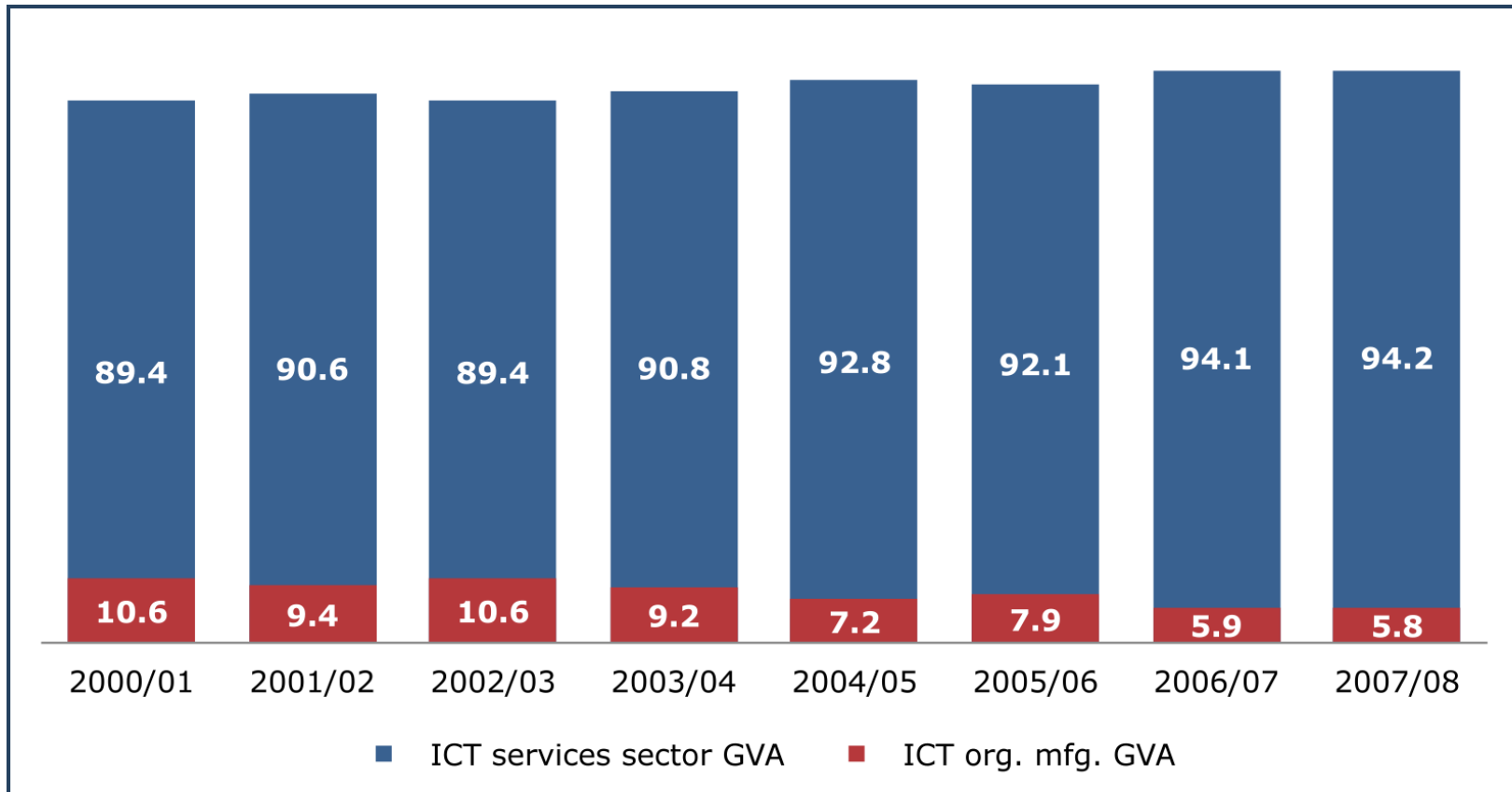
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ICT Sector Trends

