Globalization and Innovation in China's Telecommunication industry

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Outline

1. FDI in China and technology transfer
2. Global innovation network and Indigenous Innovation in China's ICT Industry
3. Conclusion and Policy Implications

The Advantages and backward of Developing Countries

To be able to learn from others: the advantage of being latecomers

- Less uncertainties with proven technological trajectories
- Technology development process can be compressed
- Localization of technology required in some cases, especially true for large country
- Technological leapfrogging or path-creation possible

- Backward:
  - Role of monopoly of multinationals
  - Lock-in of technology trajectory
  - low level of R&D investment
  - Lack of innovation atmosphere

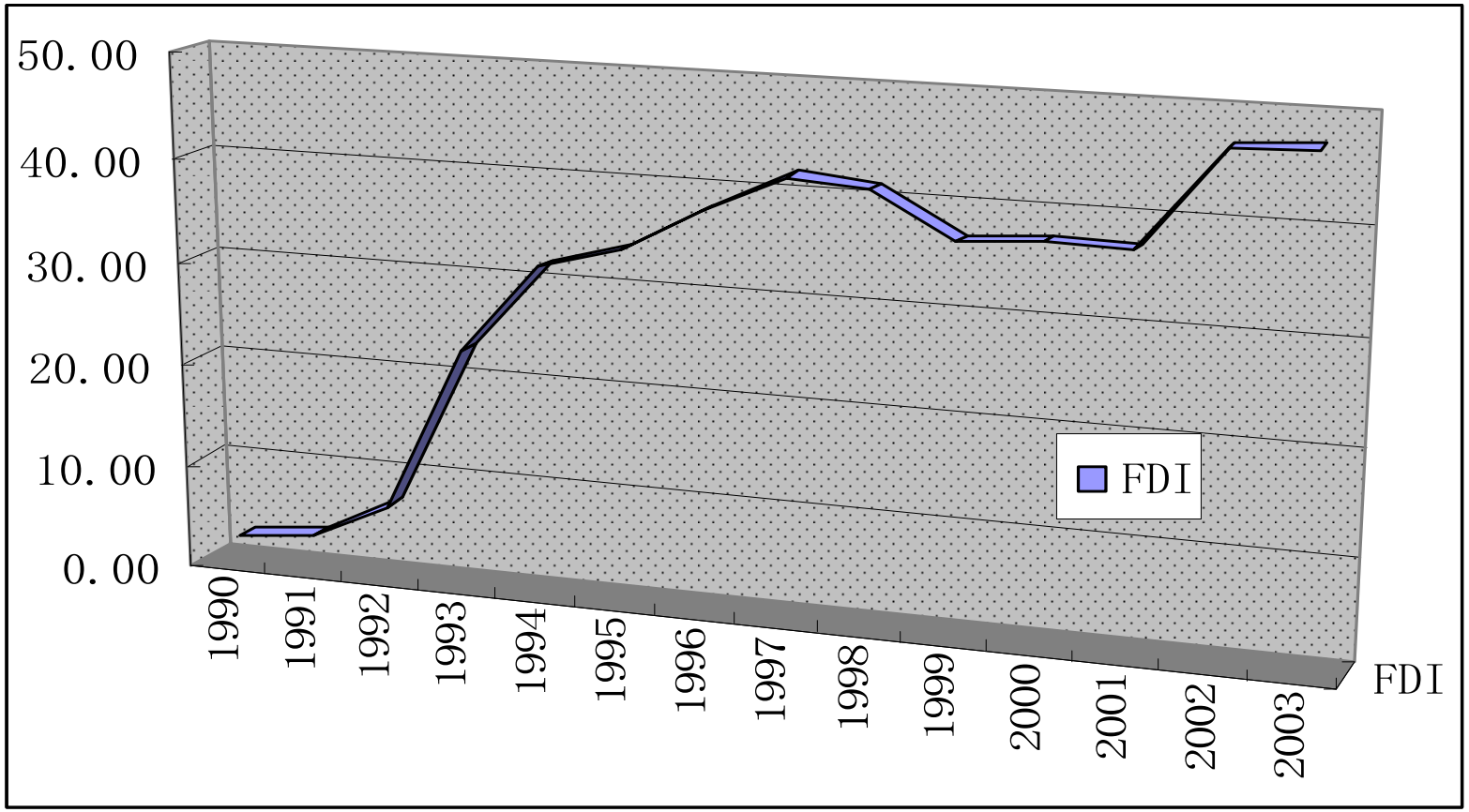
questions

- Can developing country use opportunity of technology revolution to catch up by using global innovation network?
- How can companies in developing country change from a role of technology adaptor to an innovator in an open economy.
- Any new innovation system or model?

1. FDI in China and made China connected with the world

- First wave: imported lots of technologies from various countries.
- Second wave; joint venture helped China enter digital communication age in fixed phone service.

