





	2001	2002	2003	2004	2005	2006
R&D经费支出 (亿元) GERD (100 million yuan)	1042.5	1287.6	1539.6	1966.3	2450.0	3003.1
R&D经费支出/国内生产总值 (%) GERD/GDP (%)	0.95	1.07	1.13	1.23	1.33	1.42

**2007: GERD - 3710; GERD(%) - 1.49%:
-- average growth since 1991: 22.6%**

	2001	2002	2003	2004	2005	2006
科技活动人员总量 (万人) S&T personnel (10,000 persons)	314.1	322.2	328.4	348.1	381.5	413.2
全国 R&D 人员 (万人年) R&D personnel (10,000 person-years)	95.7	103.5	109.5	115.3	136.5	150.2
# 科学家工程师 Scientists and engineers	74.3	81.1	86.2	92.6	111.9	122.4

Bird's eye view of China's innovation system

Marin T. Tintchev

- China's understanding
- Evolution of China's innovation system
- Structure, key players and roles
- Universities and entrepreneurs - leading the innovation environment
- Concluding notes

The Chinese agenda ...

China will embark on a new path of innovation with Chinese characteristics, the core of which is to adhere to innovation, seek leapfrog development in key areas, make breakthroughs in key technologies and common technologies to meet urgent requirements in realizing sustained and coordinated economic and social development and make arrangements for frontier technologies and basic research with a long-term perspective.

Hu Jintao, 2006

Understanding and policies based on well structured theoretical base

- Historical roots
 - Friedrich List (1841): A critical response to Adam Smith
 - National innovation system
 - Freeman (1983 & 1987)
 - Lundvall (1985)
 - Lundvall, Nelson and Freeman (1988)
- Deep roots in OECD research*
- Sectoral innovation system
 - Franco Malerba

The focus differentiates within central and local governments, and the academic community

- US approach focus on

- Institutions promoting S&T

-- *Central government comfortable following the S&T approach*

- European (Aalborg) approach focus on

- National production system
- Theory of international trade
- Innovation as interactive process
- Role of institutions

-- *Representatives of the academic community promoting the development of high-tech and low-tech innovation systems*

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From the infant stage to centrally planned development

- R&D establishments originate in the 1920s
- Since 1950s - process of institutionalization of modern science and technology
- R&D system designed in accordance with centrally planned economy
 - Huge size - reflection of the Marxist idea of science as a societal force of production and also a result of the self-reliance development strategy
- Reform of the R&D system initiated in 1985
 - Focus on re-shaping the division of labor and the interaction between producers and users of knowledge and innovation.

-- Organizational separation between innovation and production

1985 reform – transformation from *soviet style* to a more modern innovation environment

- Reforms in Science and Technology System Management
 - Rearranging the relationship between knowledge producers and users and their relationships with the government

The management [S&T] system as practiced until now has actually clogged this direct linkage, so that research institutes were only responsible to the leading departments above, in a vertical relationship, with no channels for interaction with the society as a whole or for providing consultancy services to production units. This is the root cause of the inability of our scientific research to meet our production needs over the years....

Zhao Ziyang, 1985

Adaptive policies process

- Establishment of *technology markets*
 - functioning as distributive institutions for R&D outputs
- Excellence-based allocation mechanisms
 - allocation of public R&D funds
- Degree of autonomy
 - Hiring personnel, contractual projects, acceptance and use of contractual fees

-- *It was believed that push and pull approach will force previously publicly funded R&D institutes to move serving clients via regular and multiple linkages*

Mergers and the introduction of S&T programs

- 1987 reform
 - Merger of R&D institutes into existing enterprises or enterprise groups
- 1988 Torch program
 - Encouraging universities and R&D institutes to spin-off enterprises - called NTEs (New Technology Enterprises)
- Local governments role
 - Investment in infrastructure and supporting institutions
 - High-tech Industry zones – incubation bases for the NTE-startups
- Institutions support
 - Encouraging scientists and engineers to go into commercial application of their inventions and expertise
- Early 1990s
 - Transforming individual R&D institutes into production entities

-- Nearly closed to international exchange in technology and knowledge, China becomes a widely open innovation system, with enormous inflows of technology in forms of international capital goods and FDI.