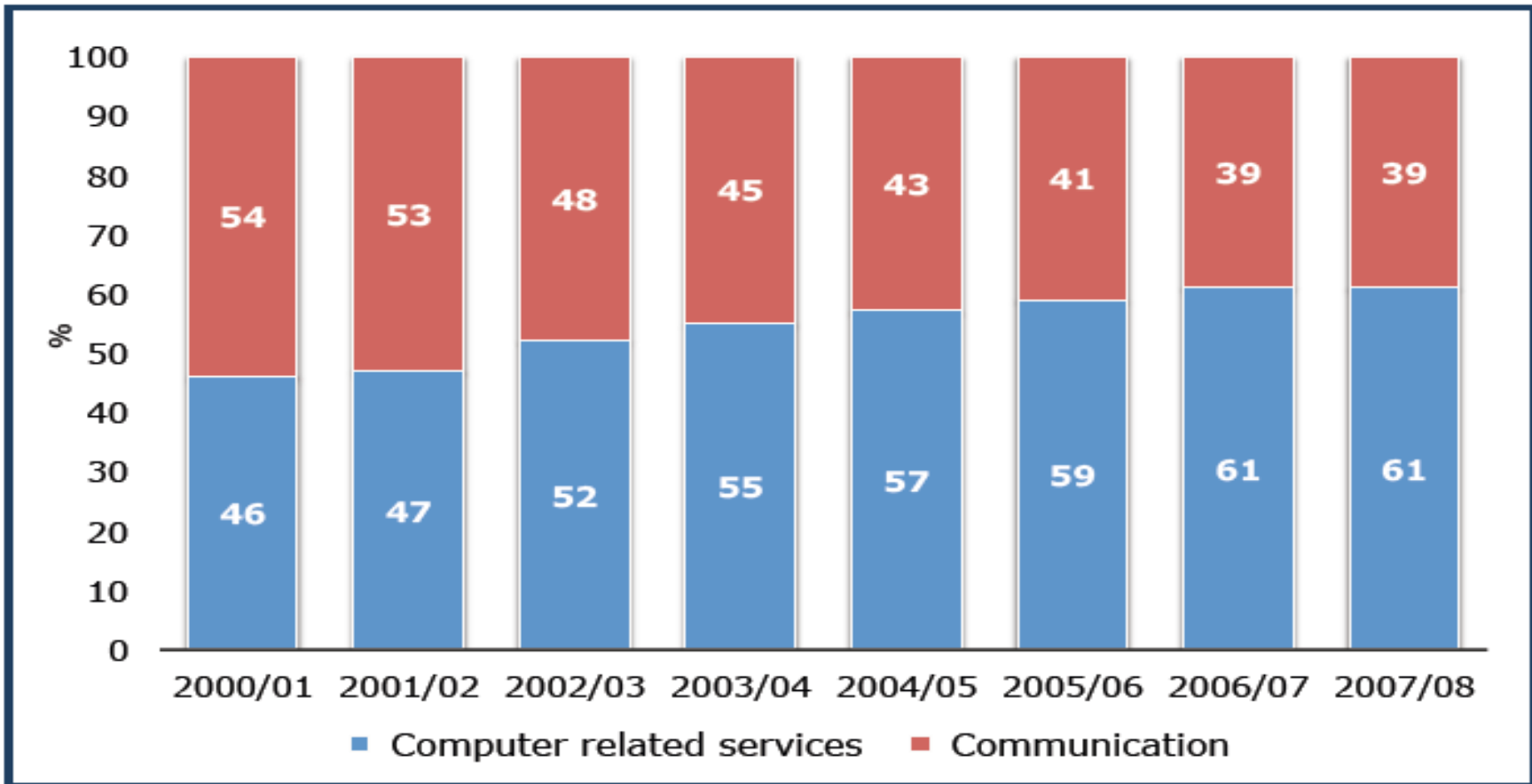
- ICT sector GDP increased from Euro 15.8 billion in 2000-01 Euro 45.18 billion in 2007-08 with CAGR of 21.3%
- Contribution of the ICT sector to GDP increased from 3.4% to 5.9%
- Share of ICT manufacturing sector to GDP remains more or less constant with about 0.35%
- Share of ICT services sector to total GDP increased from 3.05% to 5.52% (Euro 14.15 billion to Euro 41.8 billion)
- Annual growth rate of ICT services between 23% and 26%
- IT services exports increased from Euro 5.93 billion (2003-04) to Euro 20.20 billion (2008-09)
- Contribution of exports in total ICT sector has increased from 64.5% in 2004-05 to 66.1% in 2008-09

Share of ICT Services to ICT GVA (%)



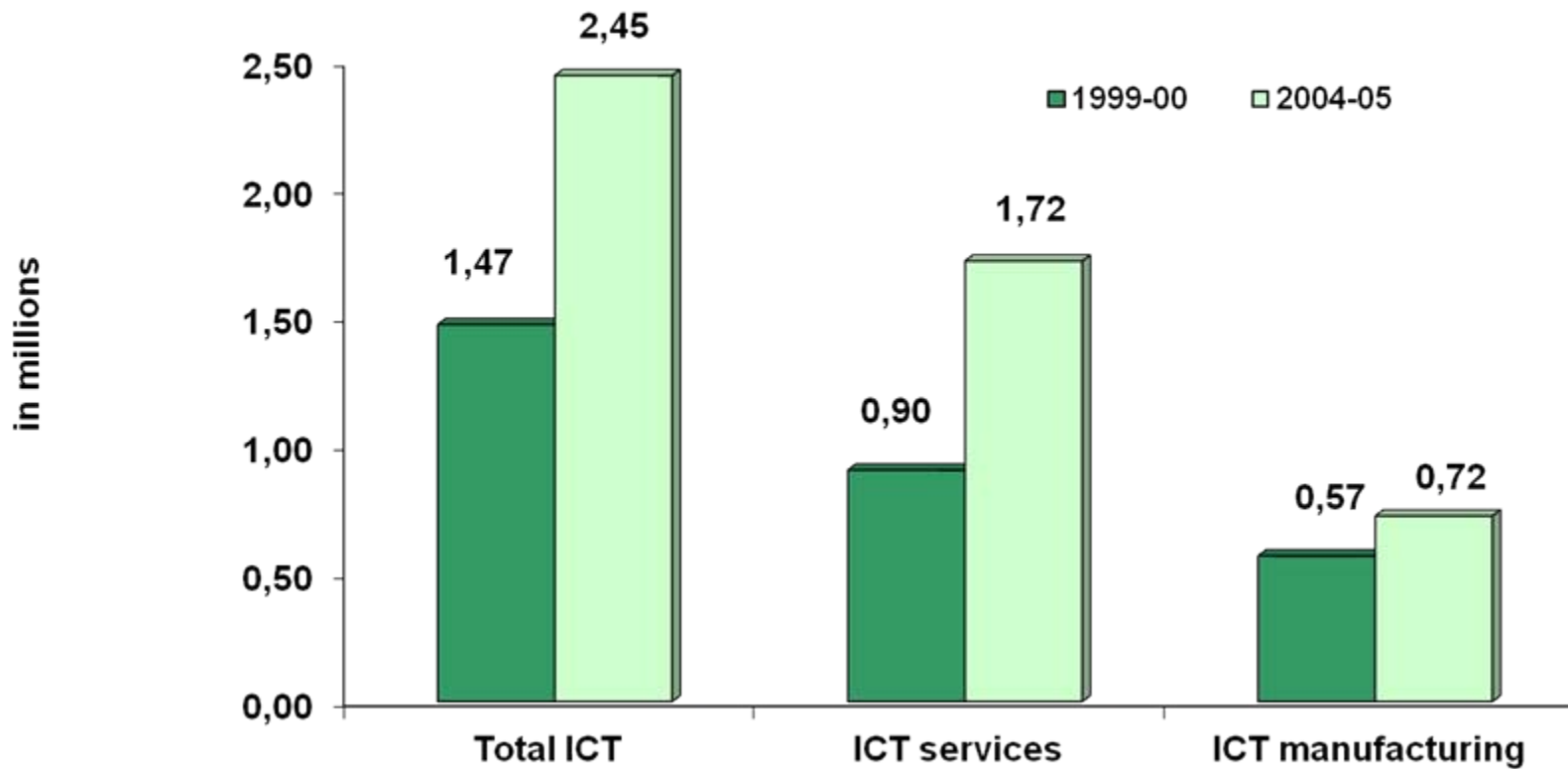
Source: Annual Survey of Industries (ASI) and National Accounts Statistics (NAS), MOSPI, Government of India