Net FDI in China (Balance of Payments, current USD, 1990-2003) in billion USD



Large Scale FDI in telecommunication equipment sector

	First FDI (JV or Subsidiary)	Accumulated Investment	Investment and R&D Centres by 2000	Total sales in China in 2000(%of total sale)	notes
Motorola	1987	US3,4 000 m (including in chips)	1 Solely-owned, 1 holding company, 8 JV, 26 branches, several R&D centers	37.5 bn RMB	Mainly in mobile systems and handsets (no. 1).
Alcatel	1984	$500m	17 subsidiary & JV, 6R&D Centers		No.1 SPC supplier, 80 m lines sold
Siemens	1992		Many Rps and JVs, R&D centers		3rd largest SPC Supplier, 50 m lines sold by 2001
Nokia	1992	$1,700 m	20 branches, 8 JV, 1R&D	$2.8bn	Mobile systems
Ericsson	1988	$600 m	24 Rp and 10 JV	12%	Mobile systems
Nortel	1988		4JV, 2 R&D Centers	Over $2 bn	Optic and Switching
Lucent	1995		8 Rp, 8JV, 3 Subsidiaries, 8 R&D Centers		Major supplier of SPC, CDMA system

Outline of joint venture's production in digital switches

Product type	Company	multinationals	Equity share by Chinese partner	Start year of production	Sales volume (10000 lines)1997
S-1240	Shanghai Bell	Alcatel Belgian	60%	1986	500
EWSD	Beijing International communication	Siemens Germany	60%	1992	300
AXE10	Nangjing Ericsson	Ericsson Sweden	43%	1993	80
NEAX-61E/61	Tienjing NEC	NEC Japan	60%	1994	70
5ESS	Qingdao Lucent	Lucent USA	49%	1995	150
DMS-100	Guangdong Nortel	Nortel Canada	60%	1995	100
F-150	Jiangsu Fujitsu	Fujitsu Japan	35%	1995	100
Total					1300

Large Scale FDI and Technology Transfer

The huge market for ICT has attracted most MNCs to invest in China, through joint ventures, cooperation, and solely-owned subsidiaries over the past quarter-century.

Technology transfer, although a requirement from Chinese government for FDI before China's WTO membership, has mostly benefited local suppliers, mostly in the form of helping them to build up managerial and functional capabilities rather than develop their innovation capabilities.

technology transfer in the age of globalization

- Horizontal (Direct) Technology transfer limited: JV, or licensed companies helped with mastering productions technologies: assembly, testing, quality assurance, MIS, services and technical support. But core technologies not transferred to even JVs.
- Vertical technology transfer: production and managerial knowledge shared with local components suppliers, but not core technology development expertise.

but Limited Direct Transfer from FDI

- Employee mobility low: high wage acting as barrier preventing skilled labors or engineers being lured away by local companies
- R&D Mainly for product localization: less generic technologies or ingenious technologies developed; R&D investment less than MNC's average, less than local leading firms
- Demonstration and Role Models: FDI has set up models for local companies to closely watch and imitate, especially for production, management and marketing

New trends: more innovation network in China

- R&D labs in China: The trend is growing to set up R&D labs in Beijing and Shanghai, now in second tier cities where high talent human resources are available, such as Nanjing, Xian and Wuhan.
- More local R&D collaborations with local companies: Siemens to form R&D collaboration with Datang,Ericsson is intending to have a joint venture with Datang to play an important role in TD-SCDMA.
- Innovation for local market

2. Global innovation network and rising local companies

Huawei, and Zhongxing: Sound business strategy and steady technological progress: a wide range of products, starting with both indigenously developed technologies (digital SPC switching) and licensed technologies (GSM, CDMA), and now serious contenders in the world for a full spectrum of communications technologies

Datang: invested heavily in R&D, developed 3G Systems that rival MNCs: TD-SCDMA by Datang; McWill by Xinwei, a company controlled by Datang

