China

Part III*: Education, Patents, Industry, Energy & more

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COMO PARK PAVILION , MICHAEL DONALD GLASS MEETING ROOM , 1360 N. Lexington Parkway, St. Paul, MN 55103

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Global Technology Diffusion

Guangdong Science Center -- China
Opens 2008

June 2006

Effects of Tech Globalization

- **By 2008, China and India account for 31% of global R&D staff, up from 19% in 2004.**
- **77% of new R&D sites planned for next 3 years will be built in China or India.**
- **The US ranks 17th among developed nations in the proportion of college students majoring in science and engineering.**

The Problem of speed

- Knowledge created in the 1990's is equal to all knowledge created in 300,000 years of human history to that decade.

- NSA estimates that the internet will carry 647 petabytes (billion million bytes) of data EACH DAY in 2007. For comparison, the Library of Congress holdings represent 0.02 petabytes.

- Estimated that in 2010, the cost of synthesizing bacteria genome-sized DNA sequence will be equivalent to the price of a car.

Trends

- Internet users grew 183% from 2000.
  1 billion users last year. 2 billion by 2011.
- 2 billion cell phones this year. 3 billion by 2009.
- Wireless “hotspots” grew 87% in one year.
  Now 100,000. 200,000 by 2010.


NEC

Context

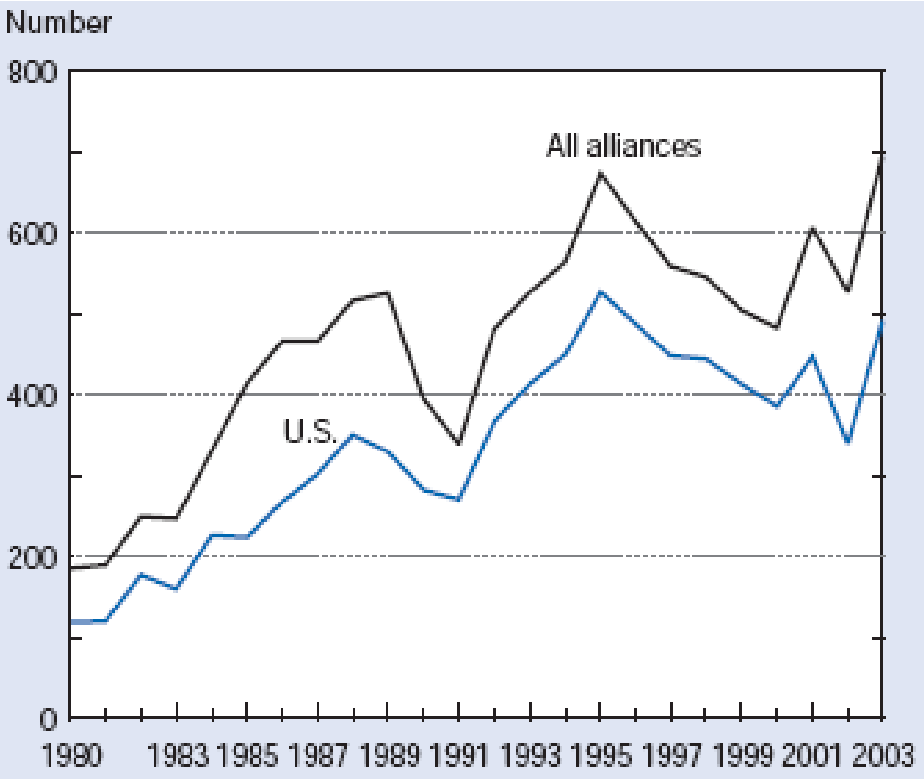
- How many Americans today have passports?
- Which country has the world's largest "middle class with purchasing power" population?
- Which geographic region made up the most (30%) of the world's Gross Domestic Product (GDP) in 2004-06?

Context

- How many Americans today have passports?
  - 67 million
- Which country has the world's largest "middle class with purchasing power" population?
  - India
- Which geographic region made up the most (30%) of the world's Gross Domestic Product (GDP) in 2004-6?
  - Asia/Pacific (not including Japan)

Worldwide industrial technology alliances and those with at least one U.S.-owned company: 1980–2003

1. The Cooperative Agreements and Technology Indicators database-Maastricht Economic Research Institute on Innovation and Technology (CATI-MERIT, funded in part by NSF), includes domestic and international technology agreements
2. In 2003 (latest data available) there were 695 new industrial technology alliances Worldwide.
3. These alliances involve mostly companies from the United States, Europe, and Japan, focusing to a large extent on **biotechnology and information technology products**, services, or techniques.
4. Other technology areas include advanced materials, aerospace and defense, automotive, and (non-biotechnology) chemicals.



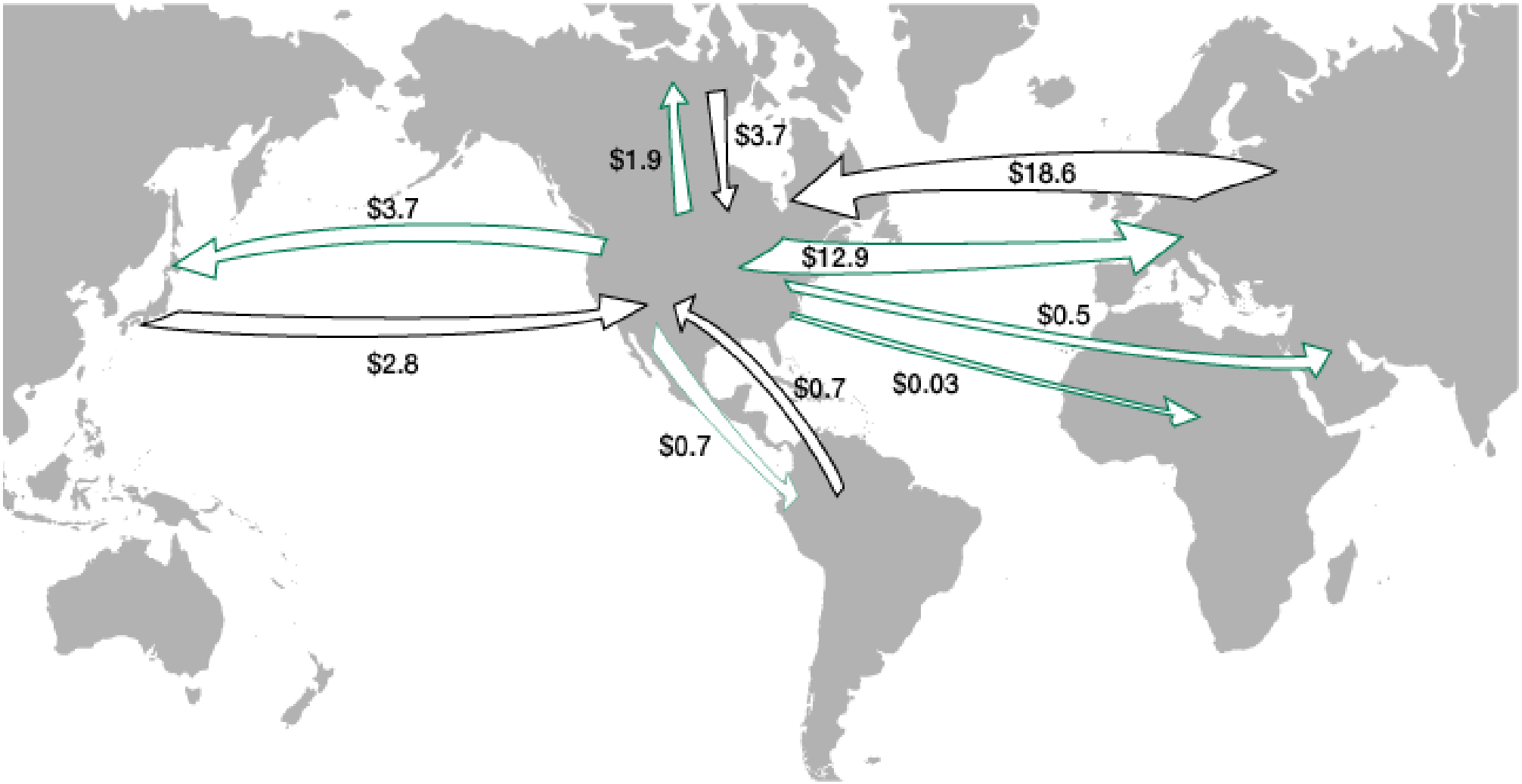
NOTE: Annual counts of new alliances.

SOURCE: Maastricht Economic Research Institute on Innovation and Technology, Cooperative Agreements and Technology Indicators (CATI-MERIT) database, special tabulations.

SOURCE: National Science Board, *Science and Engineering Indicators-2008*

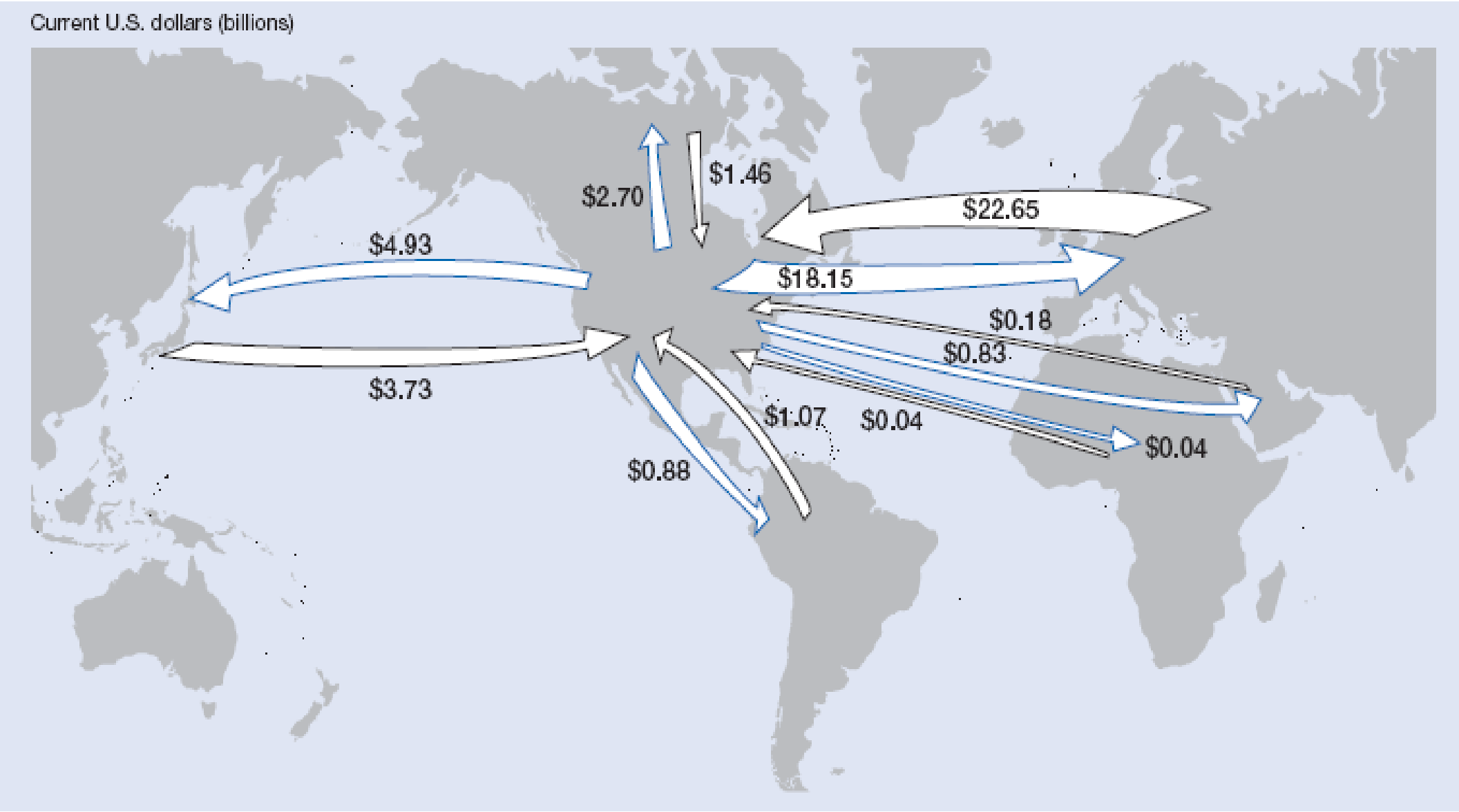
Foreign-owned R&D in United States and U.S.-owned R&D overseas, by investing/host region

(Billions of current U.S. dollars)



SOURCE: National Science Board, *Science and Engineering Indicators-2004*

Foreign-owned R&D in United States and U.S.-owned R&D overseas, by investing/host region: 2004 or later



