

Open Innovation in China:
Evidence from the
Semiconductor Industry

Presentation to SPRIE:
New Patterns and Paradigms in
Global Innovation Networks

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FOREWORD BY JOHN SEELY BROWN

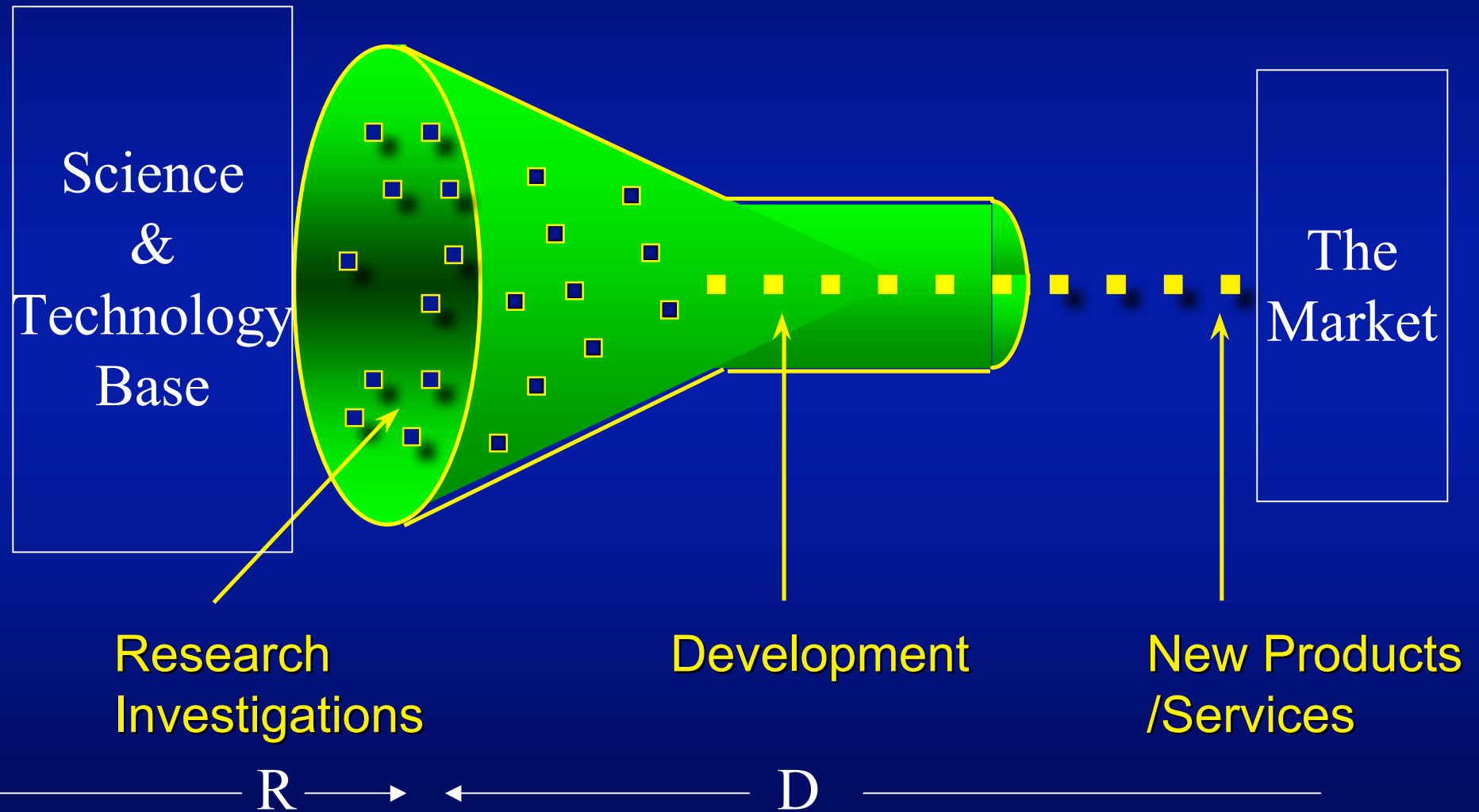
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OPEN
INNOVATION