Decomposition of the ICT Services sector

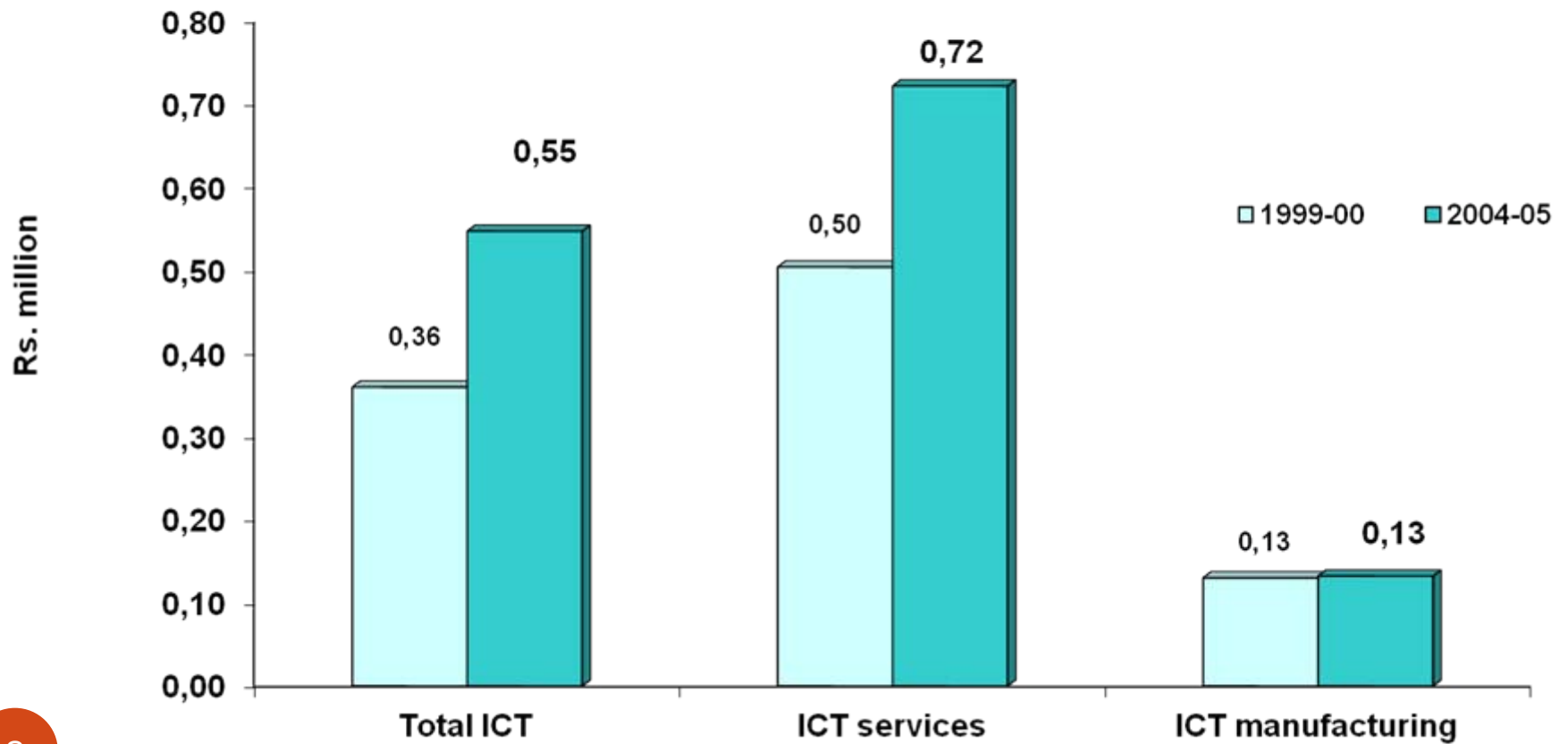


Source: National Accounts Statistics (NAS)

