

Chinese Multinationals: New Contenders in Global R&D

Prof. Dr. Max von Zedtwitz

Tsinghua – University of St. Gallen – AsiaCompete Ltd
max@post.harvard.edu

+86 135 0106 4914
+852 357 57 405

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

10

Chinese Multinationals: Which Ones Do You Know?



Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

11

Key Question 1: From Physical Labor to BRAIN Labor?

Academic Meritocracy

- 9.5 million applicants take college entrance exam (in early June)
- 2.6 million slots are available
- Tsinghua: accepts 3'500 students every year
- 50% of them find PhD slots in the US

- High school and college colleagues are building the core networks for professional Guanxi

"It's more difficult to get into Tsinghua than into Harvard or MIT."

Central Party School

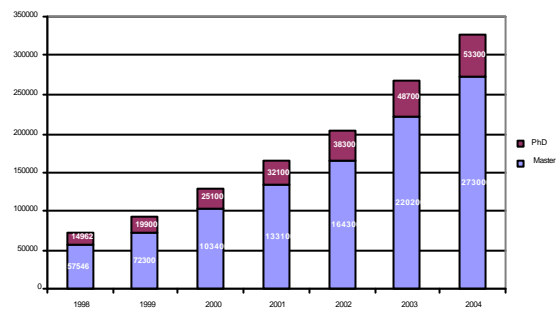
- Hu Jintao was its director for nine years before becoming President
- Teaches virtually all upper national-level cadres

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

12

In China, Number of Graduate Students is Increasing Fast

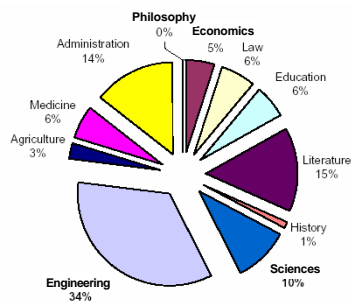


Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

13

Relative Share of Graduates from Different Faculties



Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

14

Key Question 2: China as a SOURCE of Innovation?

Traditional View

- China imports technology from Western companies in return for market access.
- Chinese companies copy, don't invent.
- Chinese companies either receive gov't protection or innovate using copied Western business models.

Putting this View into Perspective

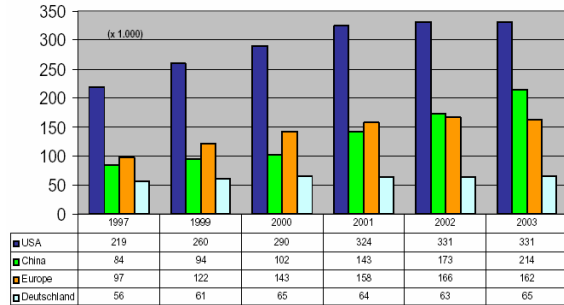
- Imitation is a natural (necessary?) step before innovation:
 - Japan, Korea, USA, Switzerland as examples
 - Artists/students, too, learn how to copy "the masters"...
- "Western" is really a base of about 20 different contributing countries: China can become a top-5 player by gaining just a 10% "market share" in innovations.

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

15

Increasing Number of Patent Applications



Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

16

Chinese Innovations in Retrospective

China

100 bc Paper invented in Gansu Province



128 Seismoscope invented by Chang Heng



300 Compass developed



800 Gunpowder (also used for military applications)

1045 Printing / movable type

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

17

Chinese Innovations in Perspective: What Took Us so Long?

China

100 bc Paper invented in Gansu Province



128 Seismoscope invented



300 Compass developed

800 Gunpowder (also used for military applications)



1045 Printing / movable type

Europe

900 Paper introduced to Europe via Arabs

1800 Seismoscope reinvented in Europe

1150 Compass introduced to Europe

1300 Gunpowder introduced to Europe

1455 Gutenberg's printing press

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

18

One Thing Chinese Companies Definitely are Good at!



© Max von Zedtwitz, max@post.harvard.edu

Source: Aktion Plagiaris

19

Chinese Inventions: Brain-Machine Interfaces

Where: Tsinghua Institute of Neural Engineering at the Tsinghua School of Medicine

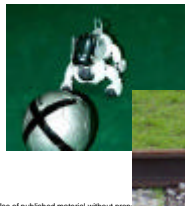
When: Spring 2006

What: Linking brain activity to a computer, thus interfacing with electronic/mechanical devices



Demonstrated Applications:

- Control a robot dog to kick a ball



Anticipated Applications:

- Controlling artificial limbs
- Steering wheelchairs
- Surfing the internet by mind control
- Guiding remote assistants (e.g., for rescue)

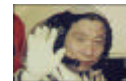
Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

20

China-Grown Technology

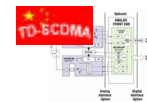
- Oct 15, 2003: Yang Liwei, first Chinese astronaut (= taikonaut), makes China the third country only engaged in manned space travel.



- Cloning of human liver related genes

- TD-SCDMA = Time Division-Synchronous Code Division Multiple Access, 3G mobile telecommunications standard; more flexible, less costly, greater spectrum efficient, lower power consumption than W-CDMA.