SOURCE: National Science Board, *Science and Engineering Indicators-**2008***

Macroeconomic Rationale

1. Endogenous growth models - theoretical support for domestic technology creation

2. Y = f(R, K, H), where:

   Y = GDP

   R = R&D

   K = physical capital

   H = human capital

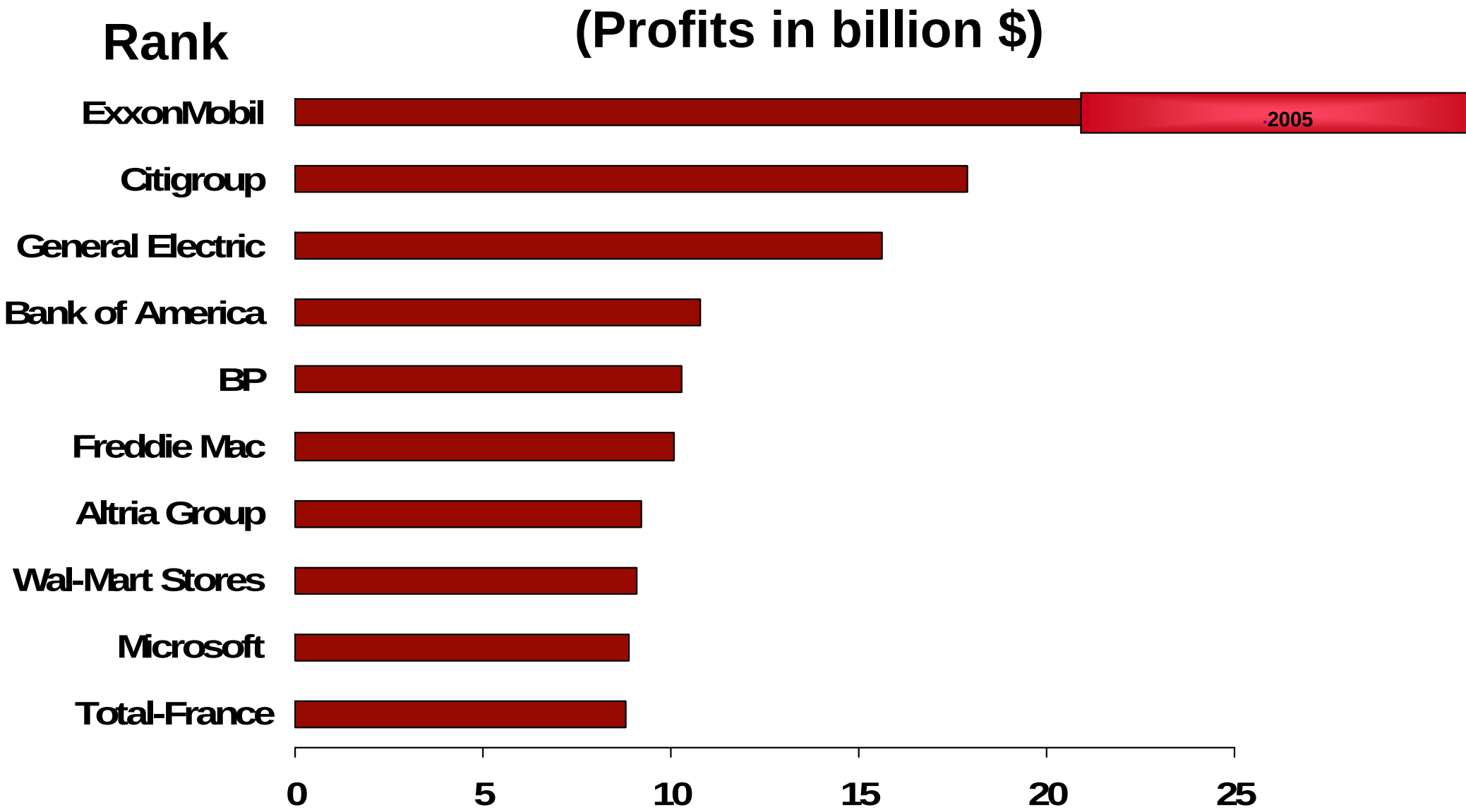
3. Velocity and proportion of R, K, H: determinants of success

HOW DO WALMART'S SALES COMPARE?

Sweden	**GDP**	**$301.6b**
Wal-Mart Stores (year ending 1/31/05)	**Total Revenue**	**$287.8b**
Austria	**GDP**	**$253.1b**
Turkey	**GDP**	**$240.3b**
Norway	**GDP**	**$220.8b**
Ireland	**GDP**	**$153.7b**
Israel	**GDP**	**$110.2b**
New Zealand	**GDP**	**$79.5b**
Chile	**GDP**	**$72.4b**

GDP Source: WDI, World Bank

World's 10 most profitable companies



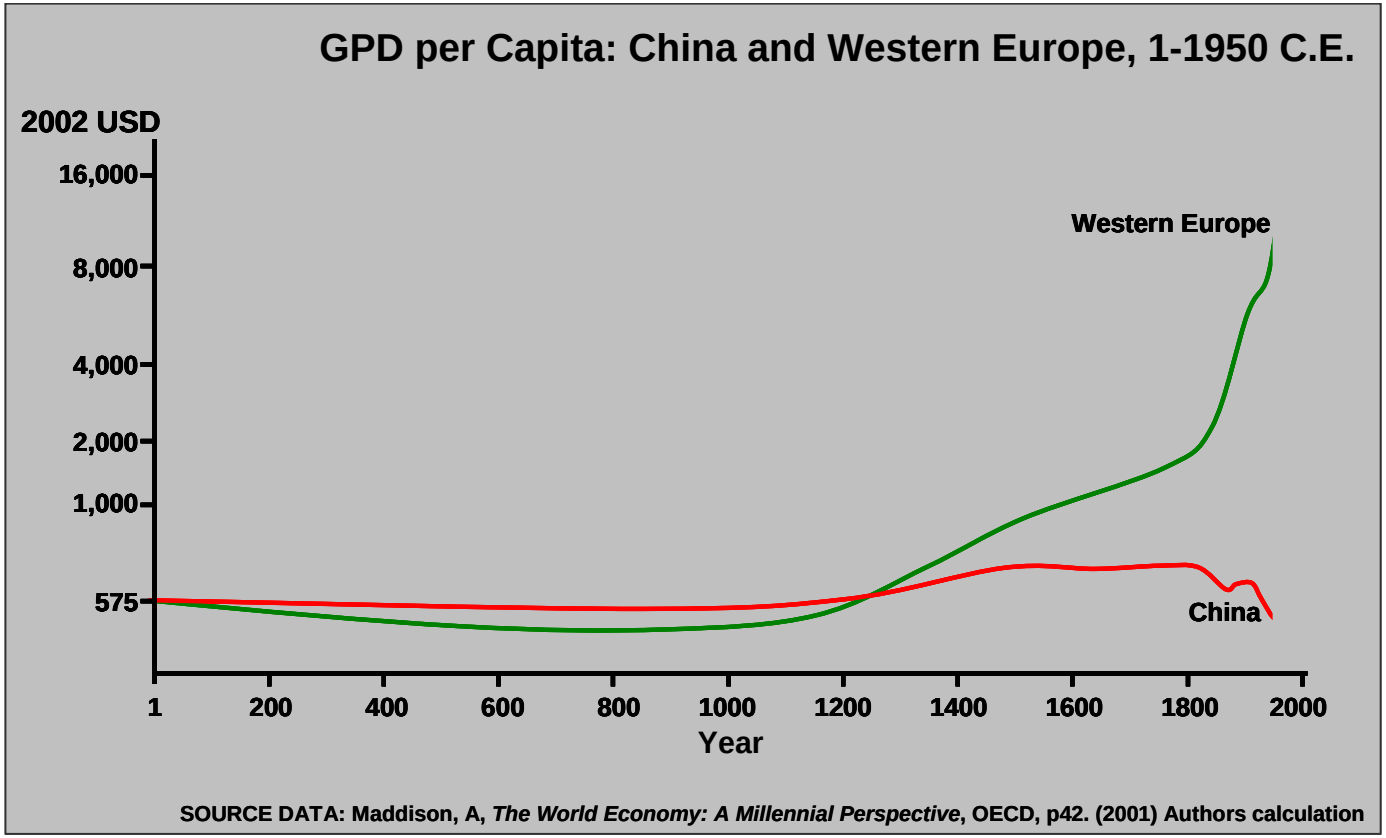
Source: Forbes Feb, 2004

World's 10 Most Profitable Companies

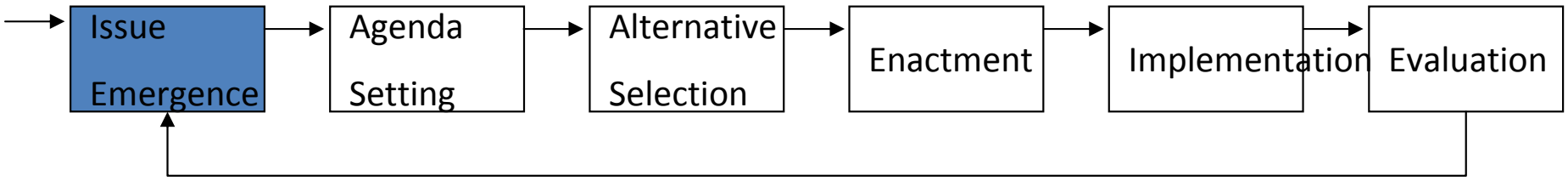
Rank (Country)	Profits in billion $
1. ExxonMobil (United States)	$ 40.61
2. Royal Dutch Shell (Netherlands)	$ 31.33
3. Gazprom (Russia)	$ 23.304
4. General Electric (United States)	$ 22.22
5. BP (United Kingdom)	$ 20.61
6. Total (France)	$ 19.247
7. HSBC Holdings (United Kingdom)	$ 19.14
8. Chevron (United States)	$ 18.70
9. PetroChina (China)	$ 18.21
10. Microsoft (United States)	$ 16.96

Source: Forbes, July 2008

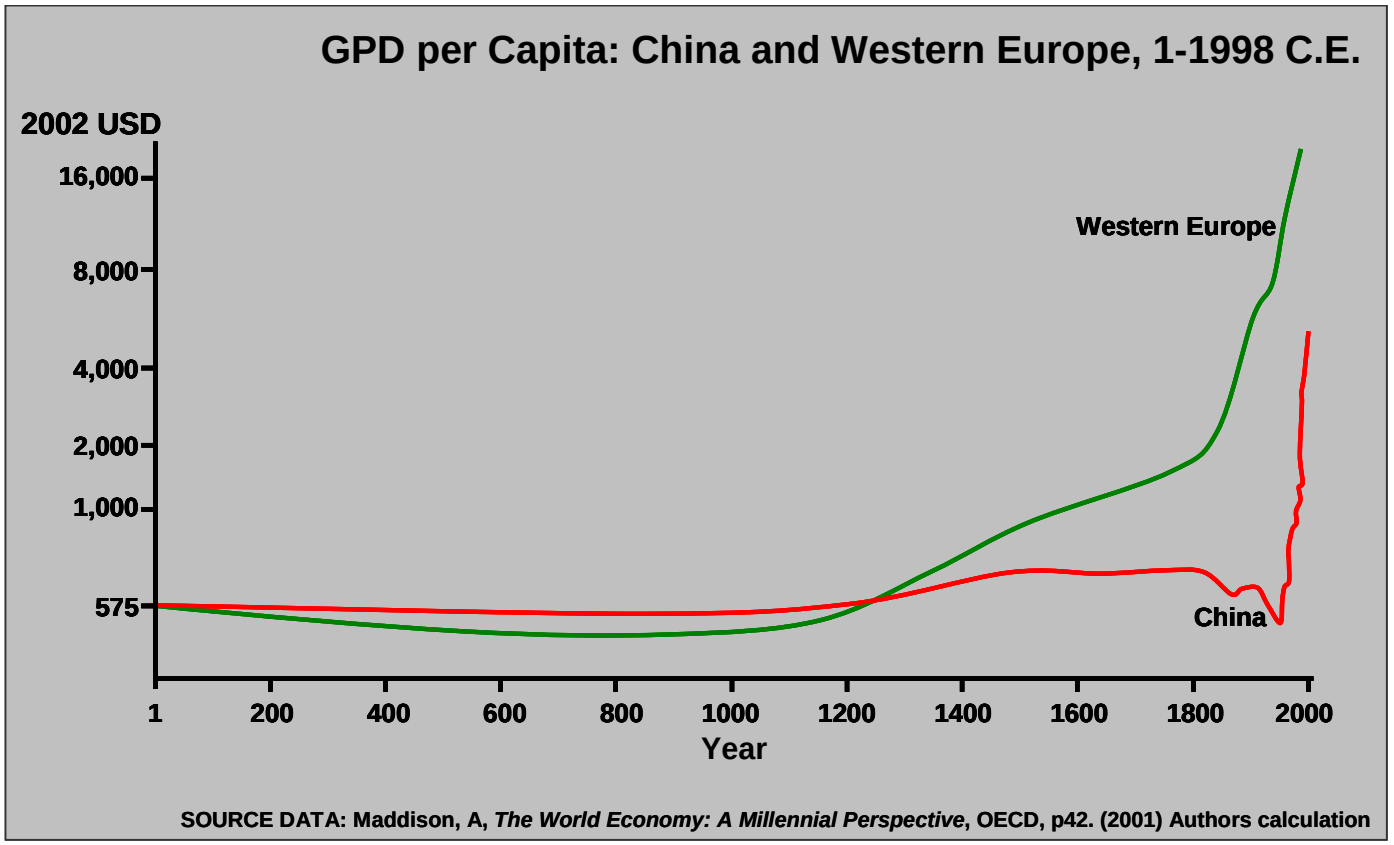
Chinese Economic Development Lags



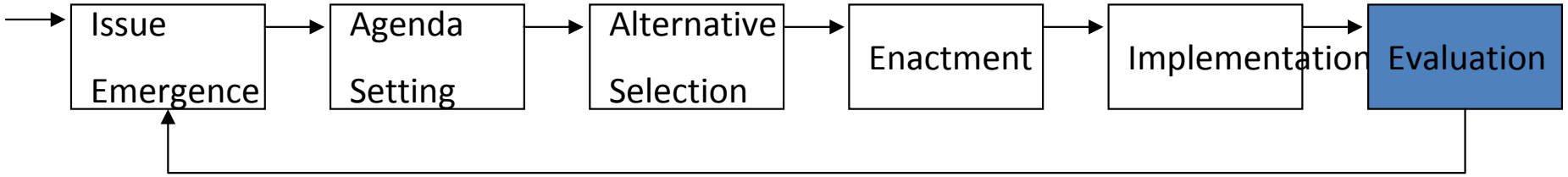
In Europe - Technologies like Printing, Gunpowder & Compass and the Industrial Revolution created dramatic inflections in the continental economy