ICT Sector Employment

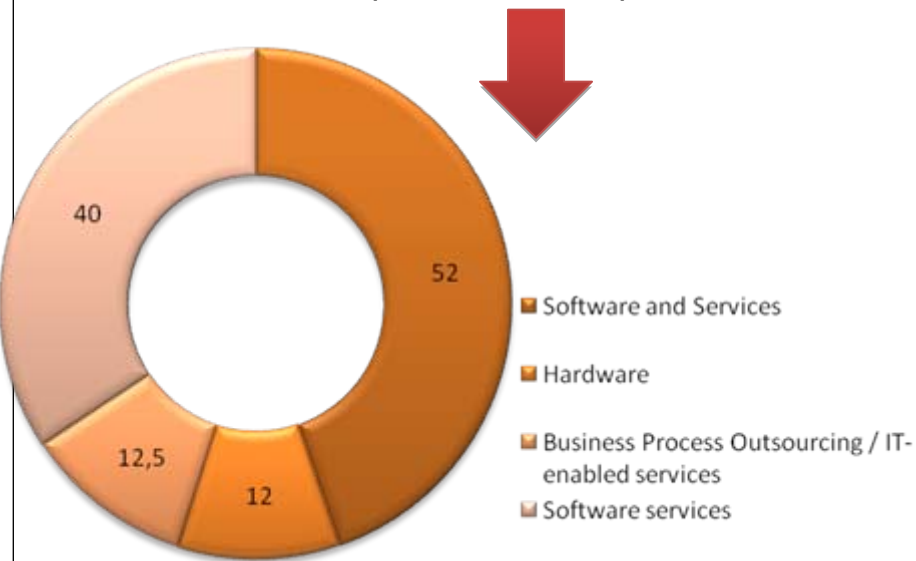


ICT Sector Productivity

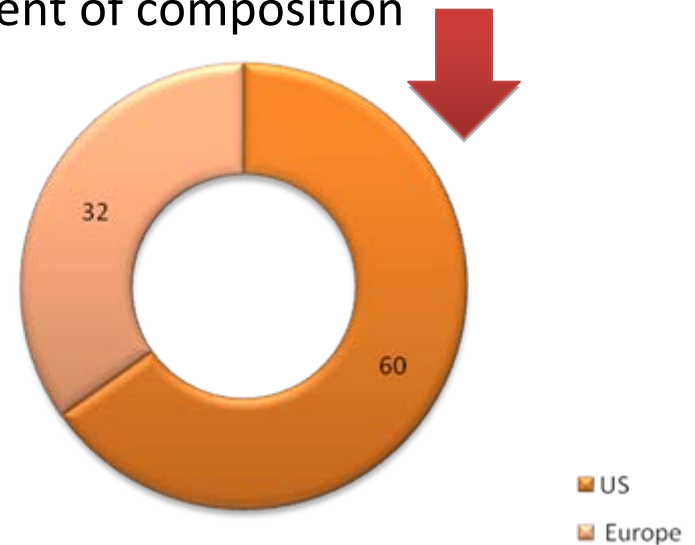


Indian ICT Industry Structure (2007-08)

Revenue (USD billion)