Fast Rising Local Companies

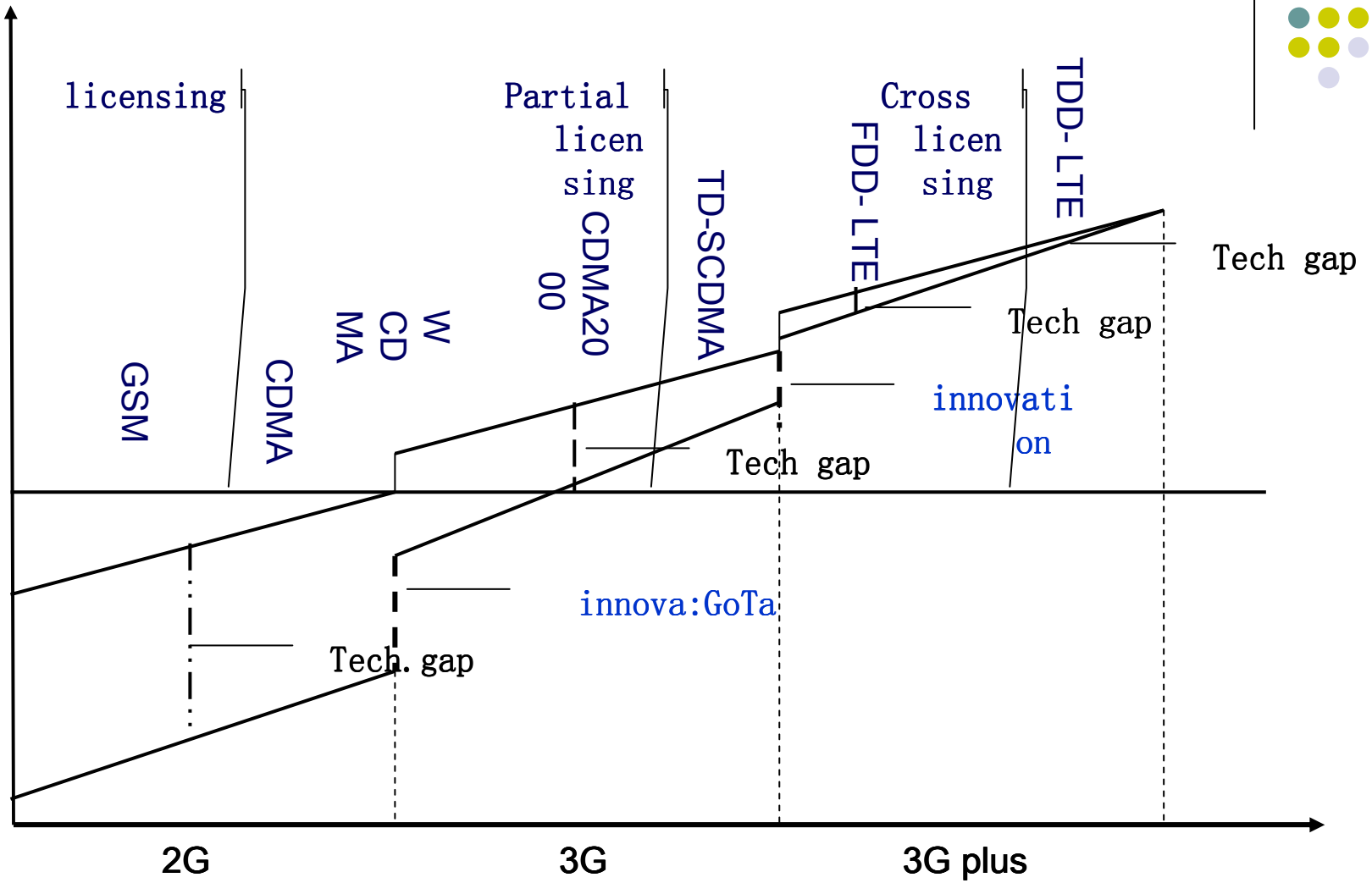
Mobile Networks:

GSM BST and BSC: Locked-out by MNC; catching up.

CDMA and 3G: catching up through licensed technologies and indigenous innovation

TD-LTE: same starting point.

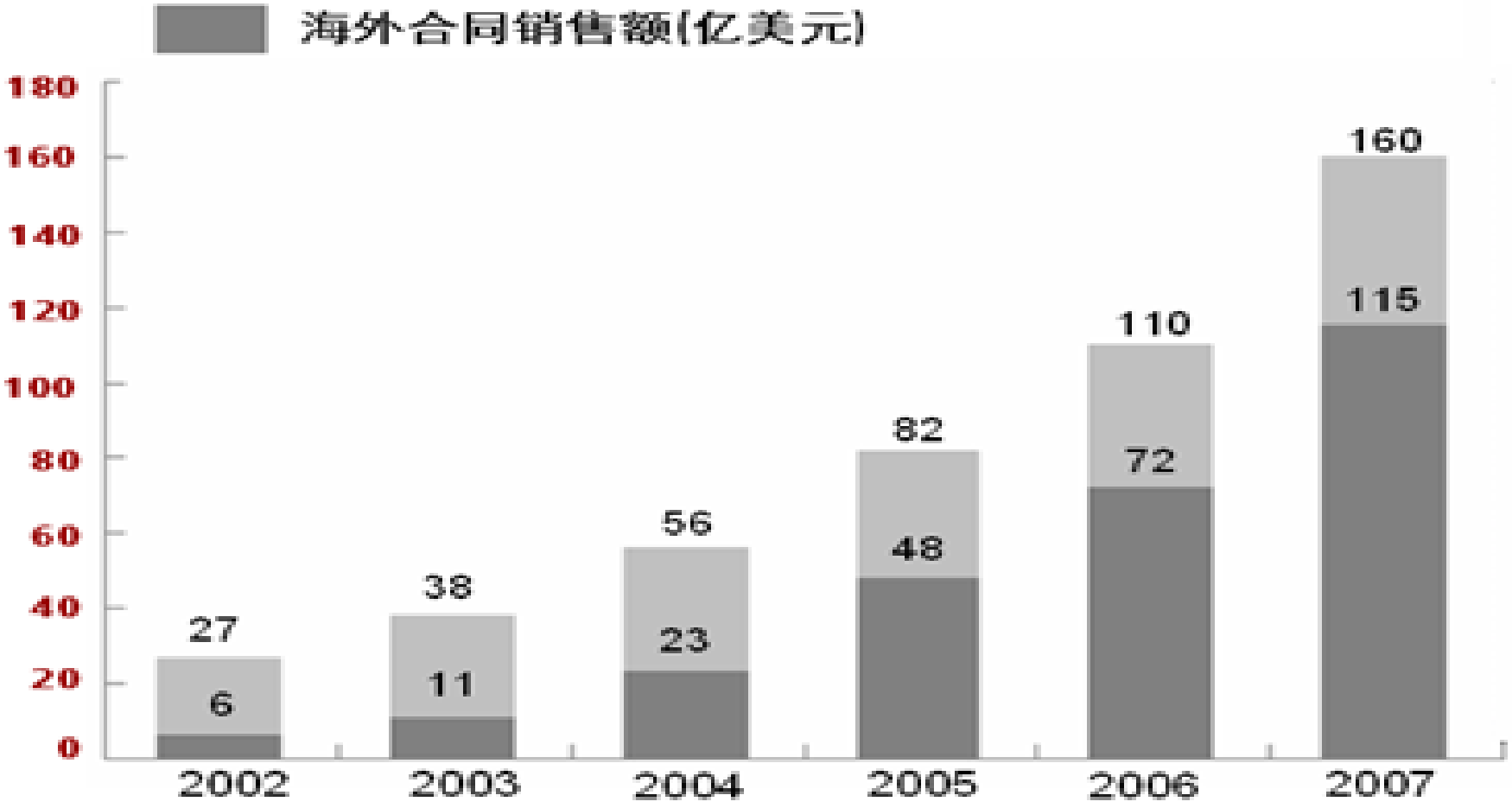
Sources: China Electronics Industry Year Book, 1990-2001; MII Website