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China's innovation system - growing world power

R&D Expenditures ~\$ 30 billion
~ 1.5% of GDP
~20% annual growth since 2000

- ~400 of Fortune 500 companies have established some R&D presence in China
- According to the Ministry of Commerce, by 2006, there were ~800 foreign-funded R&D centers
- SMEs from US and Europe also beginning to outsource R&D work to China

“...If these trends continue in the coming years, China will catch up with the EU-25 in 2010! It could even happen earlier, since the growth rate of EU's R&D intensity has been declining since 2000 and, since 2002, has been very close to zero...”

*Janez Potočnik, EU
Commissioner*

Brussels, 19 July 2005

Impressive trend since 2000

- Scientific Publications

- National Journals: 310'000 (2004)
- SCI, IE & ISTP: 153'000 (2005)

-- *China has become the world's 5th most prolific contributor to scientific journals*

- Patents: 268'000 (~25%)
 - Domestic applicants: 223'860 (~30.4%)
 - Foreign applicants: 44'142 (~4.1%)

- National State Key Labs: 181

- Incubators: ~500

- Staff

- R&D: ~1.4 million (~14%)
- Scientists: ~1.1 million (~12%)

- Universities: 1'794
 - Including 108 National Key Universities
 - Hosting 42 S&T Parks

- Public Research Institutes: 3'979 (2004)
 - Central government: 685
 - Local government: 3'294

- State High-tech Zones: 53
 - Hosting ~45,000 high-tech companies with \$425 billion in revenues (23% annual growth) and over \$100 billions in exports (26% annual growth)

Sector focus

- ICT – info communication technologies
- Chemistry & bio-chemistry
- Materials & nanotechnologies
- Transportation technologies
- Agriculture
- Life-science & pharmaceuticals
- Environmental protection
- Energy conservation and new energy sources
- Advanced manufacturing

China's innovation system - well rounded triple helix

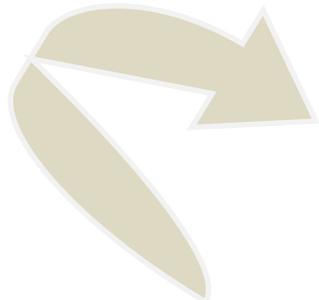
Universities

- University Labs
- Public Research Institutes

Governments

- Policies
- Programs & Funds
- Eco-system Infrastructure
- Infant Industries Protection