Major export destinations in percent of composition

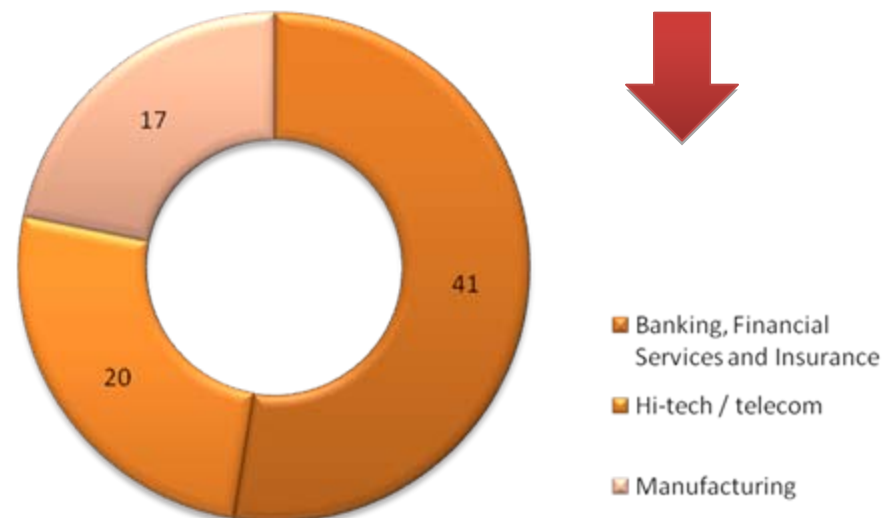


Share of top six Indian ICT geographical regions



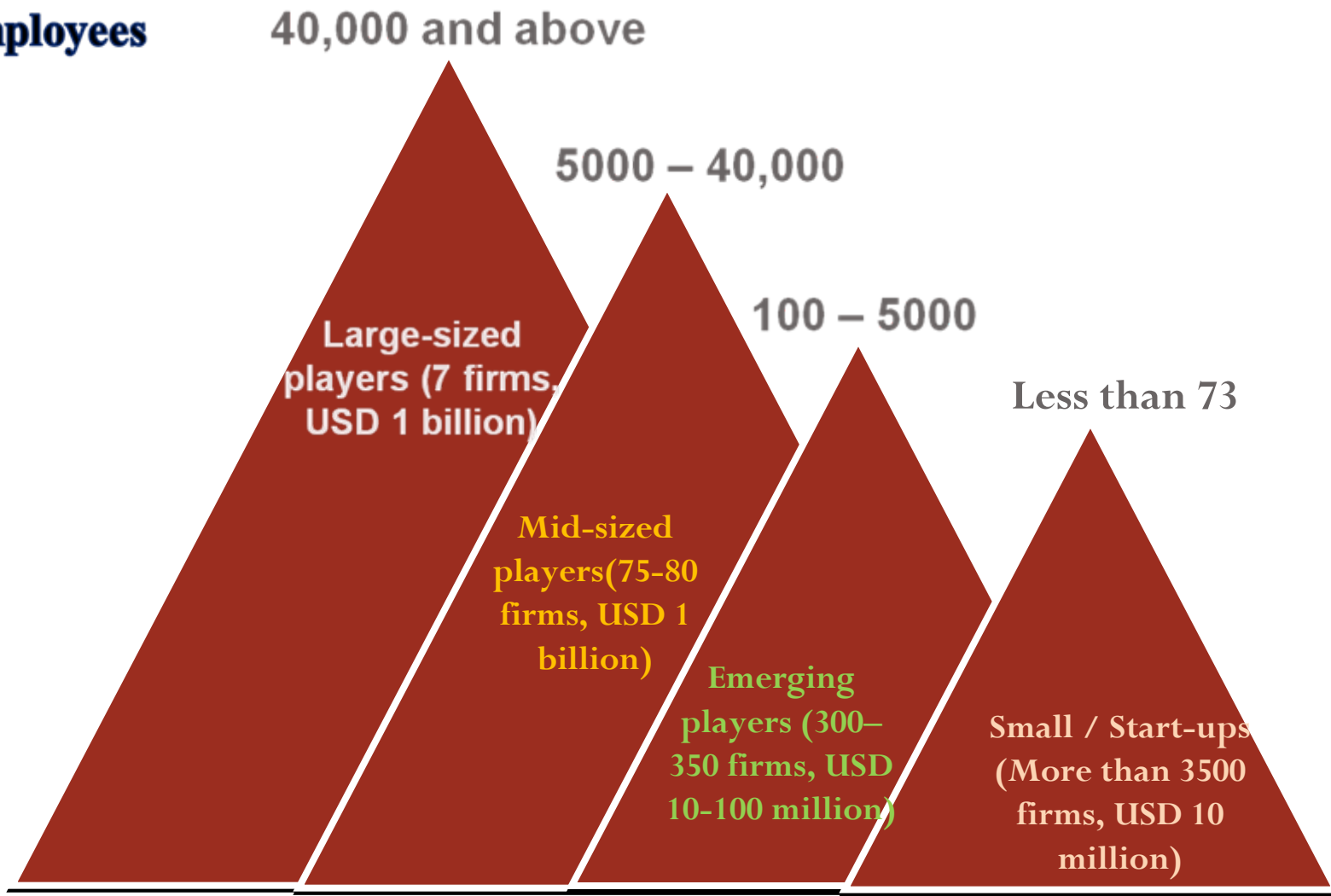
97%

Composition of industry verticals in exports



Structure of Indian IT-BPO Industry

Employees



ICT firms and their revenue

Top 200 firms contribute 86% of the total revenues of the Indian ICT industry

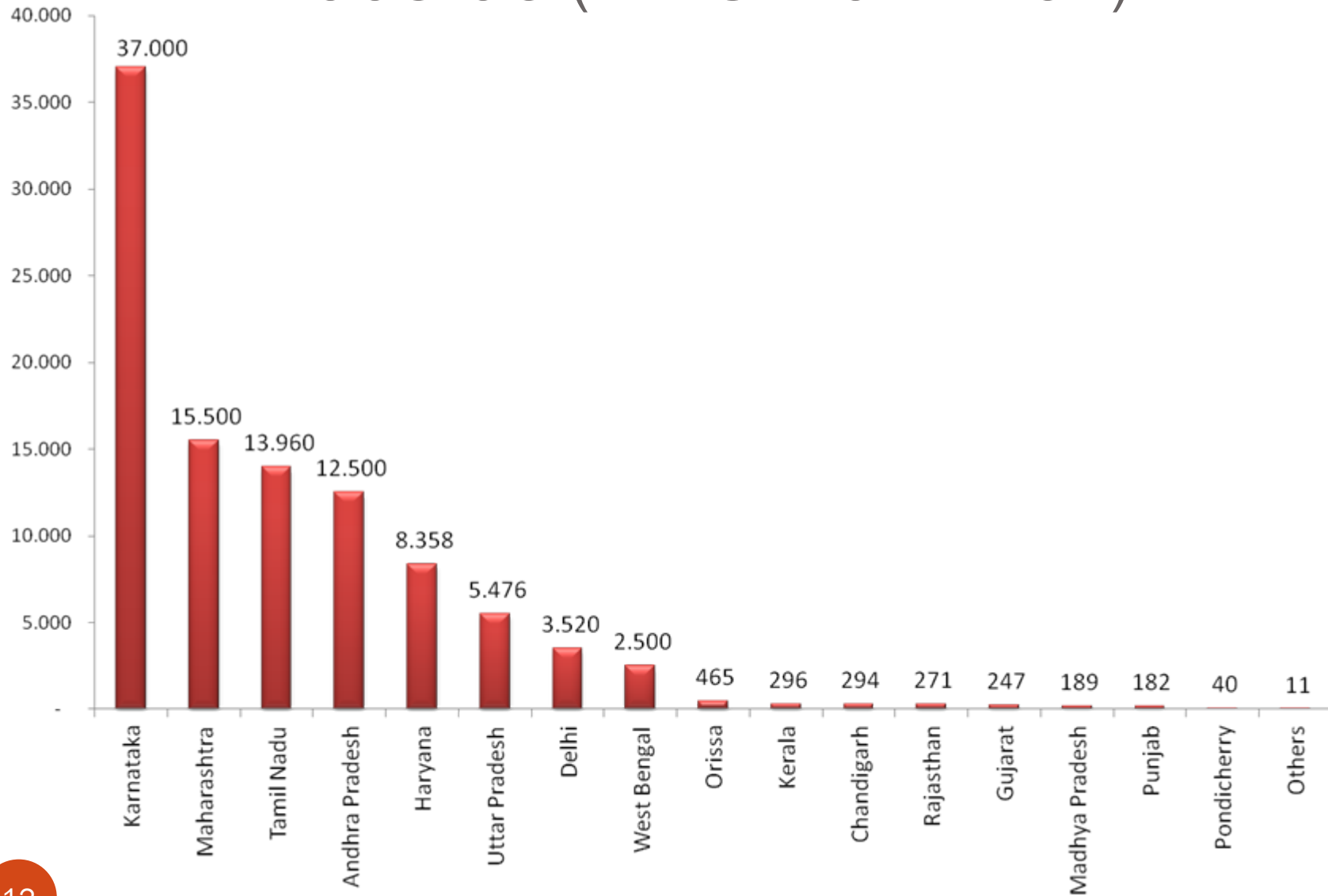
Multinational firms dominate industry revenues with 12 firms listed among the top 20 firms and around 67% in the top 200 firms