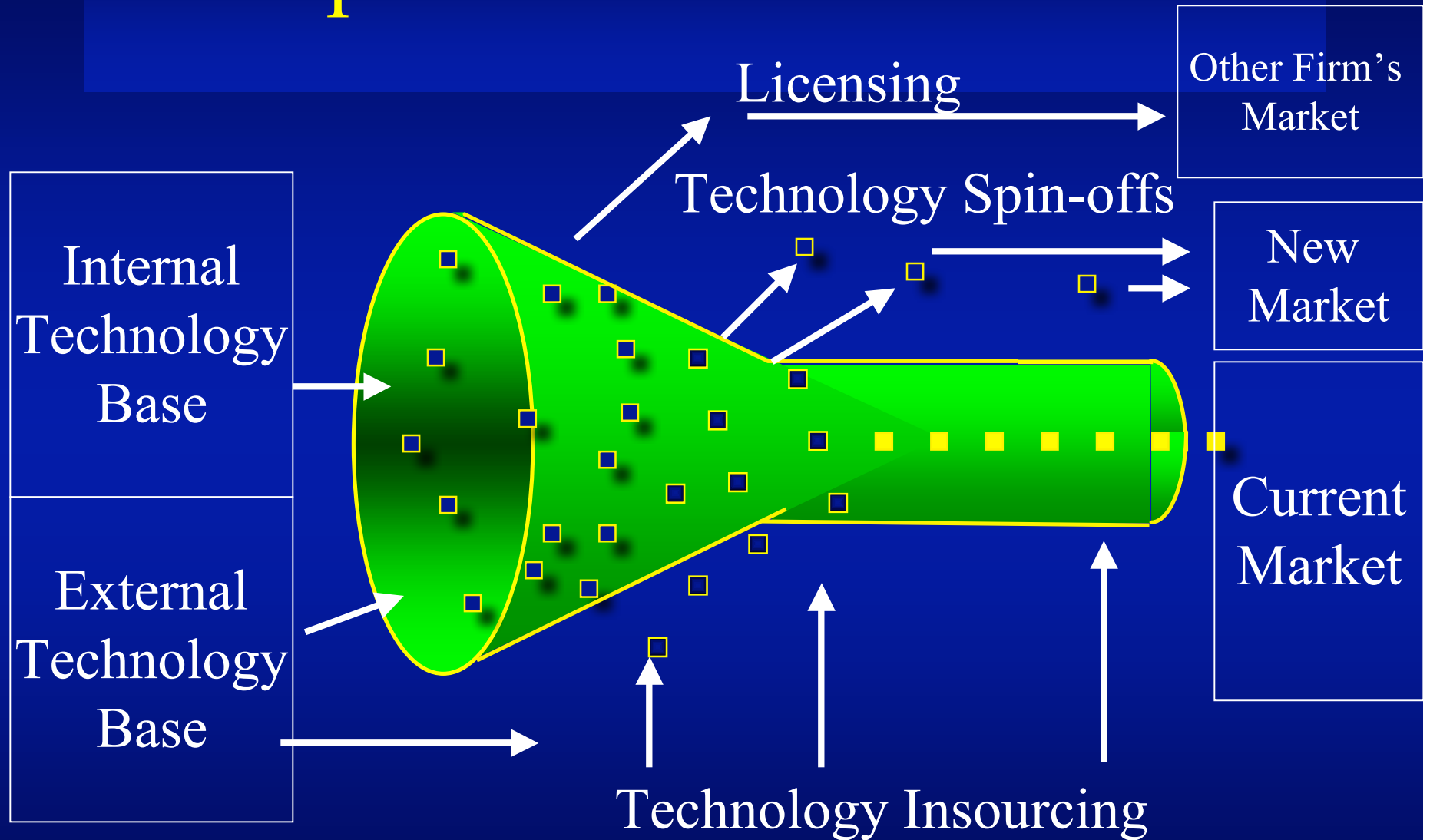
The New Imperative
for Creating and Profiting
from Technology