Chinese Economic Development Surges



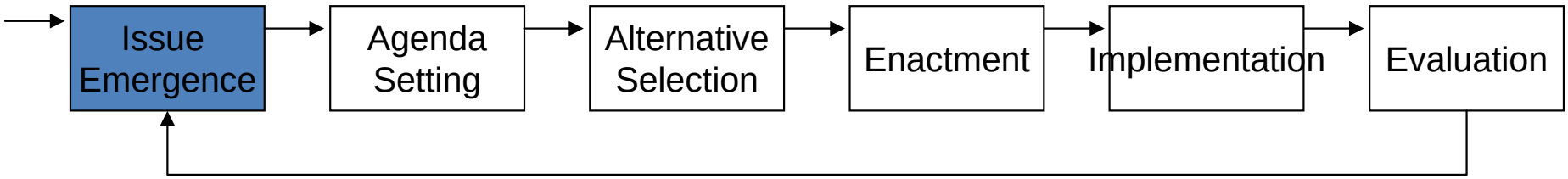
Technologies including ***Atomic science, Semiconductors, Computer technology, Lasers and Automation*** *create turnaround in the Chinese economy*



Chinese Technology

福 Nanotech	
福 Therapeutic Colloidal Au & Ink of FeOx and HgS	<20th Century BCE
福 Decimal System	15th Century BCE
福 Cast Iron	3rd Century BCE
福 Paper	110 CE
福 **Compass**	200 CE
福 **Gunpowder**	750 CE
福 Arched Bridge Construction	600 CE
福 **Printing**	581 CE
福 Military Rocketry	1044 CE
福 Toilet Paper	1391 CE
福 Global Sea navigation	1421 CE

- Chinese technology outpaced Western advances by centuries.
- With a historical leading technology position, why did China fall behind after the industrial revolution of the 19-20th centuries?

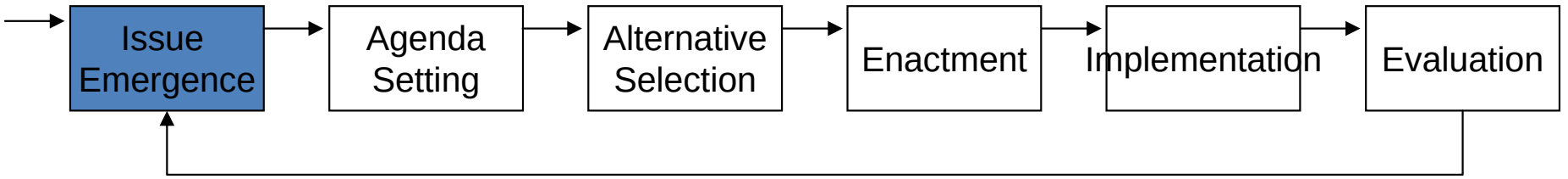


Background on China

- Communist country with current structure founded in 1949.
- The world's fourth largest country in area with 9,596,960 square kilometers (3,705,407 square miles) of total land and water.
- Contains the world's largest population with approximately 1.3 billion people.
- Currently produces 1.42 trillion kWh and exports 10.3 kWh of electricity.
- Currently produces 3.3 million barrels per day and consumes 4.57 million barrels per day of oil.
- Currently produces 30.3 billion cubic meters and consumes 27.4 billion cubic meters of natural gas.
- Second largest energy consumer after the United States.
- Currently have 263 million wired and 269 cellular phone lines.
- Has the second highest rate of Internet users (79.5 million), just behind the United States (159 million).
- Currently spends about $60 billion on military expenditures.
- Available army of 380 million people with an additional 12.5 million reaching age annually.

Issue Emergence - 1976

- Cultural Revolution Over
- Death of Mao Tse-Tung



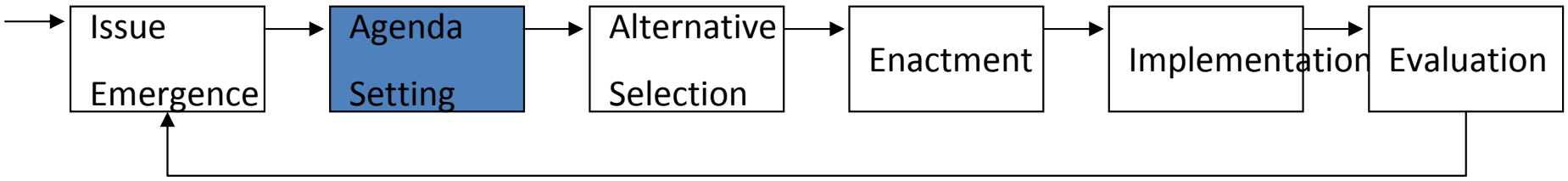
Agenda Setting – 1976-1978

- New Premier Deng Xiaoping establishes a radical new direction for the country

- "Four Modernizations" would command improvements in select key segments of the Chinese economy

  Agriculture – Industry – Military – Science & Technology

Johnson, C., *Foreign Affairs*, Fall78, Vol. 57 Issue 1, p125-137



Agenda Setting – 1976-1978

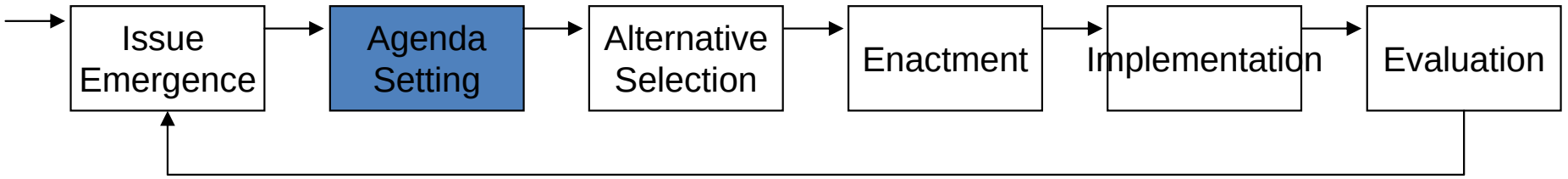
- "Four Modernizations"
  - Agriculture
  - Industry
  - Military
  - Science & Technology

Johnson, C., *Foreign Affairs*, Fall78, Vol. 57 Issue 1, p125-137

Deng Xiaoping

"*the central committee has stipulated that a system of individual responsibility for technical work be established in scientific research institutes and that the system of division of responsibilities among institute directors under the leadership of party committees be set up*." Xinhua General News Service, 21 March 1978

'As long as it catches mice, it does not matter whether the cat is black or white.'



Alternative Selection – 1979-1982

- "The *New* Long March
- "The Great Leap *Westward*."
- "Revolution within a revolution."
- Market socialism - Zhao Ziyang

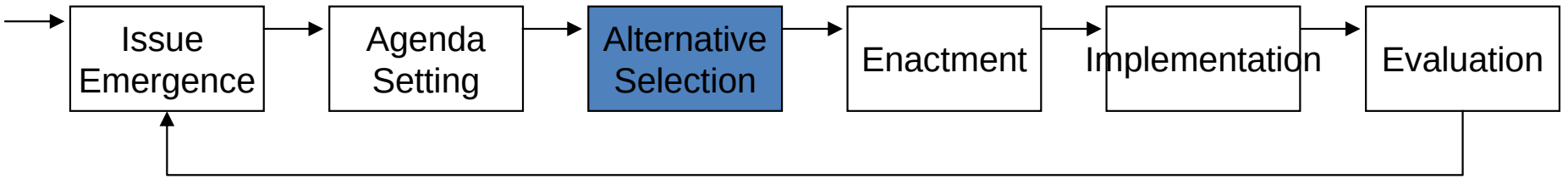
Five Golden Blossoms…

Atomic science – Semiconductors - Computer technology- Lasers- Automation

Yunag-Hwan Jo "China's Future and Ourselves" *Vital Speeches of the Day*; Vol. 45 Issue 10, p302, 3/1/79

- Premier Zhao Ziyang; National Science Awards, 1982.

"*uneven development…rivalry…poor management*"

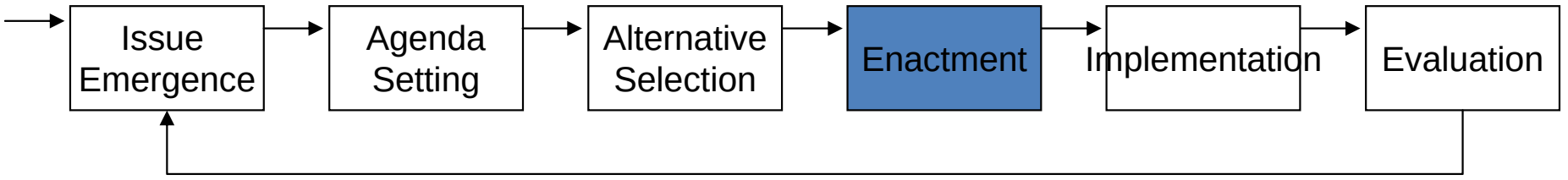


Peoples Republic of China
Science and Technology Mission

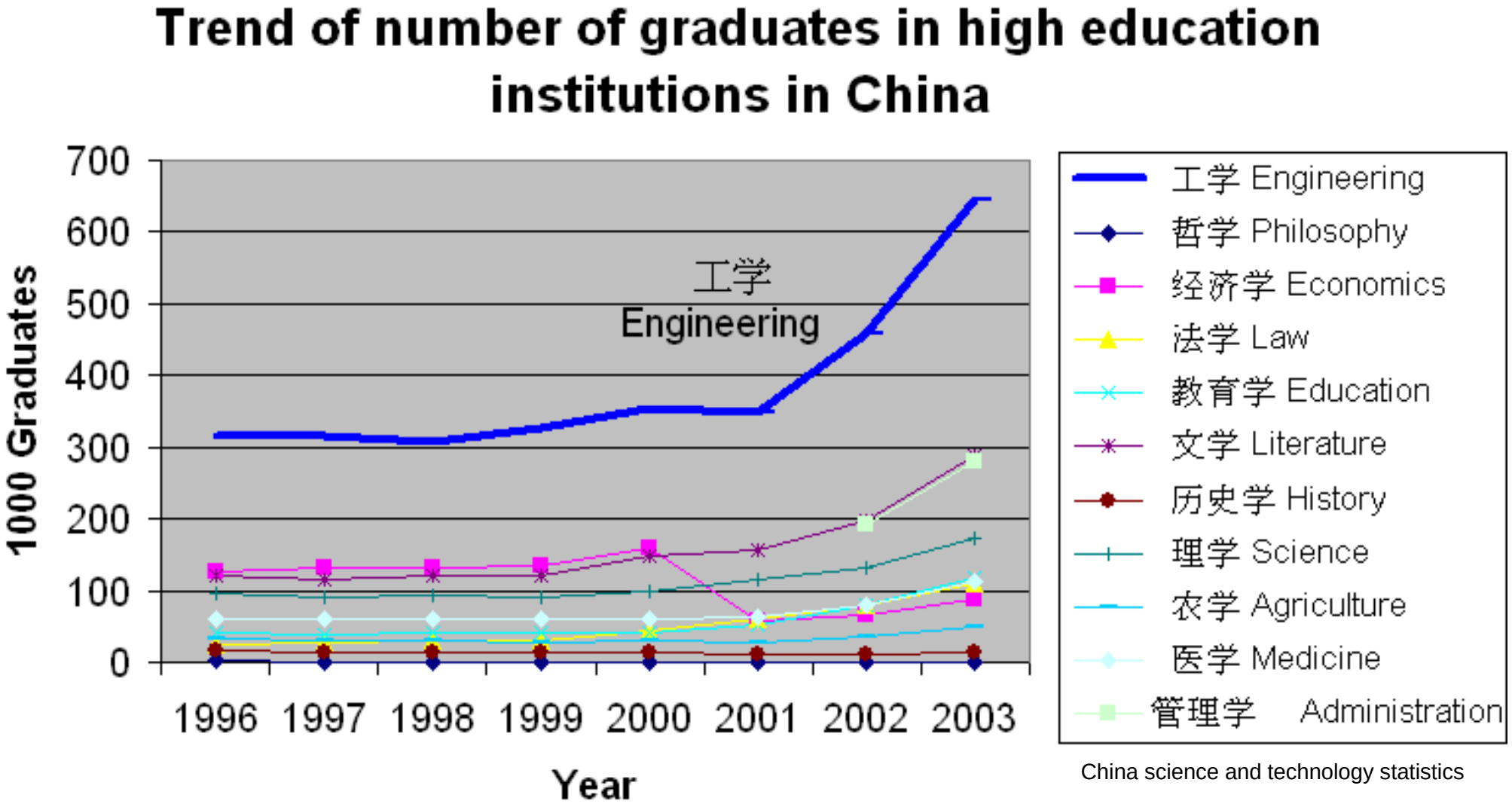
http://www.most.gov.cn/

- To promote and improve innovation
- To strengthen fundamental research and Hi-tech Development
- To guide the transfer of science and technology achievements
- To ensure bilateral international science and technology cooperation and exchange
- To take charge of management of science and technology

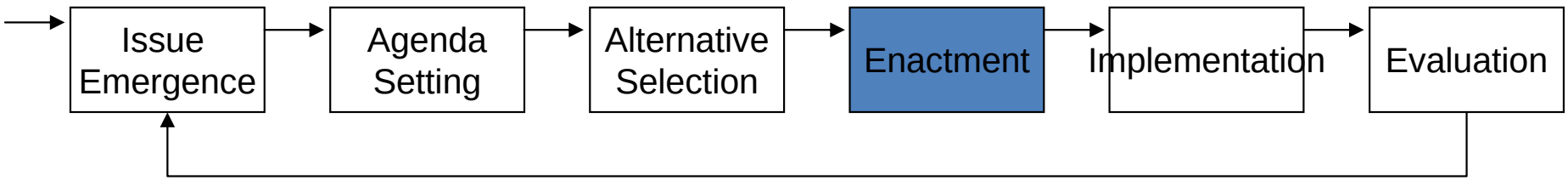
Can a centralized Science & Technology Mission of a non-democratic nation succeed?