ZTE's catching up

Huawei growing in Scale and in Scope

(Rev. $16 bn in 2007, with 72% from overseas)



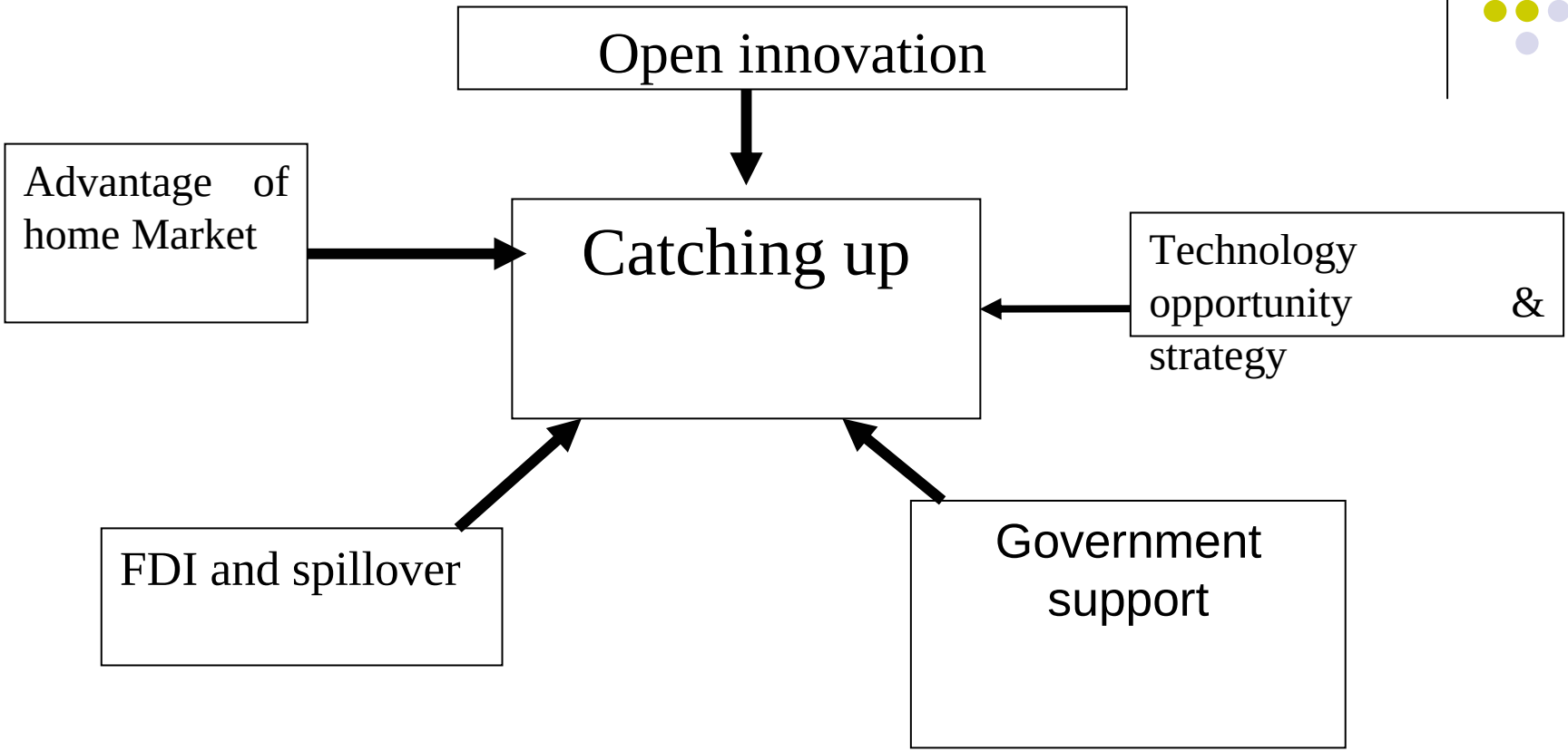


Fig. 1 Model of China's catching-up

2.1 Market and cost driven innovation: Dynamic and large home market size

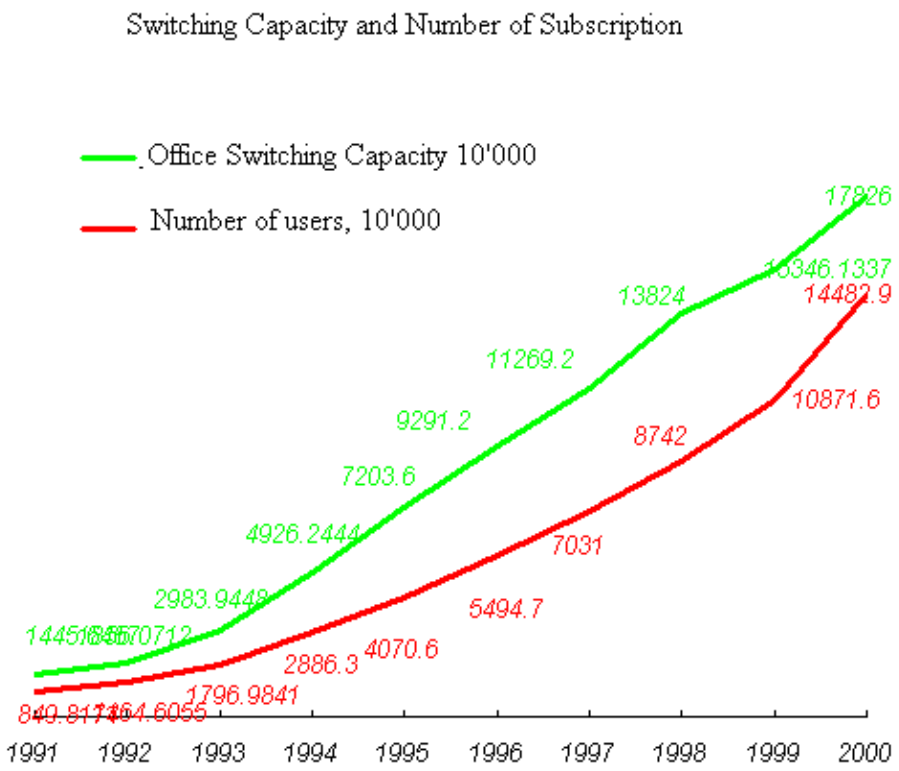
The top 5 industries in China (1986-2003)

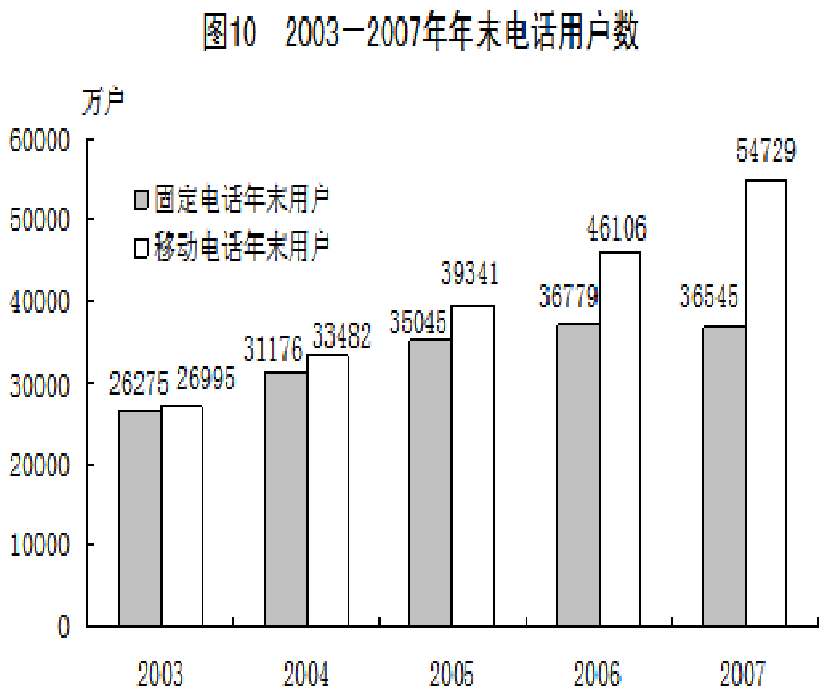
	rank	1	2	3	4	5
1986	**Industries**	*Textile & clothing*	*Chemicals*	*Tobacco*	*Oil*	*Food processing*
	Share of GDP%	*9.54*	*6.04*	*4.70*	*4.28*	*3.76*
1990	**Industries**	*Textiles*	*Chemicals*	*Oil*	*Tobacco*	*Electrical machinery*
	Share of GDP%	*9.67*	*7.76*	*6.54*	*5.84*	*4.12*
1995	**Industries**	*Chemicals*	*Oil*	*Textile & clothing*	*Transportation equipment*	*General machinery*
	Share of GDP%	*6.10*	*6.08*	*5.81*	*5.21*	*4.33*
2000	**Industries**	*Oil*	*Electronics & telecom equip*	*Chemicals*	*Textile & clothing*	*Transportation equipment*
	Share of GDP%	*8.70*	*7.18*	*5.58*	*5.01*	*4.84*
2002	**Industries**	*Electronics & telecom equip*	*Transportation equipment*	*Oil*	*Chemicals*	*Metal & processing*
	Share of GDP%	*7.64*	*6.60*	*5.87*	*5.64*	*5.45*
2003	**Industries**	*Electronics & telecom equip*	*Transportation equipment*	*Metal & processing*	*Chemicals*	*Oil*
	Share of GDP%	*8.29*	*6.90*	*6.73*	*5.87*	*5.68*