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A Closed Innovation System



The Open Innovation Framework



Evolution of Business Models in Semiconductors

- Systems (1950s, AT&T, IBM)
- IDMs (1970s, Intel, TI)
- Fabless/Foundry (1980s, TSMC)
- Today, further specialization
 - Design services
 - Foundry services
 - Packaging services
- Also more value added
 - Applied Materials selling recipes with its equipment
 - Foundries selling IP with production
 - Design services selling cores, reference designs

Key Findings: A Divided Industry

- There are two very different industry segments operating in the Chinese semiconductor industry
 1. A Globally-oriented, globally competitive segment that employs advanced technologies and is gaining market share in world markets
 2. A Domestically-oriented segment that employs backward technologies, lacks access to investment capital and management expertise, where the government is the largest shareholder of each firm

Comparing the Two Segments

<u>Domestically focused segment</u>	<u>Globally competitive segment</u>
Virtual IDM e.g., Datang System company with captive semi e.g., Huawei, Hua-Hong	No IDMs
Domestic design houses IP for designs, verification, layout (SSIPE)	Fabless e.g., Vimicro Design services e.g., VeriSilicon Design foundry
Domestic foundry services, provided by System companies	International Foundry (wafer manufacturing) e.g., SMIC
Depreciated equipment from other semiconductor processes	Equipment house (production equipment) e.g., AMEC
Former SOE, significant social obligations to employees	Returning Chinese from Taiwan and US supply technical expertise, mgmt
Domestic capital markets (banks)	International capital markets, e.g., VCs and HK, Nasdaq, NYSE

Datang – One of the Best Domestically-oriented firms

- Former SOE
- 1 billion RMB, only 5% of sales international
- #1 virtual IDM in China, #44 in the world
- Technologies focused at .25 micron and .35 micron, beginning work at .18
- Government wants foreign direct investment in Datang (how will investors get money out?)
- Significant constraints on human and capital resources
- “They are really very weak” (Mr. Xu, CSA, MII)

SMIC – a Globally-oriented Foundry

- Founded in 2000
- Revenues of \$975 million in 2004 (#3 foundry)
- 90% of revenues outside of China
- Headquartered in Cayman Islands
- IPO in 2004, Traded on NYSE, raised \$1 billion
- Richard Chang – 20 years at TI
- Hundreds of returning Chinese
- Raid of 100+ from TSMC (lawsuit)
- 7 fabs (one 12”), sampling 90nm SRAMs now

Vimicro – a globally-oriented design firm

- Founded in 1999, based in Beijing
- John Deng, CEO, Berkeley grad
- US VC funded
- IPO November 2005, ADRs (VMIC)
- 60% share of digital multimedia chip market
- 70% of sales outside of China

A Tale of Two Industries

- The growth, the technology, the capital and the management are all with the globally-oriented segment
 - Yet the bulk of employment and sales are with the domestically-focused segment
 - Sizing the two segments will require further research
- How will China's industry shift its human and capital resources to the global segment?
 - “It is hard for a firm to die in China, especially an SOE”