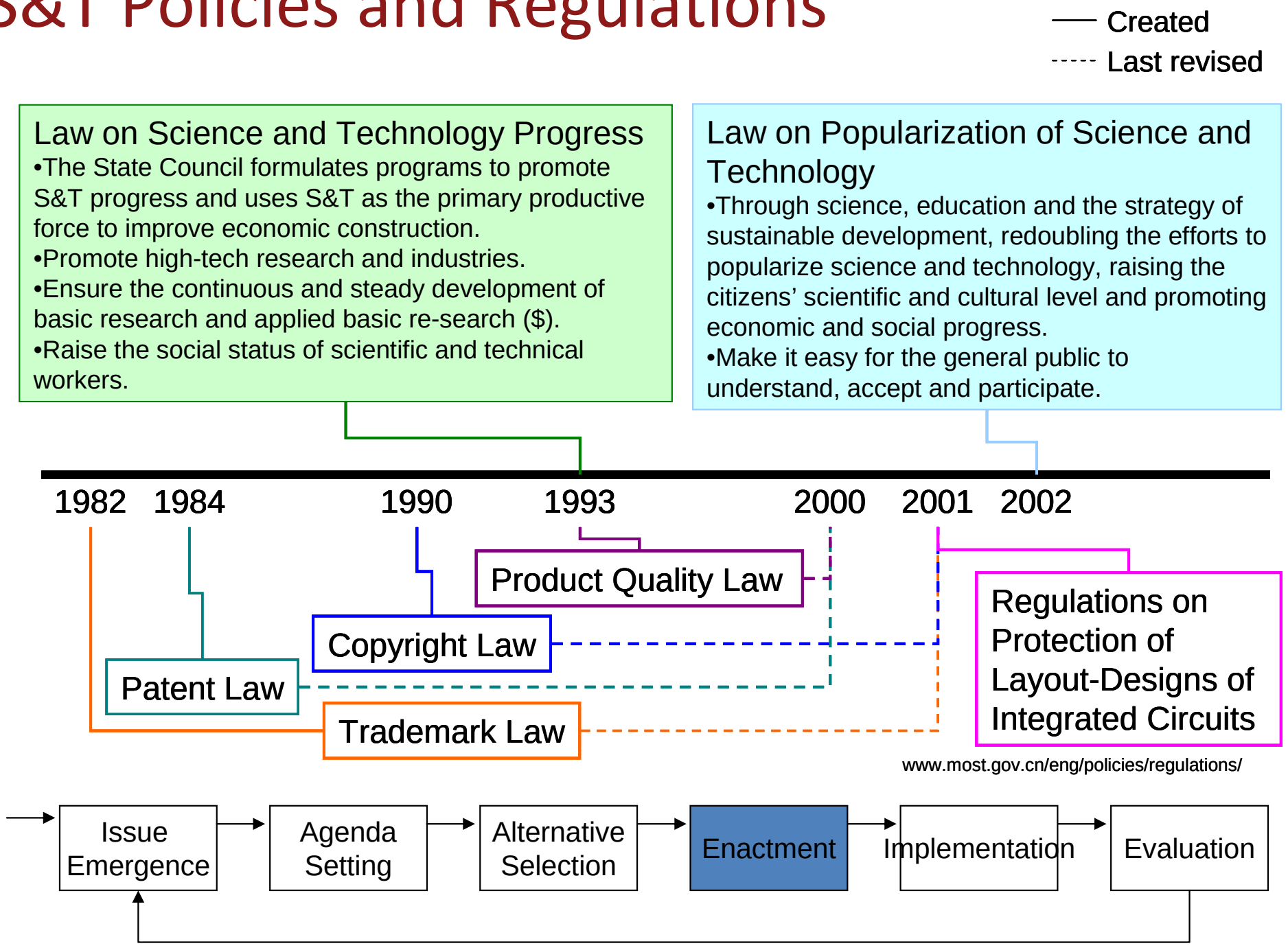
"Revitalizing the nation through science and education"

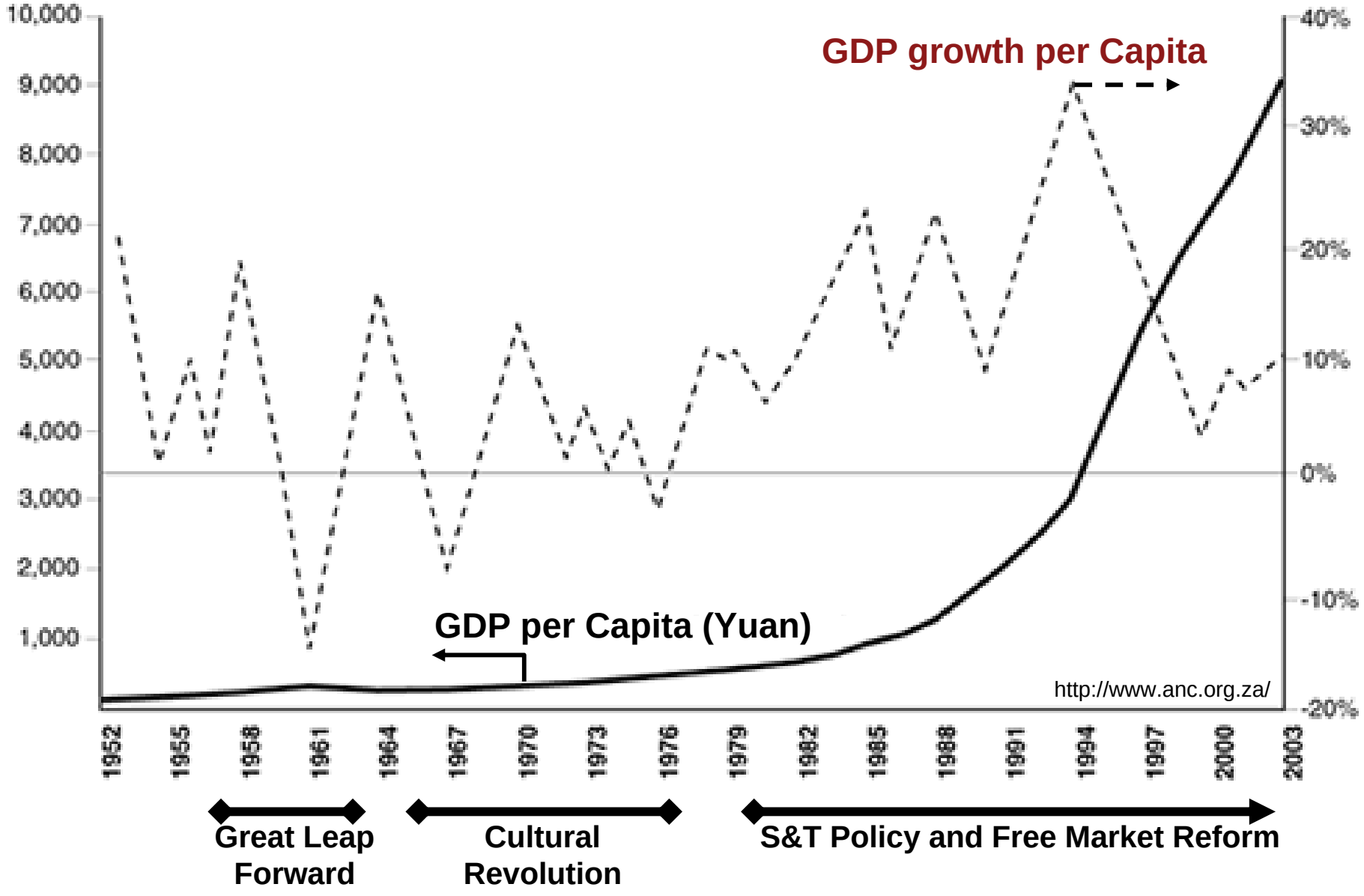


China science and technology statistics



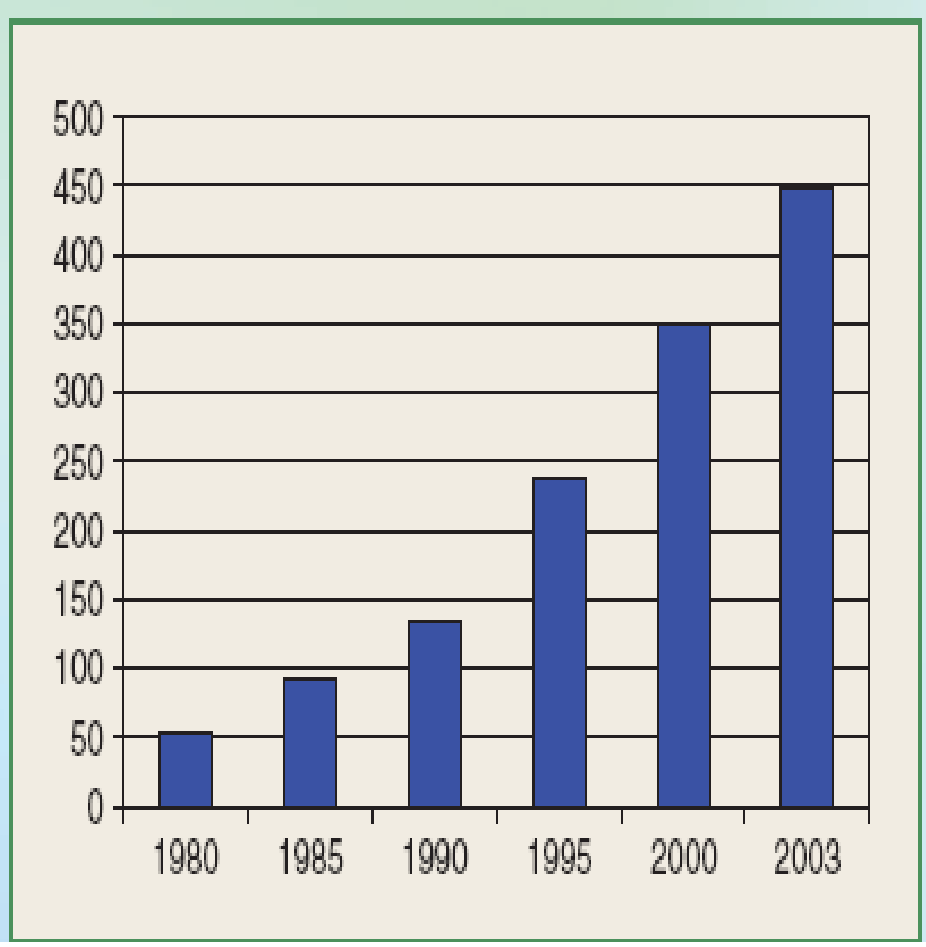
S&T Policies and Regulations




GDP growth per Capita
GDP per Capita (Yuan)
http://www.anc.org.za/
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
40%
30%
20%
10%
0%
-10%
-20%
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
Great Leap Forward
Cultural Revolution
S&T Policy and Free Market Reform