And Current Landscape ICT Industry

Advantage of home market

The growing telecom service market creates huge demand for telecom equipment for fixed network





Size of Chinese market

	2000	2006	Average annual growth Share of the world
Fixed phone users	145 million	371 million	21%, 1/4 of the world
Internet users	33.70 million	131 million	31% , 1/10 of the world
Wireless phone users	85.0 million	449 million	40%
Sales of ICT industry	607 billion	3800 billion (2005)	31%, Number 3 in the world

- Large home market size makes multinationals' monopoly very difficulty
- Large home market makes grass-root and segmentation innovation possible

Cost driven innovation to compete with multinationals

- Innovation for low end market: Huawei, ZTE, Lenovo, etc, all take the unexploited rural market as their first customer for innovative products. ZTE introducing PHS in China.
- Innovation for market niche: in mobile handset, specific designed for farmer, student, lady. Lenova's computer for SME.
- Use market size as leverage for cooperation with multinationals. Such as Siemens with Datang in TD-SCDMA.
- Use market size to acquire foreign company with technology. Lenova, TCL. BOE, etc.

grass-root and segmentation innovations of Huawei

- Many outstanding local businesses rely on the vast rural market to develop niche markets, which are usually characterized by the following—potential growth room, special groups of customers, no competitors or being ignored by the competitors.
- Take Huawei as an example. They began to do R & D and introduce digital switching solutions in rural areas in 1992. At that time, China's rural markets were just ignored by the giant multinational companies, so, rural market became the niche markets at Huawei’s early stage of development. The sales of Huawei in 1995 were 1.5 billion RMB, which were mainly from China's rural markets.