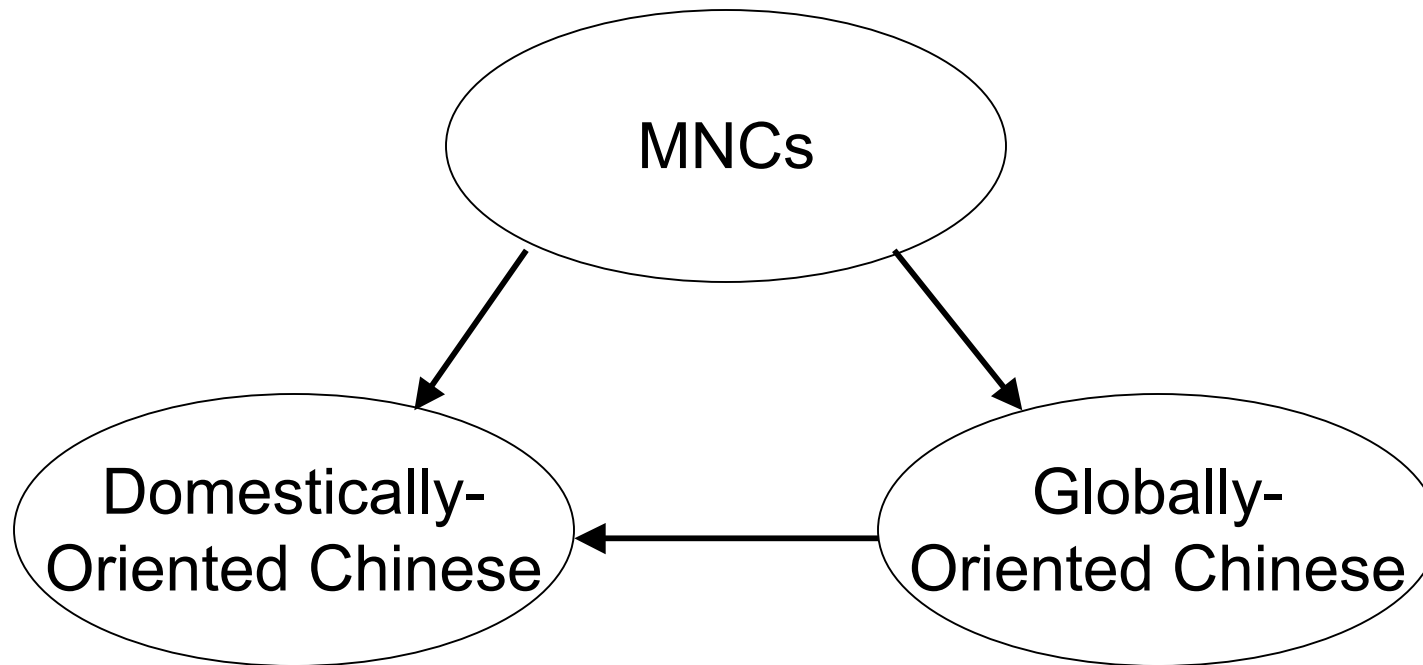
IP Management in China

- IP rights exist in Chinese law
 - Enforcement, however, is problematic
 - Some case law emerging in trademarks and copyright
 - Beijing Olympics in 2008 driving greater attention
 - In patents, courts lack technical competence
- Chinese government policy toward IPRs is fragmented
 - 8 different entities involved
 - Decision rights of each entity unclear
 - Drives up expense and uncertainty
- Fundamental economics: capital is scarce, and engineers are cheap
 - Promotes illegal copying over legal licensing
 - But, slows time to market

Strategies by Chinese Companies to Manage IP Risks

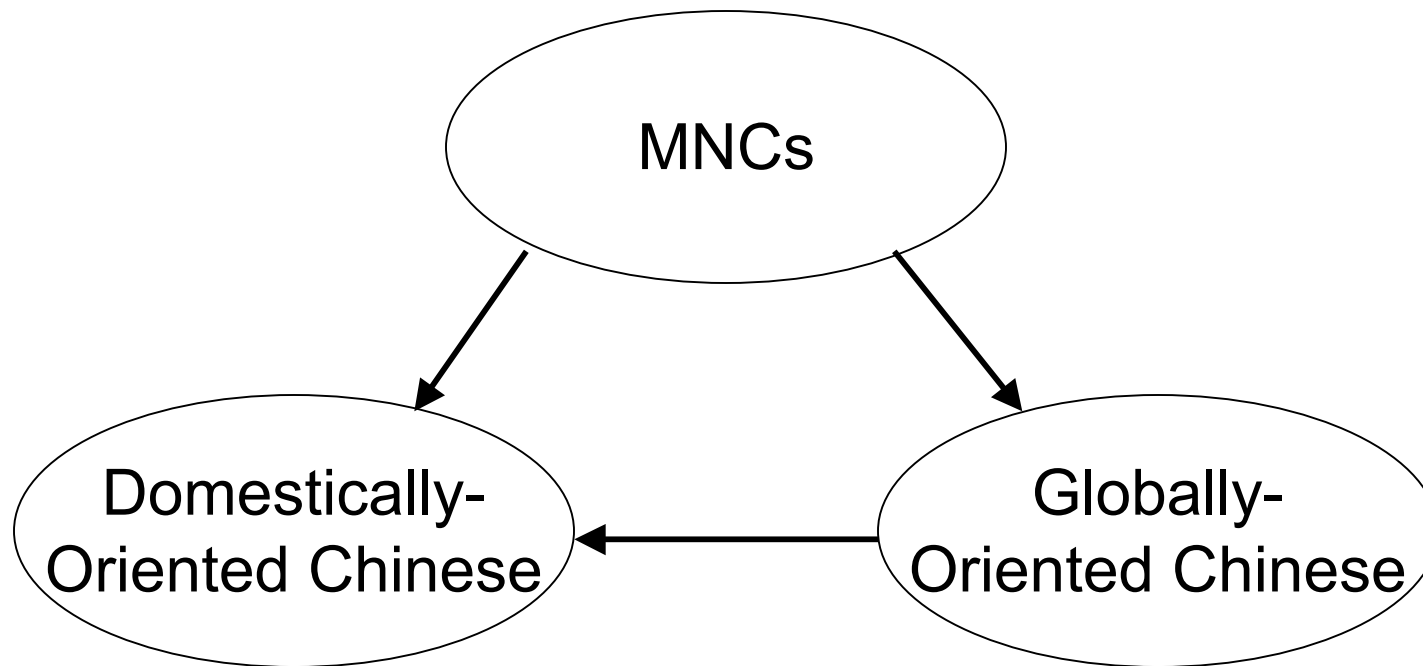
- “A good way for Vimicro to deal with the IP problem is to move fast and make it hard for imitators to follow.” (John Teng)
- “We actually have to overcompensate on IP protection to compensate for the reputation China has for weak IP protection.” (SMIC)