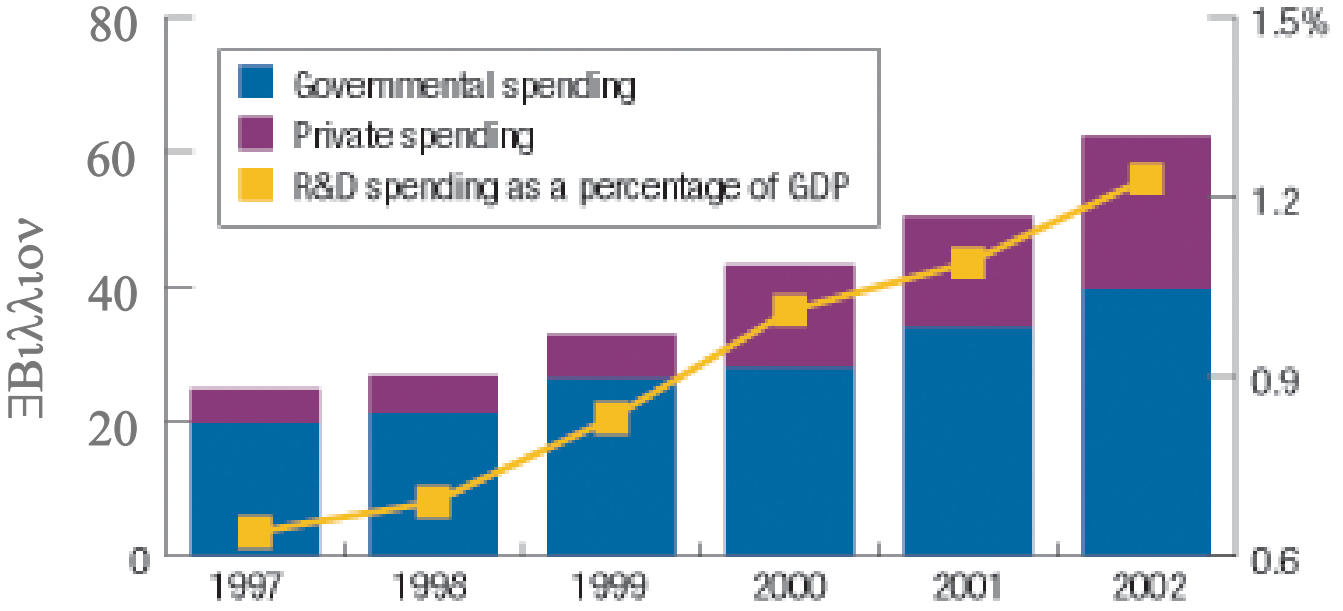
GDP in billions of U.S. dollars (indexed 1980 $)

Since the economic reform in 1980, China has experienced unprecedented economic growth: GDP has jumped more than 800%.
The corresponding growth in primary energy consumption has increased only 278%.
The energy intensity, measured in terms of energy consumption in kilogram of coal equivalent (kgce) per economic output in dollar of Chinese yuan, dropped from 1.33 to 0.46. There are many factors contributing to this improvement in the more efficient usage of energy.
A major one may be attributed to the fact that the share of electricity utilization (a more efficient means of energy usage in most cases) in the total energy consumption has more than doubled, up from 20.6% to 43.8%. As a result, the growth in electricity has surged 634% since 1980. This figure shows the growth in the economy:



Implementation – Chinese R&D Spending

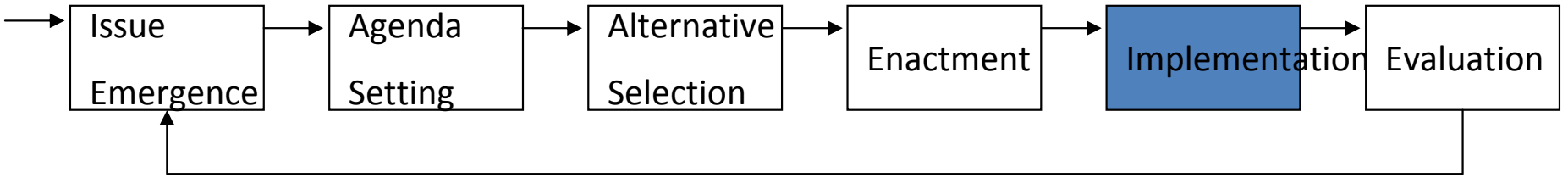
20% Compound Annual Growth Rate (CAGR) *in R&D Expenditures: 1991–2002*



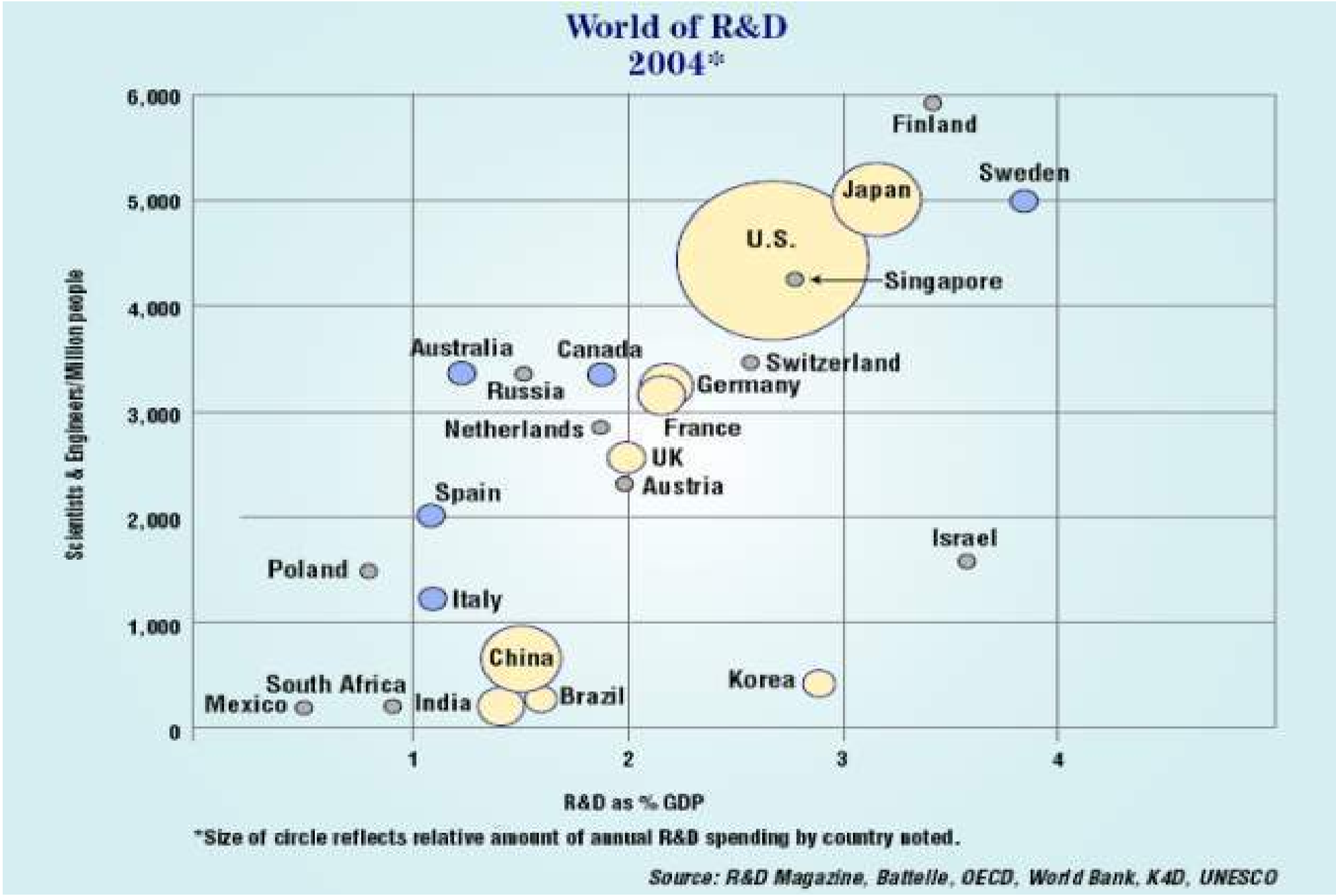
Chinese yuan were converted at the official Bank of China exchange rate, 8.28 yuan per U.S. dollar.

SOURCE: MINISTRY OF SCIENCE AND TECHNOLOGY, PEOPLE'S REPUBLIC OF CHINA

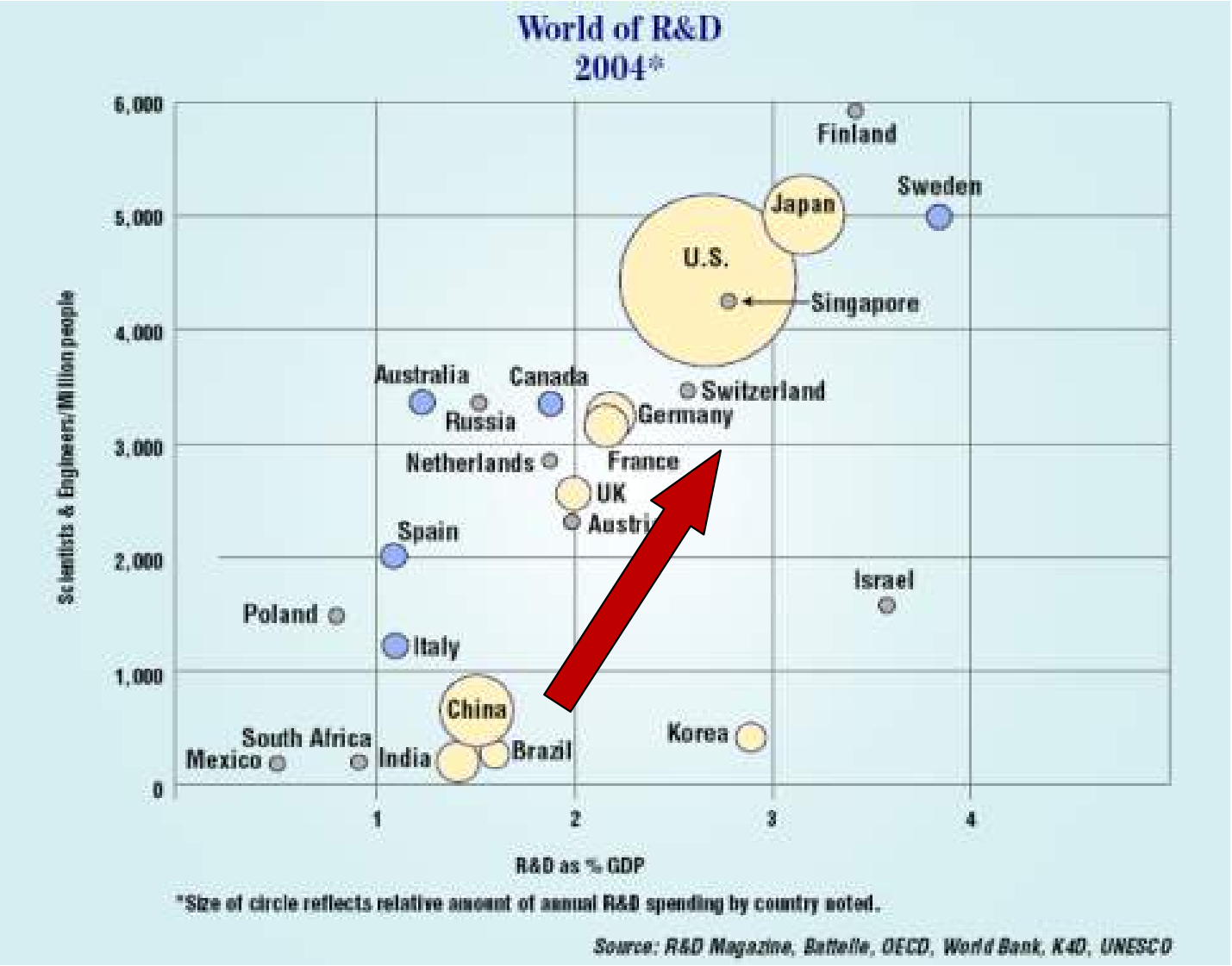
Chinese R&D expenditure is 3rd largest globally behind US & Japan

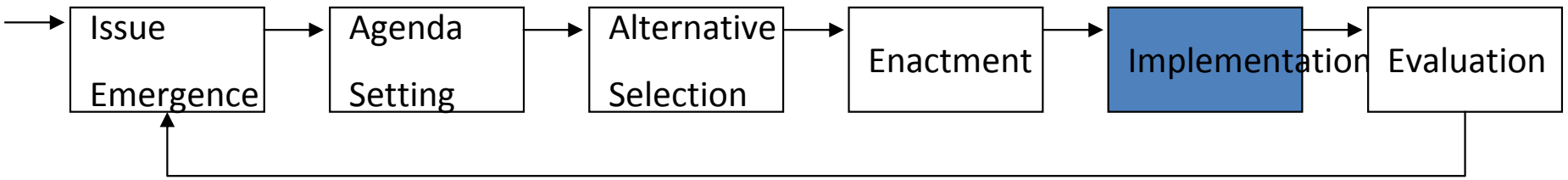


Global R&D Potential (2004 data)