PE & VC investors



National Key Labs

National Key Universities

Incubators

S&T Parks

Overseas & foreign owned R&D centers

Geographical Knowledge Networks

Industrial Networks

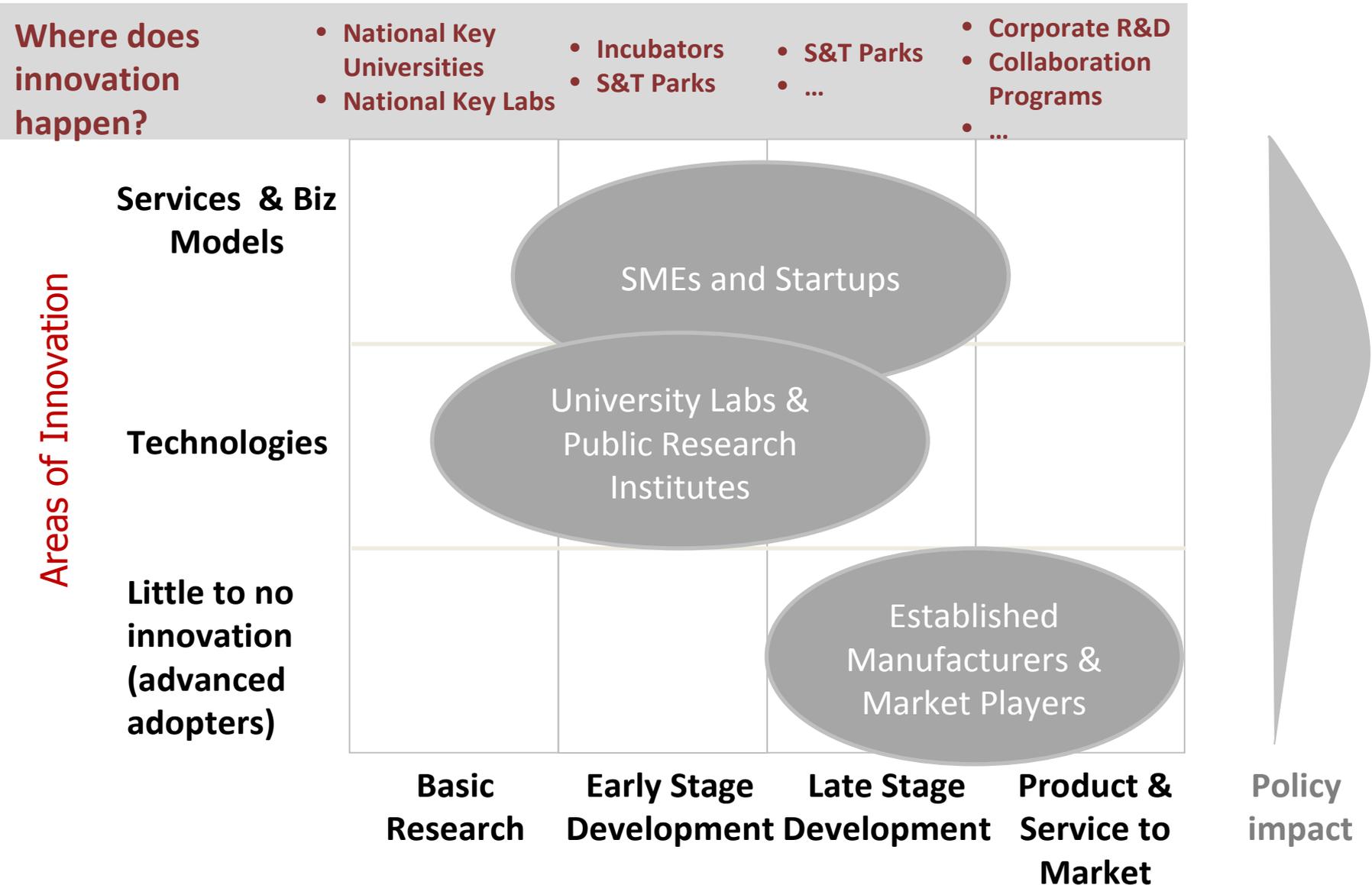
Int'l Academic Networks

Industry

- Established Enterprises
- Corporate R&D
- Start-ups & SMEs
- Investors

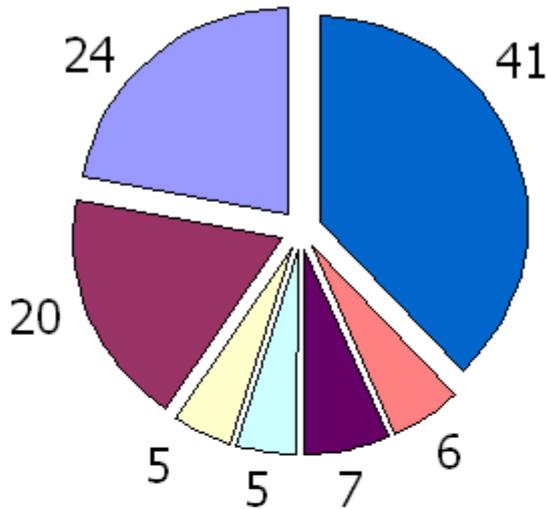
- Central Government push for S&T oriented innovation system
- Entrepreneurs/Start-ups – a critical element of the system
- Foreign-local collaboration still unbalanced

Who innovates and where

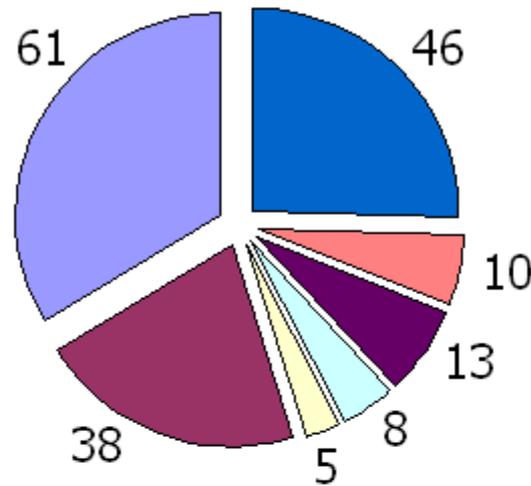


Geographical distribution of patents does not reflect regional innovation and technological capabilities