Top 20 firms contribute about 63%

Next 30 firms contribute about 17%

Next 150 contribute about 20%

Software Exports from Indian States – 2005-06 (in Rs. 10 million)



Innovation Clusters in India

R&D/Innovation Clusters

Major MNCs



Bangalore



Texas Instruments, Oracle, Sun, Microsystems, IBM, SAP Labs India, Philips Innovation Campus, HP Labs, Cisco, Intel, GE, GM, Motorola, etc.

National Capital Region (NCR)



Adobe, AVL, Ericsson, ST Microelectronics, Honda, IBM, etc.

Pune



Microsoft, Oracle, Siemens, Tata Motors, Whirlpool, etc.

Hyderabad



Microsoft, Nokia, Motor Graphics, Motorola, DuPont, AMD, etc.

Mumbai



Bayer AG, Clariant, Reliance, Johnson & Johnson, Pfizer, etc.

Top 20 firms in terms of revenue

Company	Employees	Revenue (million Rs.)	
		2007– 08	Export Domestic
Tata Consultancy Services (TCS)	126,150	212,150	93 7
Wipro Technologies	108,071	168,840	76 24
Infosys Technologies	104,850	155,310	99 1
HP India	31,656	154,540	18 82
IBM	76,000	101,010	58 42
Cognizant Technology Solutions	48,000	63,100	100
Ingram Micro	1,200	86,200	100
HCL Technologies	51,979	62,000	93 7
HCL Infosystems	6,077	50,580	100
Redington India	1,700	62,800	100
Cisco India	4,850	58,370	92 8
Oracle India	24, 000	58,080	
Intel India	2,500	43,100	90 10
Accenture	40,000	38,000	93 7
SAP India	5,424	32,600	79 21
Dell India	13,000	32,000	100
Tech Mahindra	24,318	36,370	98 2
Microsoft India	5,300	32,630	90 10
MphasiS	33,810	18,810	100
Patni Computer Systems	14,479	25,690	99 1

Evolution of the Indian ICT Sector in the Past 20 Years

Approximately in three phases:

- Till 1984 – state attempted to run the industry no distinction between Hardware and Software
- 1984 to 1990 – Potential of software was recognized
- Policy exigencies resulted in “Born Global” firms
- Post 1990 - software export industry blossomed
- Hardware and domestic industry relegated
- Higher revenue contribution from onsite services suggests that it is composed of low-end activities like maintenance and testing of existing client software rather than high-end software services driven by intellectual property blocks and patents
- Scenario is changing from providing low-end onsite services to high-end offshore services
- Increased investments in semiconductor manufacturing

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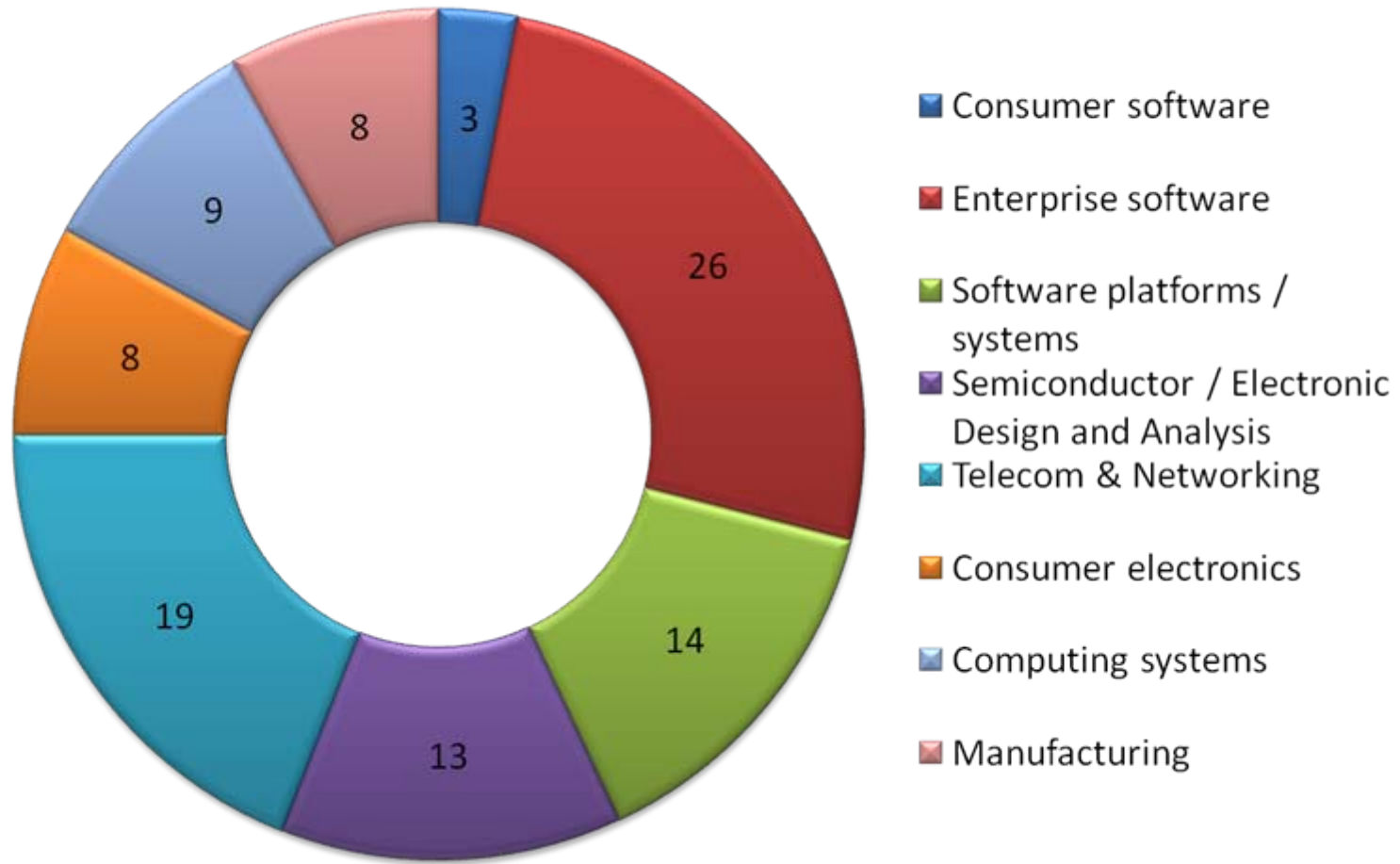
ICT R&D Firm Profile