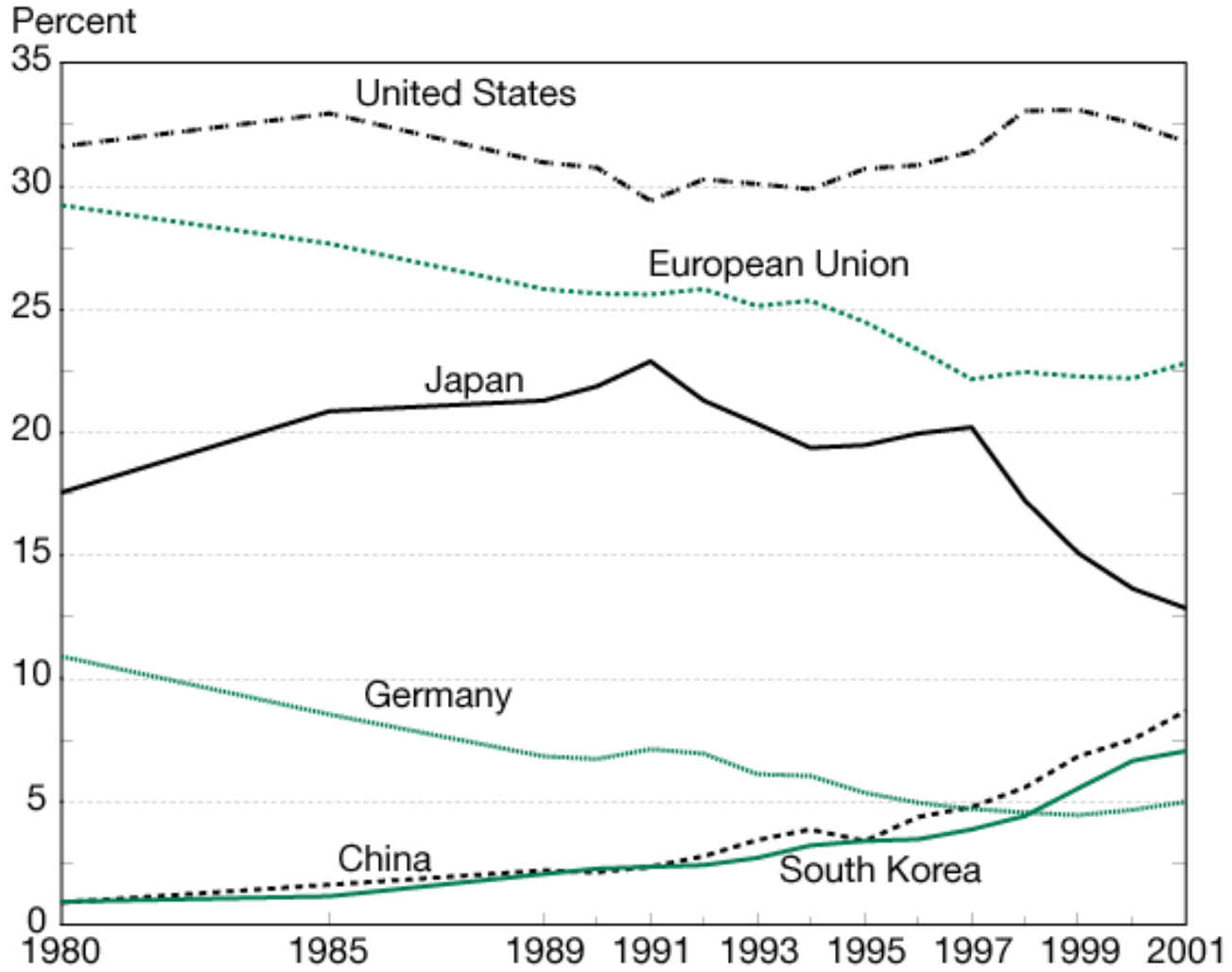


Global R&D Potential 2004



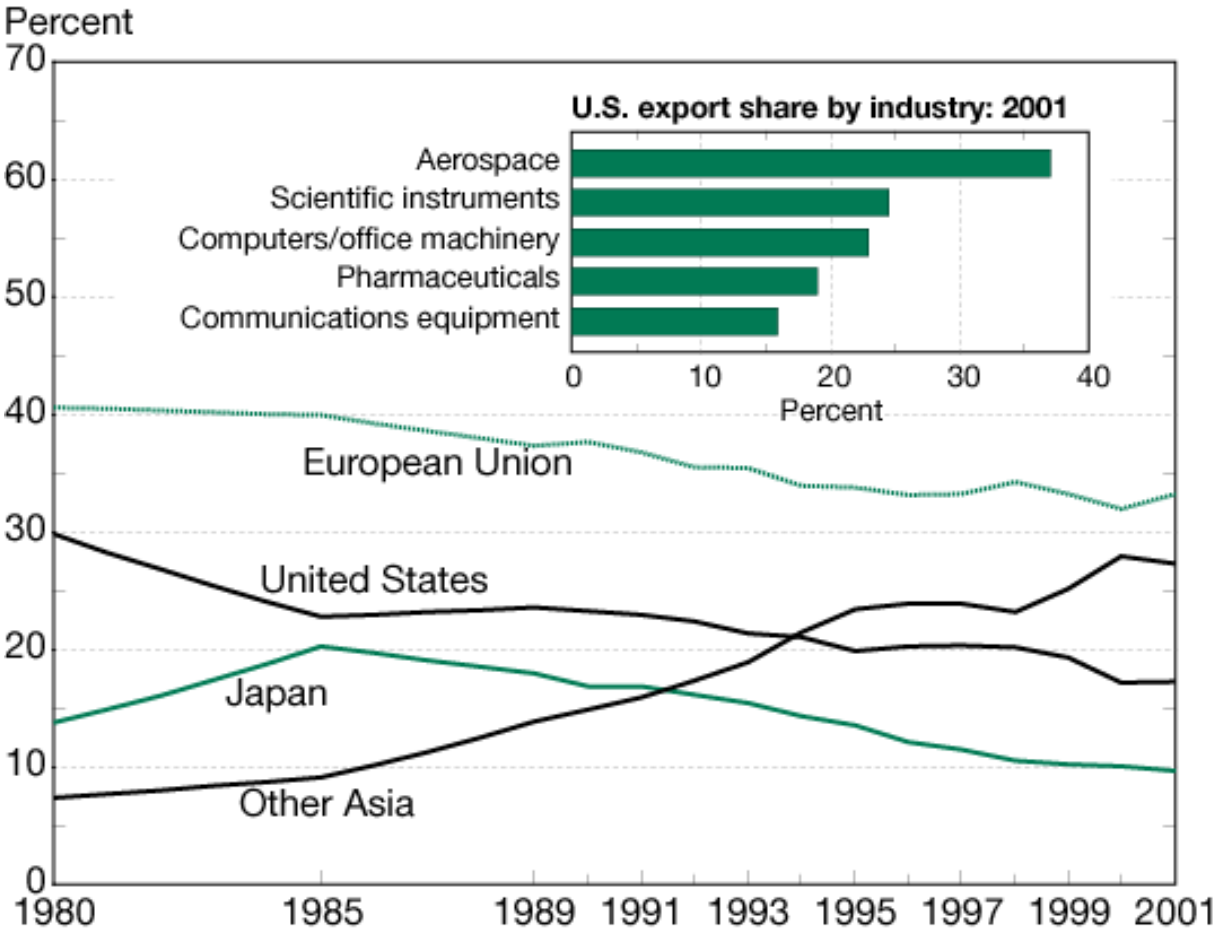


Global high-technology market share, by selected country/region: 1980–2001



Source: NSF, Science and Engineering Indicators- 2004

Global high-technology export share, by selected country/region: 1980–2001



NOTES: Other Asia includes China, South Korea, Malaysia, Singapore, and Taiwan. Data for 1981–84 and 1986–88 are extrapolated.

Source: NSF, Science and Engineering Indicators- 2004

Free Market Vision

- Zhao Ziyang - China's greatest liberal
- Market-Liberal Vision
  - Strengthening the socialist legal system
  - Advocated new types of institutions to promote development of a market system
- Required political reform
- Viewed as a threat
  - Ousted from General Secretary position
- How would the world look at or deal with China if the Market-Liberal Vision had been fully implemented?

Science and Technology Mission

- To promote and improve innovation
- To strengthen fundamental research and Hi-tech Development
- To guide the transfer of science and technology achievements
- To ensure bilateral international science and technology cooperation and exchange
- To take charge of management of science and technology

How much Innovation has stemmed from China, given its strong S&T Mission?

S & T Policy & Programs

Since	S&T Programs	Implemented through	Goal / Objectives
1982	National Key Technologies R&D Program	Four Five-year Plans	To address pressing major S&T issues in national economic and social development. The program concentrates on the R&D of key and common technologies that drive technical upgrading and restructuring of industries that promote sustainable social development
1986	National High-tech R&D Program (863 Program)	Three Five-year Plans	To boost innovation capacity in the high-tech sectors, particularly in strategic high-tech fields, in order to gain a foothold in the world arena
1997	National Program on Key Basic Research Projects (973 Program)	10th Five-year plan	To build up a solid S&T foundation for the sustainable socio-economic development.
	R&D Infrastructure and Facility Development	10th Five-year plan	To strengthen activities involving basic S&T and public interests and to promote international S&T cooperation along with national S&T bases construction
	Environment Building for S&T Industries	10th Five-year plan	To strengthen policy for environment construction, promote regional economic development, enhance technical services and exchanges, stimulate development of small and medium-sized S&T enterprises (S&T SMEs), vigorously develop S&T intermediaries, and create a sound environment for the commercialization of S&T findings and the their industrialization.
	Mega-projects of Science Research	10th Five-year plan	To take favorable positions in the science frontier in the 21st century and achieve significant technical breakthroughs, leading to industrialization in major fields related to national socio-economic development, all within 3 to 5 years.

Data from Ministry of Science and Technology of the People's Republic of China http://www.most.gov.cn and China Science and Technology Statistics http://www.sts.org.cn

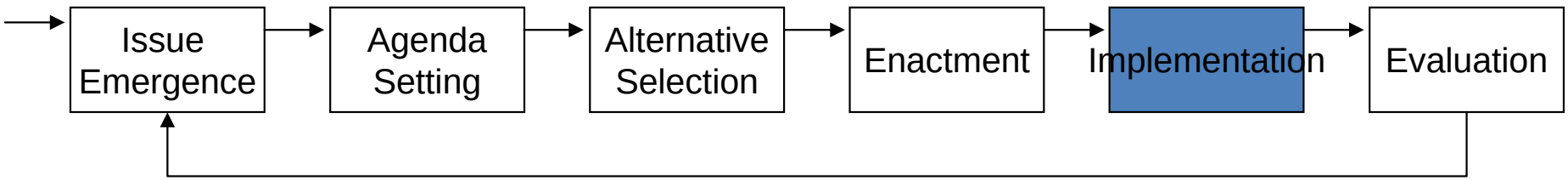
Analysis of Research & Development

- Primary R&D focus
  - Manufacturing
  - Electronics
  - Information Technology
- National R&D expenditure trends
- Distribution of R&D expenditures
- Comparisons to leading countries
  - United States
  - Japan
  - Germany
  - South Korea
- Future R&D projections

Implementation - Special Economic Zones

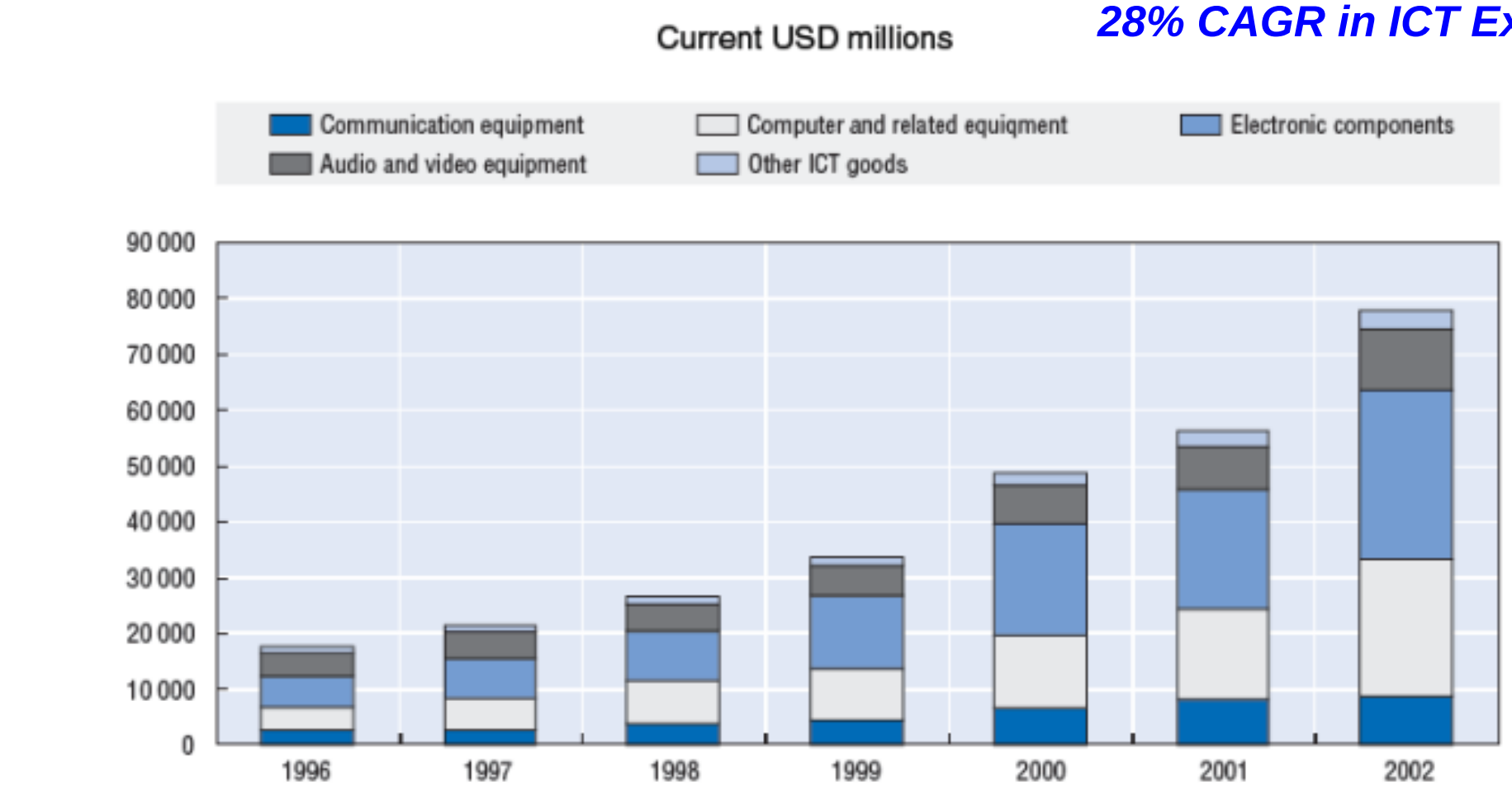
http://en.wikipedia.org/wiki/Special_Economic_Zone