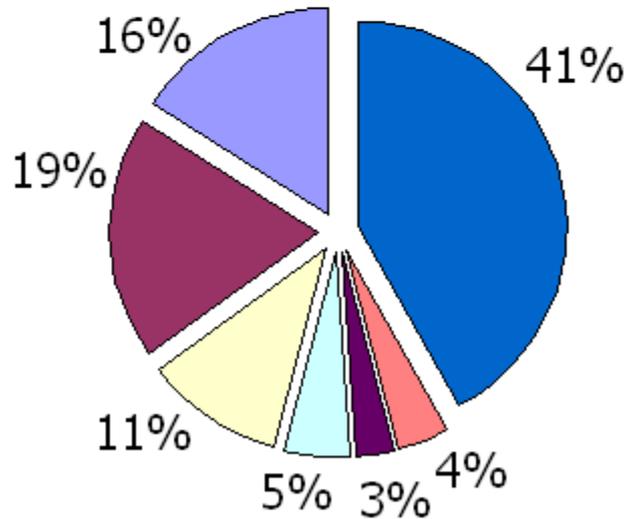
National Key Universities (108)



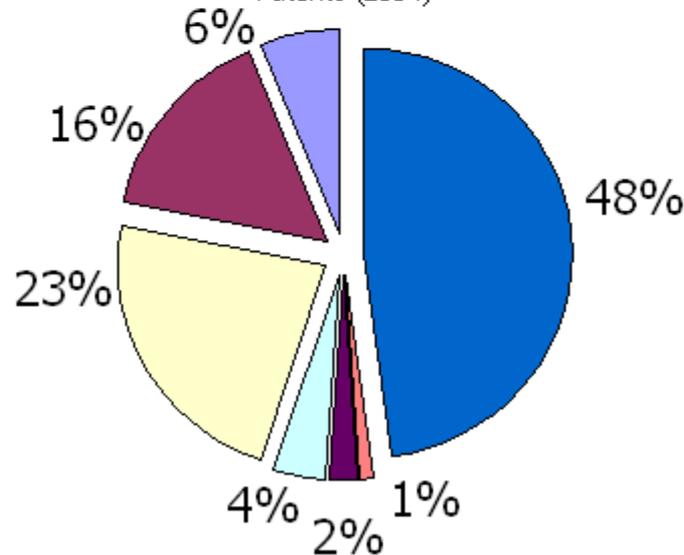
National Key Labs (181)