Knowledge Flows, Appropriability and MNCs



- more illegal copying of IPRs
- lower absorptive capacity
- lagging technology base

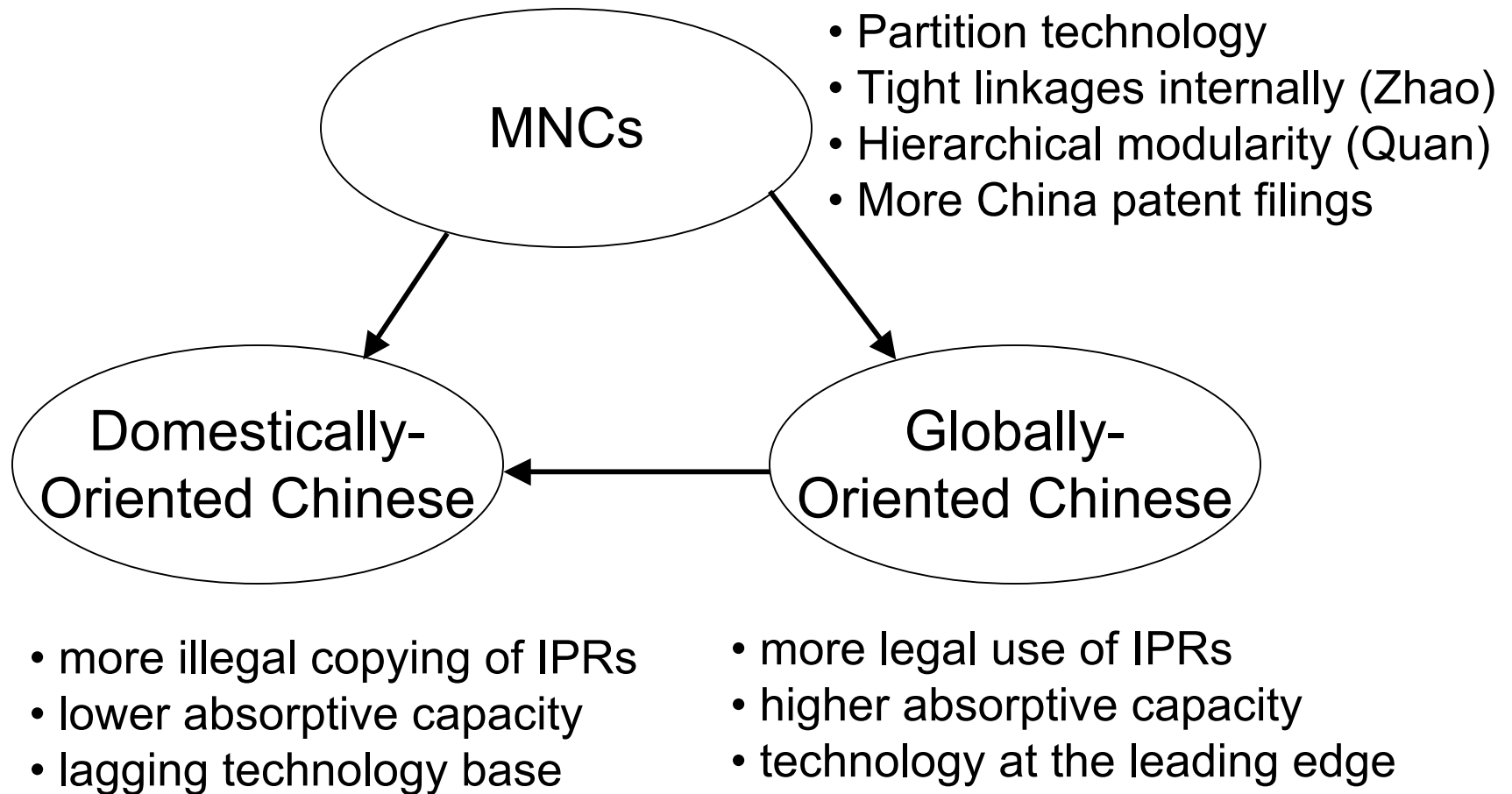
Knowledge Flows, Appropriability and MNCs