Coastal areas receive intensive infrastructure and investment

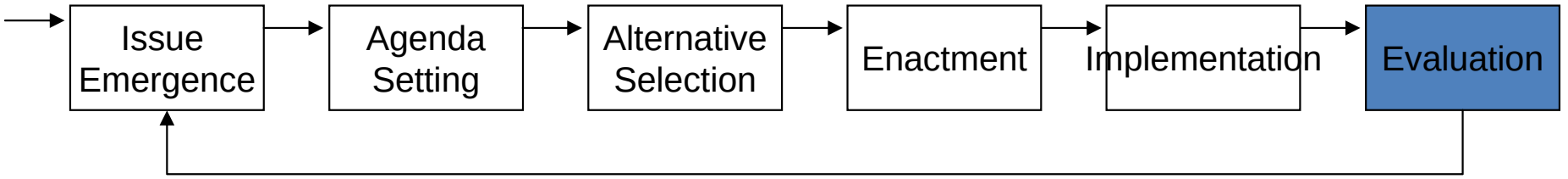


Evaluation – China's Trade in ICT Goods (1996-2002)

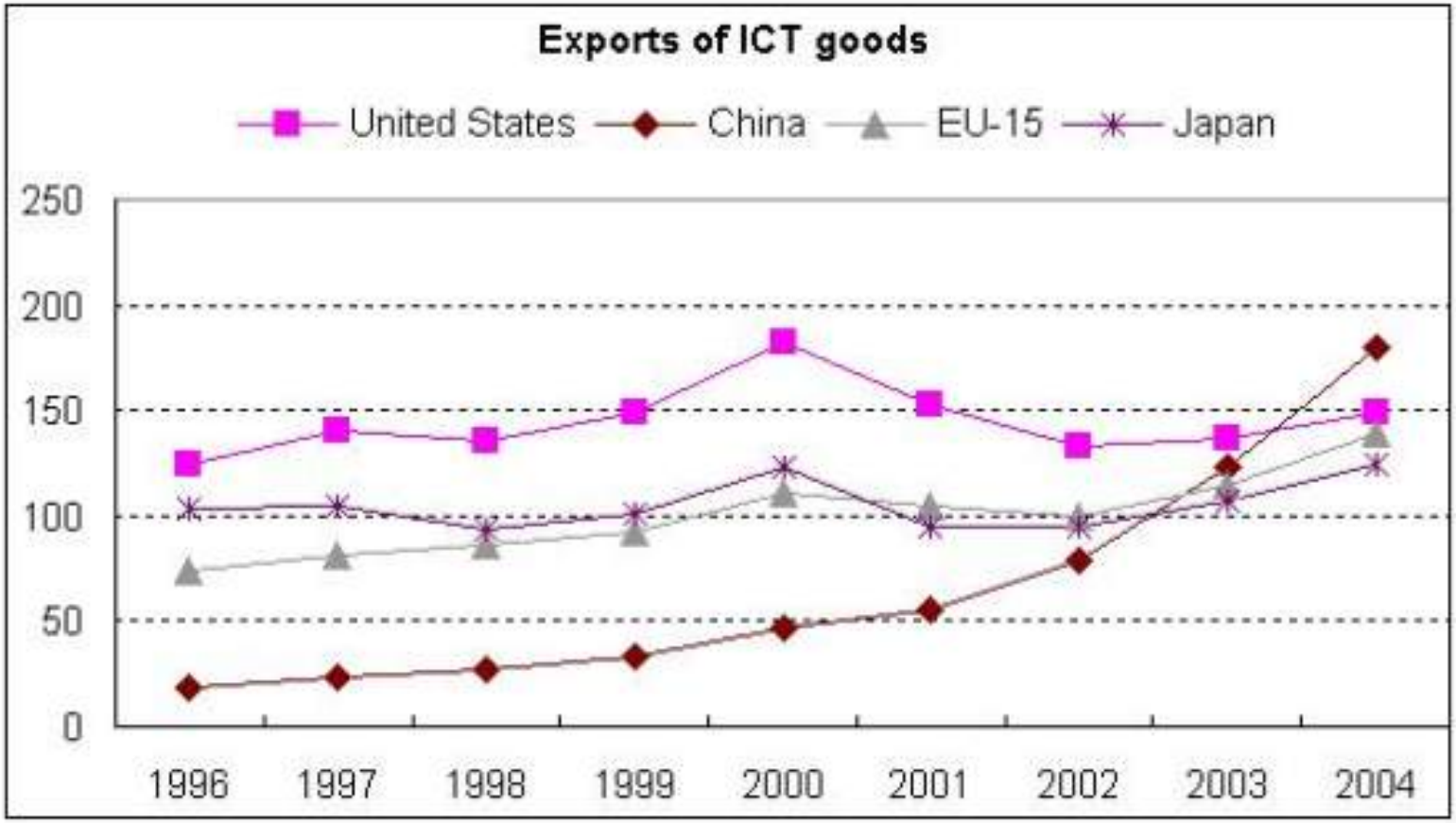
28% CAGR in ICT Exports



Source: OECD ITS database.

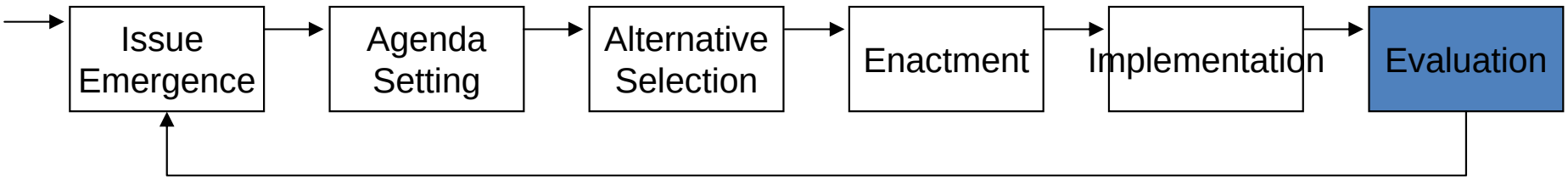


Dominance in Exports of ICT Goods



China is biggest exporter of Information Technology Goods in 2004

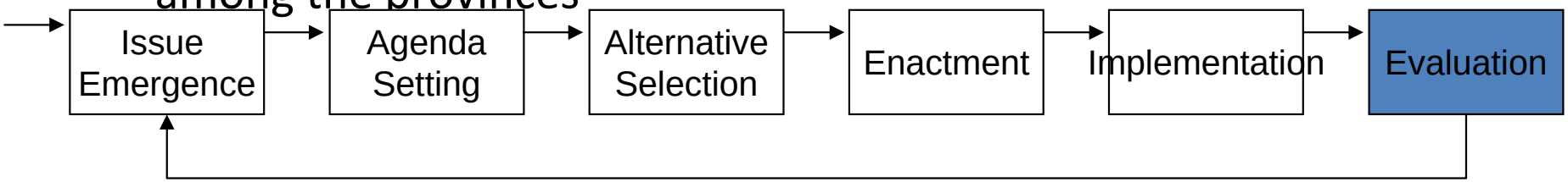
OECD: ITS database.



Centralized v. Free Market S&T Policy

- Centralized Pros
  - Easier implementation of policies
  - Focus on national agenda
  - Administrative control
  - Centralized wealth pool
  - State monitoring and auditing of regions
  - Common policies help streamline resources and provide guidance
  - Uniform policies guide the nation eliminating dysfunction among the provinces

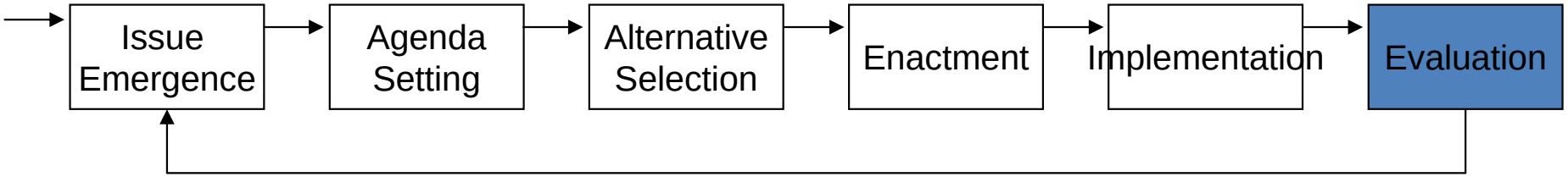
- Free Market Pros
  - Diversified goal seeking reveals unique opportunities
  - Freedom for the investors
  - Many choices for all to participate
  - Increased foreign investment
  - Liberalizing trade agreements
  - Increased consumer choices
  - Optimized resource allocations
  - Broadens global reach



China's Future

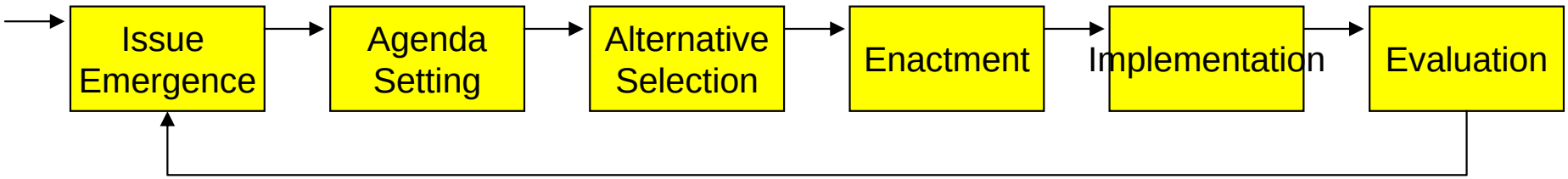
- Exploding technology, innovation & commercial opportunity
- Sustained high growth & expanding private sector
- Unique pattern of urbanization:
  - Society in transition or…
  - Social upheaval
- Further decentralization of economic decision-making
- Increased disparities in incomes between the regions
- Possible scenarios:
  - Highly assertive China bent on regional & global dominance
  - Defensive China obsessed with preventing foreign intervention
  - Chaotic and uneven growth spurs domestic unrest & revolution
  - China cooperates with the West and enjoys "Peaceful Rise"

China – Domestic Change and Foreign Policy; Michael Swaine w/RAND Corp. 1995



Interim Conclusions

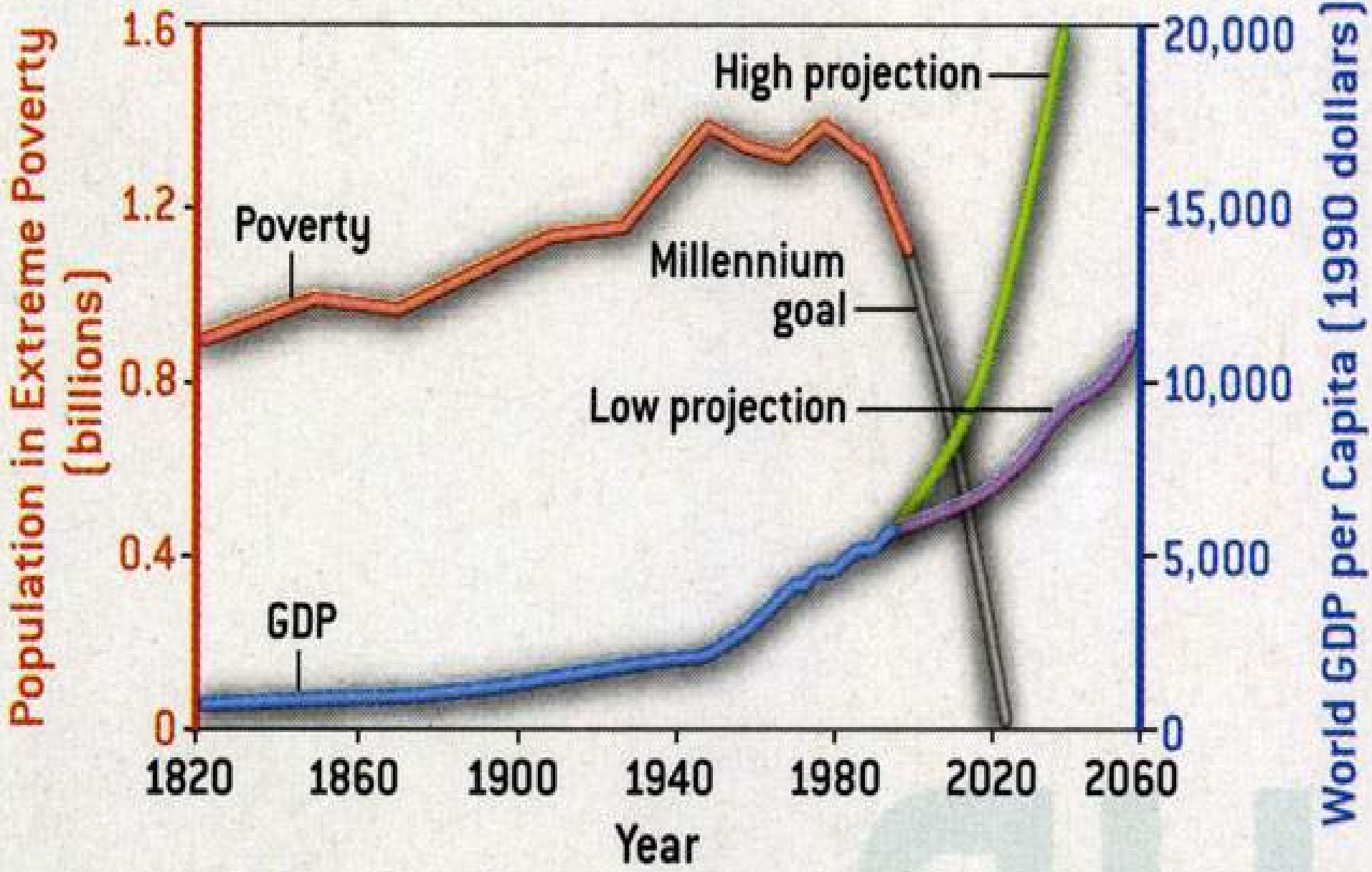
- The Black Box…
  - S&T Policy >> 20% CAGR R&D >> 28% CAGR ICT Trade
- China's 2005 GDP is projected to surpass $1.8T
- 10% GDP growth rate has been spurred and sustained by centralized S&T Policy.
- Wide discrepancy between East and West will need to be addressed to sustain healthy growth
- Centralized policy around education, resources, and science will require balance with Free Market reform.