Huawei's strategy: from rural to international

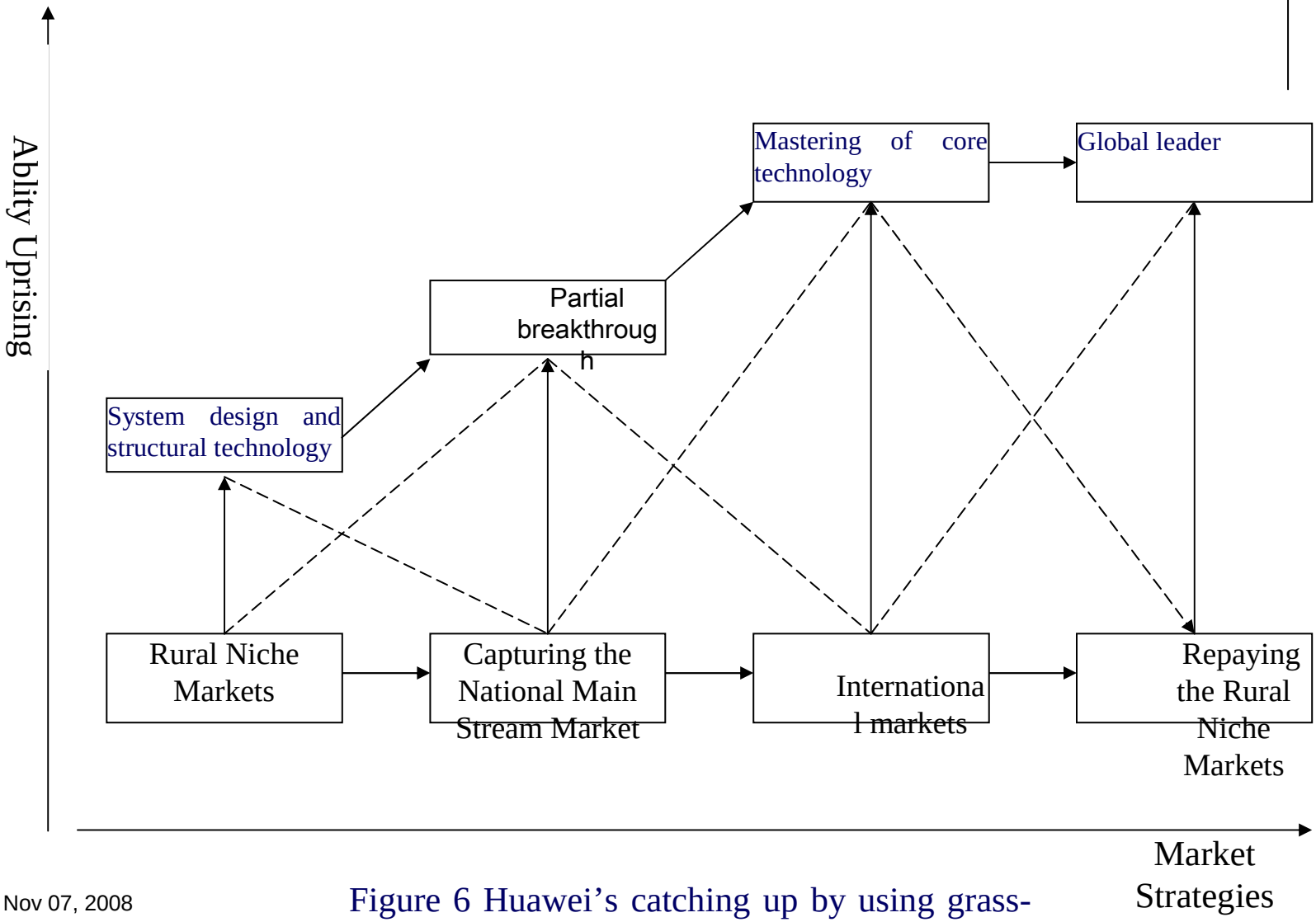


Figure 6 Huawei's catching up by using grass-root innovation strategy

2.2 Technology Opportunity and absorbing capability

- Changing technologies changed landscape of competition:
- From analog to digital switching, paved the way to innovation in fixed line telecommunication: example, H04 machine.
- specialization in handset productions etc.

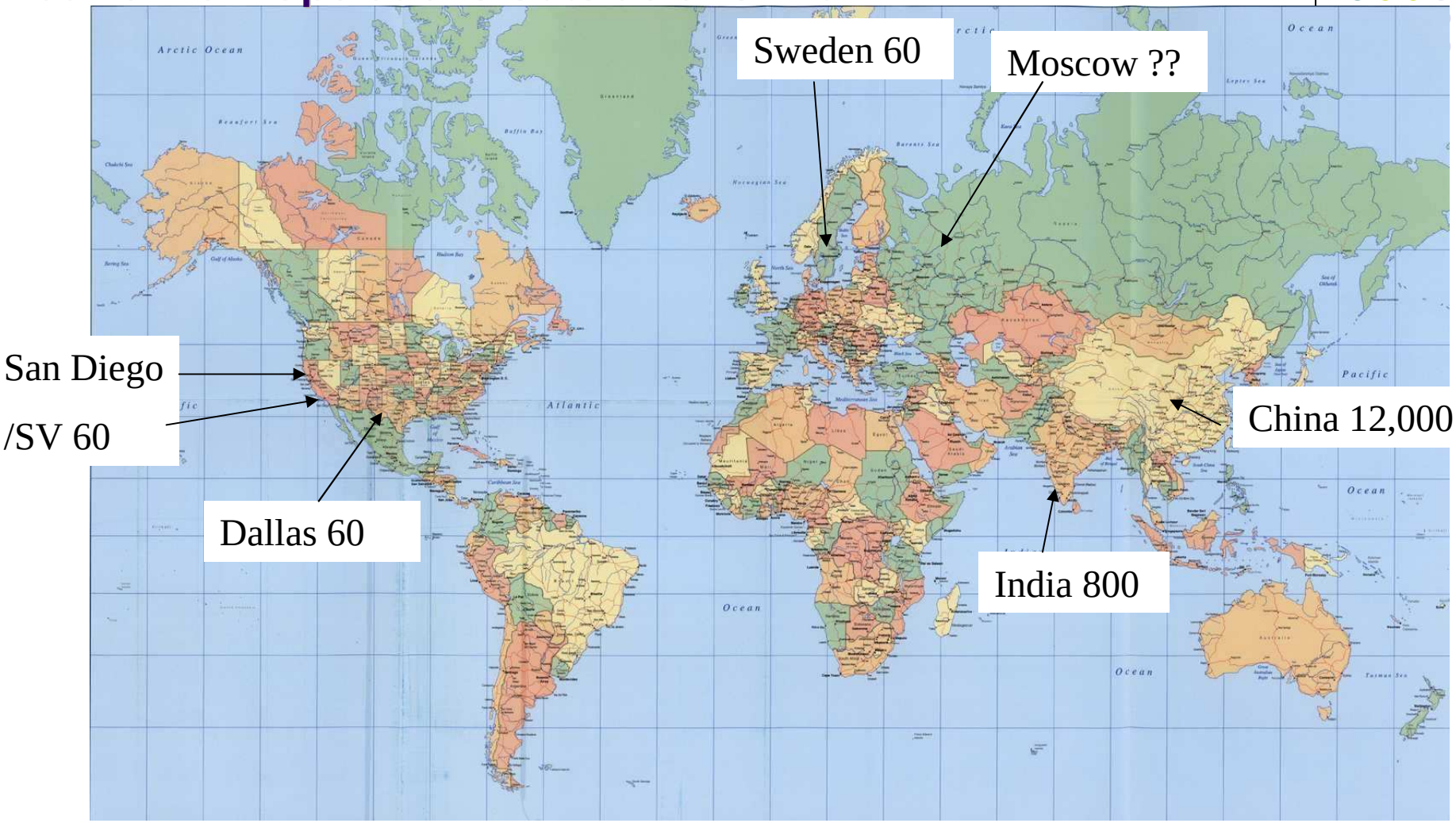
Absorbing capability by Intensive R&D inputs by companies