- more illegal copying of IPRs
- lower absorptive capacity
- lagging technology base

- more legal use of IPRs
- higher absorptive capacity
- technology at the leading edge

Knowledge Flows, Appropriability and MNCs



Changing Government Policy Towards IP in Semiconductors

- “The ironic thing about the Chinese IC industry is that where the government has put a lot of effort (money, equipment, talents) into large scale IC manufacturing firms (the effort) failed, while design houses, where no effort was ever made by the government, have flourished.” (Mr. Yang, MOST)
- ”From a technology perspective, our semiconductor industry is at least ten years behind the world standard, although this gap is growing shorter. This progress is not because of Chinese investment, but because foreign companies are bringing more and more advanced technology to their plants in China.” (Mr. Xu, CSA, MII)

Some Surprising Developments

- New businesses exist to promote legal exchange of IP
 - SSIPEX – legal IP exchange, 2nd largest library
 - ICC – design services
 - ICRC – production services, eg MPW
- Domestic constituency exists for stronger IPRs in China
 - Systems companies seeking to upgrade technology
 - Increased desire to access foreign investment capital
 - Some government ministers endorse strong IPRs

Implications

- IPRs in China are very weak today, but there are signs of strengthening IPRs
 - Not because of MNCs' lobbying, but because leading Chinese companies want to upgrade their technology
- A vertically specialized semiconductor industry structure is emerging rapidly in China
 - Intermediate markets for innovation are beginning
- These conditions are promising for a more open approach to managing innovation in China

开放式创新

——进行技术创新并从中赢利的新规则

Open Innovation: The New Imperative for Creating and Profiting from Technology

(美)亨利·切萨布鲁夫 著
金马 译

不进行创新的公司必然灭亡。我们面对的是一个复杂多变的世界，这一点对于每个公司来说都是确定无疑的。但是你的公司应当怎样创新呢？过去，成功创新的关键在于公司拥有设备优良的实验室，然而今天，知识的广泛传播已经使此类设施控制变得不太可行。竞争性优势通常来源于高效地使用别人的发明创造。

不再完全依靠公司内部计划、想法来发展业务，这种新的开放式创新途径能够有效地利用公司内部和外部的所有创意。与此同时，开放式创新也不再狭隘地把创新行为只局限在市场营销方面，它激励企业抓住新商机，并为之找到最合适的商业模式，大赚一笔——不管这种模式是存在于企业内部，还是必须通过外部的专利权转让、合伙或风险投资等方式建立。

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