- Two sets of players in India who perform ICT R&D activities:
 - ✓ large domestic players and subsidiaries of multinationals
- Large domestic players undertake two kinds of innovative activities: internal and external
- Internal activities help in service delivery process improvement and are consumed by the firms themselves
- Only 12 or 4.3% of all listed software firms in India had lab or R&D equipment expense

ICT R&D Firm Profile

- Activities performed for external clients who outsource their product development activities
- ‘Engineering services and R&D and software products’ and is listed as high-end work
- USD 8.6 billion in 2008 and constituted around 13 percent of total industry revenues in 2008
- 74 percent engineering services and R&D and software products is exported
- However, the revenue generated from software products or licensing of software intellectual property blocks by firms in India is small,
 - with only USD 1.1 billion of the total revenues of the industry and USD 64 billion in 2008 (NASSCOM, 2009)

Structure of industry verticals of ICT R&D centres



Indian ICT Sector Patent Data

- Only four US software patents awarded to Indian firms compared 118 patents awarded to US and other foreign firms operating in India (Nollen, 2004)
- On traditional measures like patents or copyrights, most of the innovation in India is done by multinationals in comparison to Indian firms
- Share of ICT-related patents filed under the Patent Cooperation Treaty (PCT) in 2004 was 0.3 percent
- High level of foreign co-inventors, suggesting both its relative openness in research activities and its dependence on foreign partners

ICT R&D: Internationalisation

- Most multinational firms come to India to use the low-cost high-skilled labour and continue working on activities delegated by their headquarters
- Over time, the India centre gains confidence and starts undertaking high-skilled work from the parent firms
- Archibugi and Pietrobelli (2003) framework:
 - ✓ Centre for Global (50%)- base for executing designs made in the home country
 - ✓ Local-for-global (46%)- centres work on “mainstream research” by the parent firms
 - ✓ Local-for-local (4%) use local talent to come up with products for the local market