- Artemether, a novel anti-malarial drug



- Sobuzoxan, an anti-tumor drug

- Huperzine A (HupA), a novel alkaloid isolated from a Chinese medicinal herb, was improves memory deficiencies in Alzheimer patients

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

21

Chinese Industrial R&D and Innovation

E.g., Huawei:

- 44,000 employees, >10% of revenue dedicated to R&D, 48% of employees in R&D
- CMM5 certification – the highest accreditation available
- Member of 70 international standardization organizations
- E.g. ITU-T, 3GPP2, ETSI, OIF, RPR, OMA, TTA, TMF...
- Filed over 14'000 patent applications by mid of 2006 (up 8'000 within two years)
- Granted over 2'000 patents by mid 2006 (up 600 within two years)

E.g., CNPC:

- CNPC invested 4200M RMB in R&D in 2004
- CNPC has three hundred R&D institutes in China, including 7 institutes directly under HQ, 65 under the secondary companies, about 250 secondary branches R&D centre.
- 81 major research projects, including 15 national key ones and 66 company ones
- 594 patents were awarded

Others: ZTE, Haier, TCL, Lenovo, Dongfang Motors, Hisense, Li-Ning, Founder, etc.

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

22

Not All Chinese Companies are up to the Task

Example: Duoyuan



- 20% of the offset-press printing machine market in China
- Considers itself the "Heidelberger" of China
- Wants to become a top-5 printing company in the world

Reality: Mismatch between Wants and Haves!

- No clear goals and targets (Competitors? Success control?)
- Poor R&D management: control on time, not budget or quality
- All machines based on copied technology from the West
- Poor marketing: machines sell because China grows
- Project selection: R&D internal, no info from other dep'ts
- Single-man-leadership, no shared responsibility
- No make-or-buy: everything is made in-house

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu Zedtwitz (2005): R&D from Developing Countries. UNCTAD

23

Context of China's R&D Internationalization

- Most high-tech companies are **small** (600 p.) and **less than 15 years old** (World Bank)
- Even large companies (e.g., Lenovo) are **comparatively small** (just 4% of IBM's turnover)
- 50% of Chinese companies' **supply network is within the city**, and 75% within China (Steinfeld, 2002)
- Chinese companies: mostly **pursue opportunities with low barriers of entry**
- Extent of Chinese companies' internationalization: **patchy** but mostly low
- "Zou Chu Qu" policy: Go abroad! R&D encouraged where local S&T is strong, and international S&T exchange

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

Zedtwitz (2005): R&D from Developing Countries. UNCTAD

24

China's R&D: Why Internationalize...?

Why a Chinese firm would internationalize R&D:

- Local technology and market intelligence
- Hiring foreign experts
- Developing a global image
- Supporting local sales

Example Haier:

- #5 white-goods company worldwide
- Competes and cooperates with companies like Siemens, Whirlpool, GE
- R&D in Qingdao, Beijing, Guizhou
- R&D in Hong Kong (now PRC), London, Silicon Valley, Sydney

→ **A necessary (for some) but painful process!**

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

Zedtwitz (2005): R&D from Developing Countries. UNCTAD

25

Chinese R&D, Globally Dispersed



Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

Zedtwitz (2005): R&D from Developing Countries. UNCTAD

26

Barriers (for Chinese Firms to Internationalize R&D)

- **Size disadvantages** compared with Western MNCs
- Focus on **local business** and local markets
- Reliance on **local business connections** (Chinese management style?)
- Lack of history of product innovation, tendency to **diversify** rather than innovate
- Lack of resources: R&D is **expensive**, and first-movers are putting themselves at comparative disadvantage
- Lack of **management expertise**: no history of international operations, no international cadre (or none that is internally generated)
- Potentially **attractive markets already contested** by Western MNCs (with more R&D power, more experience, and better brand to back up)
- **Costs of doing R&D outside China: high**
- Lack of **English skills** among middle managers

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu

Zedtwitz (2005): R&D from Developing Countries. UNCTAD

27

Implications for R&D from China

- Chinese companies are about to set up R&D in hot spots around the world
 - Boston, Silicon Valley, Japan, UK, Germany
 - But also India, South America, Korea, Western Asia, etc.
- Chinese companies are facing steep learning challenges with respect to doing R&D, and managing international organizations
- The Chinese have a tremendous willpower to adopt Western technologies and demonstrated that they can do so fast
- If the technology doesn't come to China easily, local R&D centers can source technology where it is created, and secure global ownership rights
- Chinese companies will compete over top graduates from Western universities

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu Zedtwitz (2005): R&D from Developing Countries. UNCTAD 28

Recent References

- von Zedtwitz, M. (2006): International R&D strategies in companies from developing countries: the case of China. In: UNCTAD (Editor): Globalization of R&D and Developing Countries New York & Geneva: United Nations, 117-140.
- von Zedtwitz, M. et al (2006): Managing R&D in China. Research Technology Management.
- von Zedtwitz, M. (2004): Managing Foreign R&D Labs in China. R&D Management, Vol. 34, No. 4, 439-452.
- von Zedtwitz, M. (2007): Connecting Science to Innovation: Managing R&D on a Global Scale Edgar Elgar: Cheltenham.
- von Zedtwitz, M.; Gassmann, O. (2002): Market versus Technology Drive in R&D Internationalization: Four different patterns of managing research and development. Research Policy, 31, 4, 569-588.
- Fischer, W.A.; von Zedtwitz, M. (2004): Chinese R&D: Naissance, Renaissance, or Mirage? R&D Management, Vol. 34, No. 4, 349-365.
- Boutellier, R.; Gassmann, O.; von Zedtwitz, M. (2007): Managing Global Innovation - Uncovering the Secrets of Future Competitiveness, 3rd ed. Springer: Heidelberg.

Use of published material without proper citation is against the law.

© Max von Zedtwitz, max@post.harvard.edu 30