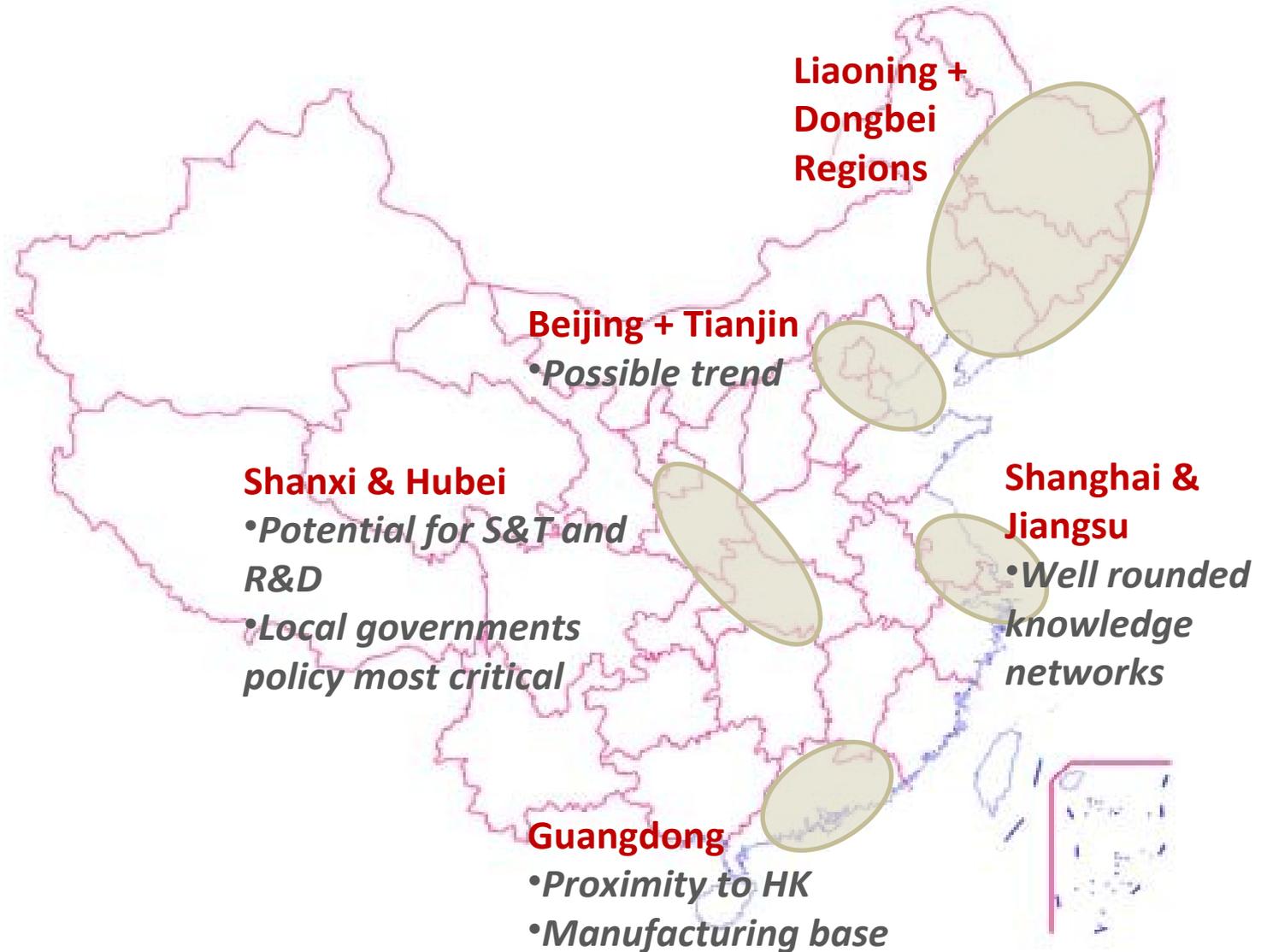
R&D Expenditures (2004)



Patents (2004)



Innovation geography



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Entrepreneurship is taking-off

~ 45'000 incubated startups in 2005 (18% growth)

- Central government policies gradually leveling the playing field for entrepreneurs vis-à-vis SOEs and national champions
- Central and local governments policies and direct support for thousands of startups through Incubators, Science & Technology Parks and Programs.
- Leading universities actively supporting laboratory spin-offs with financial, social and political capital
- VC and PE funds pouring into China to find the next big investment

Handful of high-profile startups heralding the rise of innovative Chinese entrepreneurship

NASDAQ IPOs

- Baidu
- Focus Media
- Ctrip.com

Foreign M&A targets

- Alibaba
- Eachnet (E-bay)
- 3721

Developing technology starboards

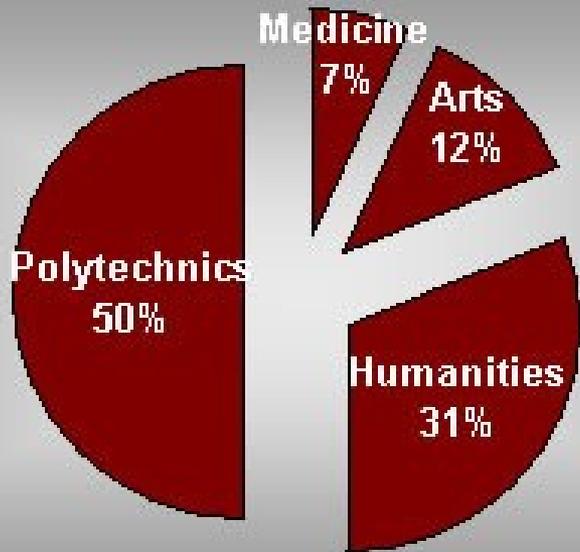
- DTV Standards
- Chinese language processing

Who are Chinese entrepreneurs?