		2001	2002	2003	2004	2005	2000-2006
ZTE	Sale	10.92		17.45	22.70	21.58	
	R&D	0.79		1.33	2.25	1.96	
	R&D/sale	7.2%		7.6%	9.9%	9.1%	
	Total invention patens application						3400
Huawei	Sale	16.23	17.21	21.67	31.52	46.97	
	R&D	3.05	3.06	3.18	3.97	4.75	
	R&D/sale	18.8%	17.8%	14.7%	12.6%	9.6%	
	Total invention patens application						11894

2.3 Using global networking strategy to access leading technology

- ZTE, the first company to licensing the 3G technology to pave the way for 3G.
- Both Huawei and ZTE set up global R&D centers to access the leading technology and professional human resources.

Using Global R&D network
Huawei R&D Operations Outside of China



ZTE

- More than 8 R&D labs in the world both as guild-posts and researching bases.
- Global R&D networking became their way of innovation.

2.4 Overseas Chinese plays a very important role in global innovation networking

- TD-SCDMA is the result of overseas Chinese invention who used to be working for AT&T.
- Many ICT companies are set up by overseas Chinese, such as SMIC(Chip), Sohu, Sina, www.ctrip,www.kongzhong.com,www.aianinfo.com. Those companies now listed in Nasdaq.

2.5 Using leading market needs to innovate

- ZTE's SDR technology, from the idea of demands of European operators
- Solution back to China
- First test in HK to tackle Nokia's problem
- Diffused in EU and other countries
- SDR: Integration of base station compatible with 2G and 3G by ZTE and Huawei , with huge deduction of cost for operators, this is late comers advantage.

2.6 international M&A can be another sources of TF
Cases of M&A by Chinese firms (2001-2005)

Chinese bidder	Target foreign firm / Unit	Industry
Holly group	Philips Semiconductors, CDM hand-set reference design (US),2001	Telecommunication
TCL International	Schneider Electronics AG (Germany), 2002	Electronics
TCL international	Thomson SA, Television manufacturing unit (France), 2003	Electronics
BOE Technology Group	Hyundai display technology,(South Korea), 2003	Electronics
Shanghai Auto Industry Corporation (SAIC)	Ssangyong Motor (South Korea), 2004	Automotive
Lenovo group	IBM ,PC Division (US), 2004	IT

Source: Wu (2005), The Boston Consulting Group (2005)

2.7 international consulting to use leading management practice

- Huawei: IBM’s consultancy for IPD(integrated product development)
- ZTE(2005): consulting company for Market oriented new product development.
- ZTE(2009): introduce HPPD(High performance product development) from a consulting company

2.8 Government support: Proper industrial policy

- Market for technology before entering WTO
  - MPT asked Shanghai Bell to hold a R&D consortium with domestic companies.
- Special Tax and Government S&T program
  - In the 2005-2020 middle and long term S&T programming, next generation of wireless technology is one of 16 mega-projects.
- Competition policy:
  - in the 3G technology, WCDMA, CDMA2000 and TD-SCDMA got their licenses in 2009.
-

3. Factors contributing to Chinese firms' success in ICT sector

- MNCs acting as role models for market-oriented production, R&D, and marketing innovation
- Supply of skilled labour and qualified engineers
- Changing technologies changed landscape of competition: digital switching, specialization in handset productions etc.
- Unique demand structure induced localized innovation (small capacity digital switching)
- Competitive environment promotes innovation.
- Using global innovation network

Questions: is innovation in China going on in convergence with developed countries or emerging as a new model?

Thank You!