ICT R&D: Internationalisation

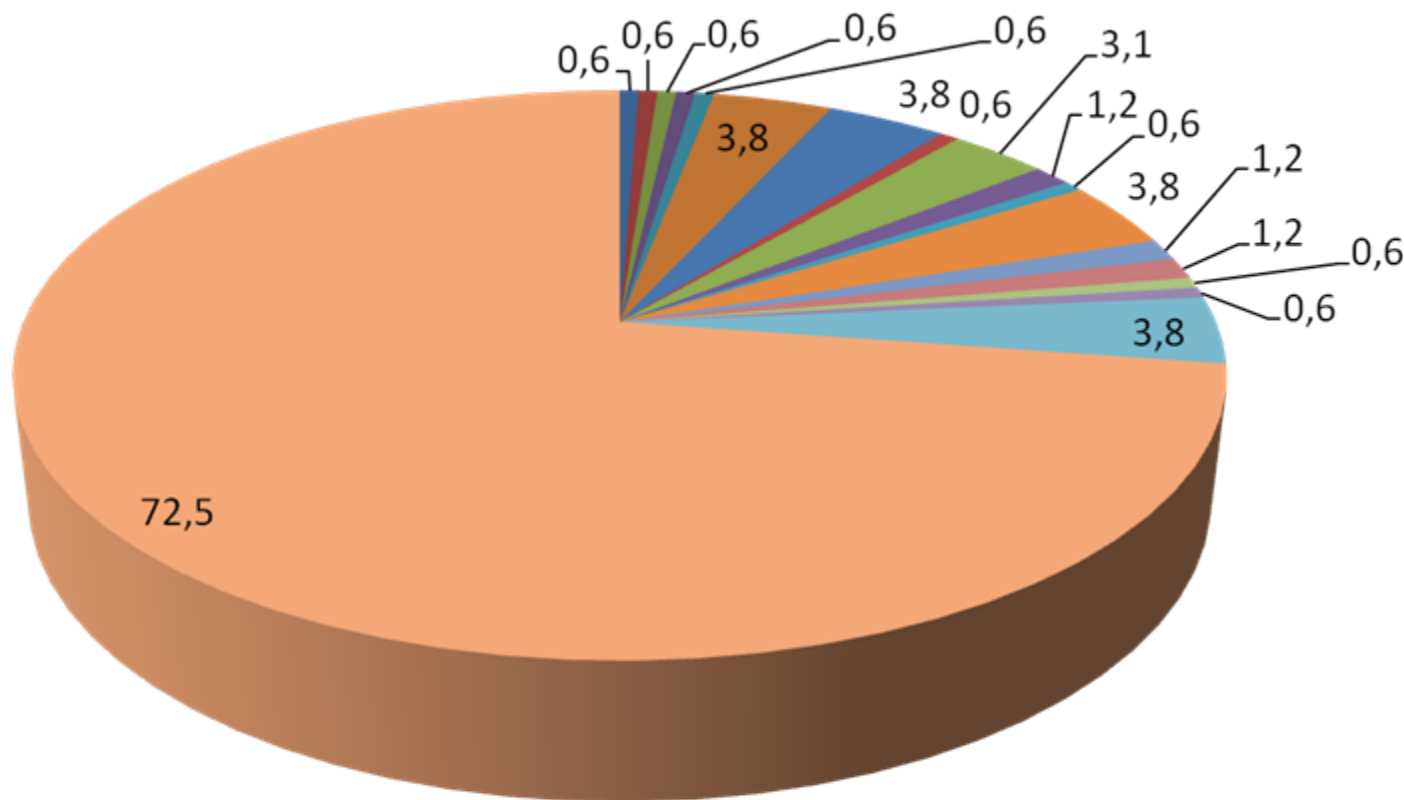
◆ Center-for-globals

- ✓ Operate on the labour cost arbitrage model
- ✓ Control of the project activities still lie with the parent firms

◆ Local-for-globals

- ✓ Indian centre an equal partner
 - ✓ Share responsibility for product development activities
 - ✓ National technological capabilities are enhanced multi-fold
 - ✓ Disseminates the MNE's expertise locally
 - ✓ As the number of local-for-global centres increases, opportunities to serve the global market in the product segment open for the Indian workforce through domestic partners
 - India centre responsible for a certain number of patents filed
 - Patents are not filed in the name of the India centre
 - MNEs file the patents in their parent countries without crediting any of the host countries
- ## ◆ Indian firms are expanding their global reach and technology domains in service through acquisitions

Country Location of Headquarters of ICT R&D Centres in India



- Austria
- Brazil
- Canada
- China
- Finland
- France
- Germany
- Israel
- Japan
- Netherlands
- Singapore
- South Korea
- Sweden
- Switzerland
- Taiwan
- Turkey
- UK
- USA

Core Skills in ICT R&D

- Core competence of the services lay in managing the service process delivery and sustaining it in innovative ways
- Data relating to acquisition of R&D and other external knowledge is not available
- Activities like intramural research and experimental development (internal R&D); training; market introduction of innovations; and design, other preparations for production/deliveries mostly internal operations of the firms

Innovation in the Indian ICT Sector

- Transition from onsite to off-shore
- Productised services
- Human capital capacity building
- An edge in Semiconductor Design, embedded systems and has the potential of becoming an engineering design house for the world
- Adequate capabilities to perform high skilled innovative work
- Perform high end work that result in end products for their customers but without ownership
- Capabilities can be canalized for creating global products
- Transition is highly dependent on ability to market in the global markets or getting a right partner to sell in the global markets
- Less risk taking behavior or happy-with-service- revenues attitude can be a constraint
- Innovation in hardware domain is skewed towards embedded software, especially in the telecom domain

Innovation in the Indian ICT Sector

- Impressive with a broad-based network of government-supported research and development laboratories with multi-disciplinary expertise
- Large education capacity with world-class engineering/teaching institutes, a dynamic private sector with a significant number of MNCs and R&D units
- Efforts to nurture technology entrepreneurship by the government (CoEs)
- Increasing foreign investment in R&D
- Domestic players faced global competition from MNCs on their home turf and the need to invest in R&D was tremendous

Innovation in the Indian ICT Sector

- A number of limitations
 - ✓ Lack of dynamism in the government R&D system
 - ✓ Poor research output from the higher education system
 - ✓ Limited scope and impact of government support programmes for R&D
 - ✓ Science-technology divide
 - ✓ Inadequate spillovers of foreign direct investment in R&D

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What plagues ICT R&D?

- From the R&D point of view, IT industry “applied”, “service-oriented”, or “incremental” in its innovation
- ◆ *“There’s a big difference between discovering something, versus discovering something that you know somebody else says can be done. That difference is the difference between the service business and the products business (Vivek Paul, ex- CEO Wipro)*
- ◆ Captive design centres of multinationals or third party service providers
- ◆ Fruits of value addition going to countries, which have state of the art and large scale manufacturing facilities
- ◆ **Chinese threat? India has filed 766 patents for the year of 2008 vs. China 6089**

Final Observations

- India spends much less on R&D
- Fewer scientists per million of population
- Produces fewer patents in relation to the size of its economy than other countries
- Cannot have the same capabilities for innovation as those that spend more on R&D, have more scientists, and produce more patents
- Conclusions arise from the paradigm of 'innovation equals science and technology'
- Misleading view of India's innovation potential (GoI)
- Many useful innovations that transform the lives of people arise outside the scientific and industrial establishments where expenditure on 'R&D' is measurable
- India needs more 'frugal innovation' that produces more 'frugal cost' products and services that are affordable by people at low levels of incomes
- ◆ But is all this sufficient to shift the production possibility frontier that results in an economic transformation?

Thank you
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