- Turtles
 - Sea Turtles
 - Strait Turtles
 - River Turtles
- Enterprising scientist
- Serial entrepreneurs
- Fledgling entrepreneurs

- Haphazard planning
 - driven by philosophy that opportunity strikes at any time
- Sensational self-promotion
 - efforts to gain government attention and for PR purposes
- More personalized methods of networking / promotion
- Transparency
 - IPR protection issues
 - Difficult to trust outside of the *guanxi* circle
 - Difficult to trust foreigners

Strong technological focus of Chinese universities



- Leading Research Univ. (LRUs)
 - ~ 40 universities
 - contributing more than 60% of academic S&T and R&D output
 - ~ 60% of China's PhDs graduate from LRUs.
- National Key Universities (NKUs)
 - 108 universities
 - 211 National Key Universities Project
 - model for future Chinese universities

Creating the human resources for China's innovation system

- More than ~ 4 million graduates in 2006 (~27%)
 - ~ 270'000 Masters and PhDs
 - The most popular fields of study with over 50% of grads were science & engineering, medical sciences and agriculture.
 - Recent shifts in education method
 - Shift of emphasis from traditional rote methods to more creative forms of learning
 - More emphasis on in-school research and development projects and on-the-job internship programs
- Typically, for the price of one PhD student in the West, China can field an entire R&D team of dedicated and technically competent graduates*

Research and collaboration

- Research budgets
 - Over 50% from governments and state S&T funds
- Research focus
 - Generally reflects the broader direction of the national innovation system in accordance with state policies
 - Universities tend to be more focused on applied research and technology development, rather than basic and fundamental research
- Collaboration
 - Collaborating with local enterprises since the 1980s
 - In recent years more engagement with leading Western universities, as well as joint projects with foreign enterprises
- IPR
 - IPR offices in universities are tasked with central management of intellectual property, *although ...*
 - Ownership and management of IP by specific schools/departments, laboratories or research groups

Top 10 University owned enterprises (ranked by 2004 annual revenues)

Rank	Enterprise	Revenue RMB millions	Location	Industry
1	Founder Group (Peking University)	16,120	Beijing	ICT
2	Tsinghua Tongfang (Tsinghua University)	6,775	Beijing	ICT
3	Tsinghua Unisplendour (Tsinghua University)	3,038	Beijing	ICT
4	Insigma Technology (Zhejiang University)	2,914	Hangzhou	ICT
5	Neusoft Group Ltd.(North-East University)	2,139	Shenyang	ICT
6	Shanghai Tongji S&T Industrial (Tongji University)	1,503	Shanghai	ICT, Construction, Manufacturing, Pharmaceuticals
7	Xi'an Jiao Da Group (Xi'an Jiaotong University)	1,489	Xi'an	ICT, Manufacturing, Pharmaceuticals
8	Chengzhi Shareholding Co., Ltd. (Tsinghua University)	1,464	Beijing	Manufacturing, Pharmaceuticals
9	Jiangzhong Holdings Co., Ltd. (Jiangxi University of Traditional Chinese Medicine)	1,141	Nanchang	Pharmaceuticals
10	Shandong Shida S&T Co., Ltd. (China University of Petroleum)	1,140	Dongying Tsingdao	Chemicals / Petrochemicals

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Ongoing debate ...

- Further growth friendly to environmental protection
- Balance between rural and urban development, and between east and west regions
- Comparative advantages vs. catch-up and leapfrogging
- Developing core technologies vs. buying/borrowing from abroad
- Whether, and to what extent FDI contributes to technology acquisition and upgrading

Challenges ...

- Technological patriotism
- The role of the PE funds entering China
- SMEs from the West outsourcing R&D and manufacturing
- Widening the socio-economic gap
- Establishment of “institutionalized” *guanxi* networks
 - Politico-economic shift
- Asymmetric regulatory regimes

Thank you

Q&A

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