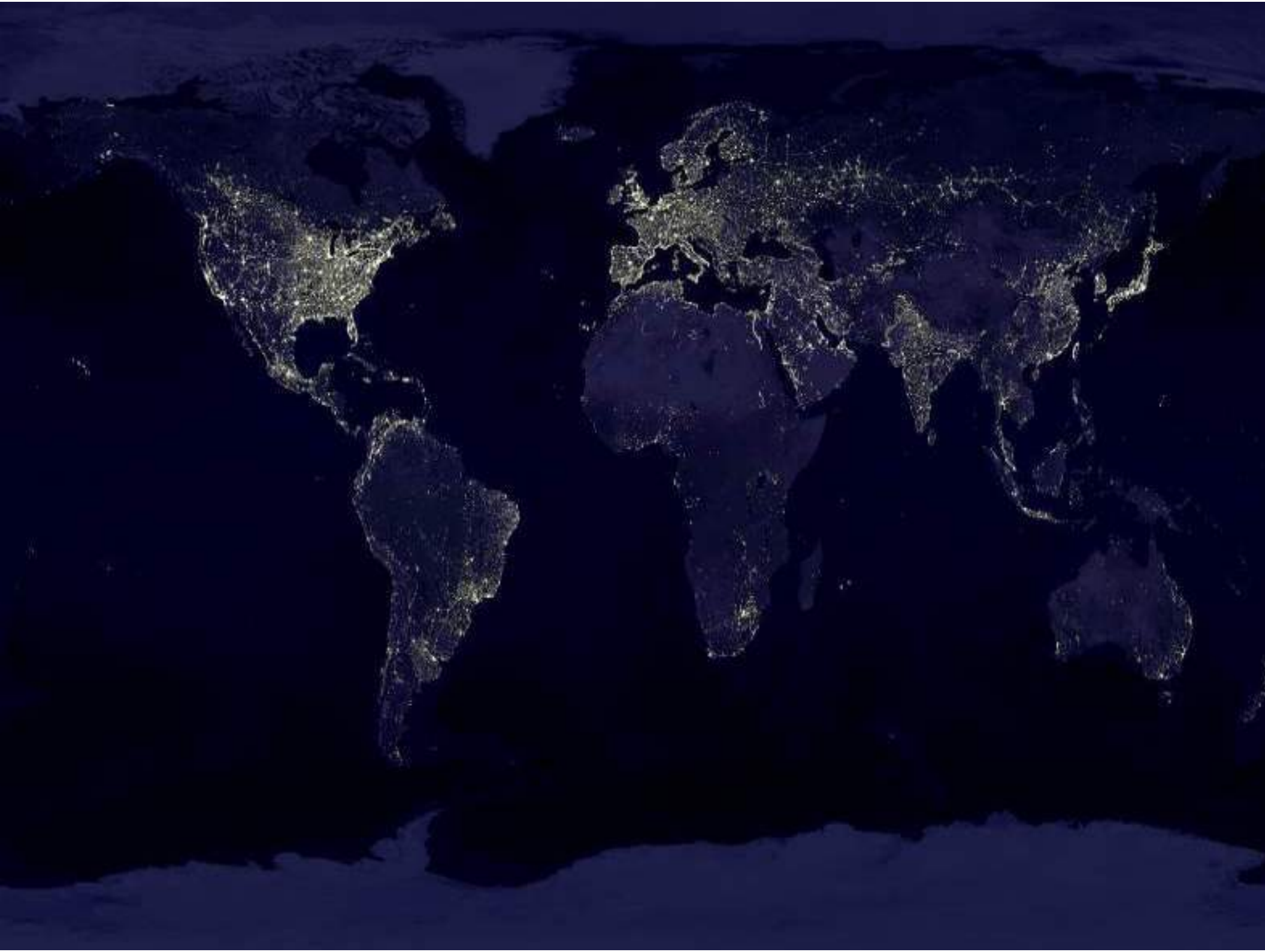


Focus Area:
Power and Energy

Sources: IEEE P&E Magazines, EIA ,and Economist

... PROSPERITY IS SPREADING ...

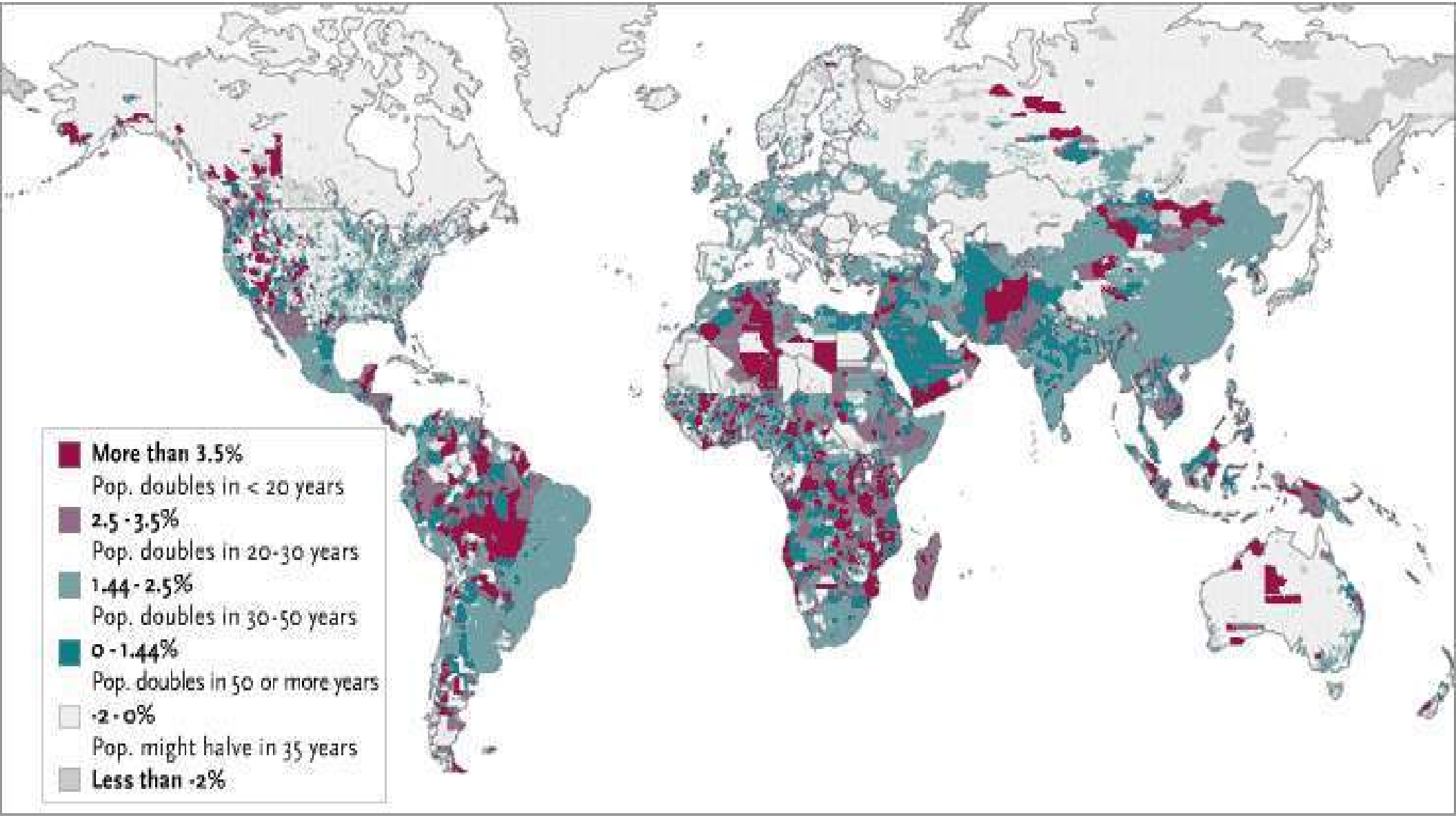




The Energy Gap

- Half the world's population subsists on agrarian or lower levels of energy access, and
- Their population density generally exceeds the carrying capacity of their environment

Context: Earth population growth

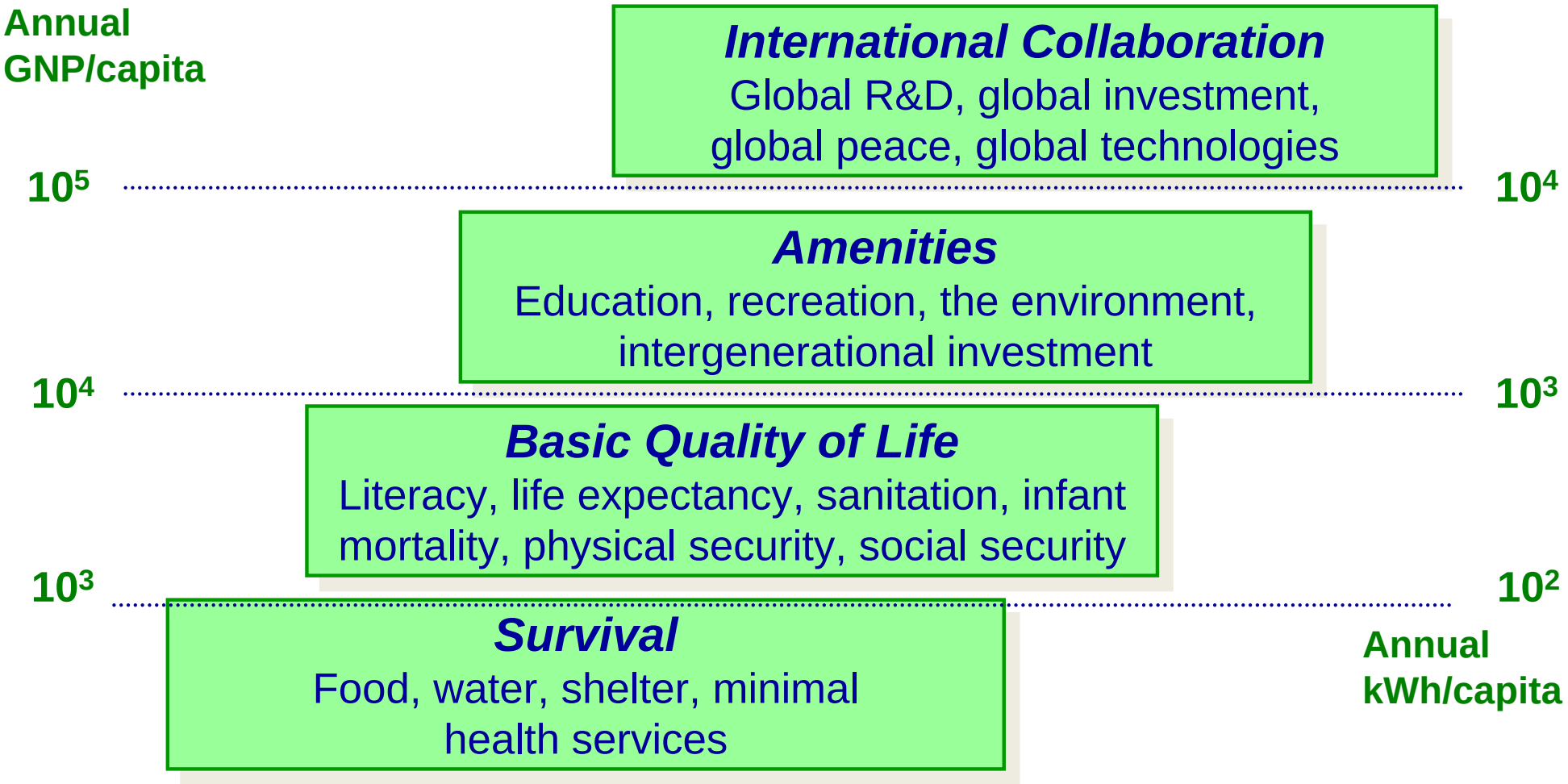


Context: Cities with 10 million people

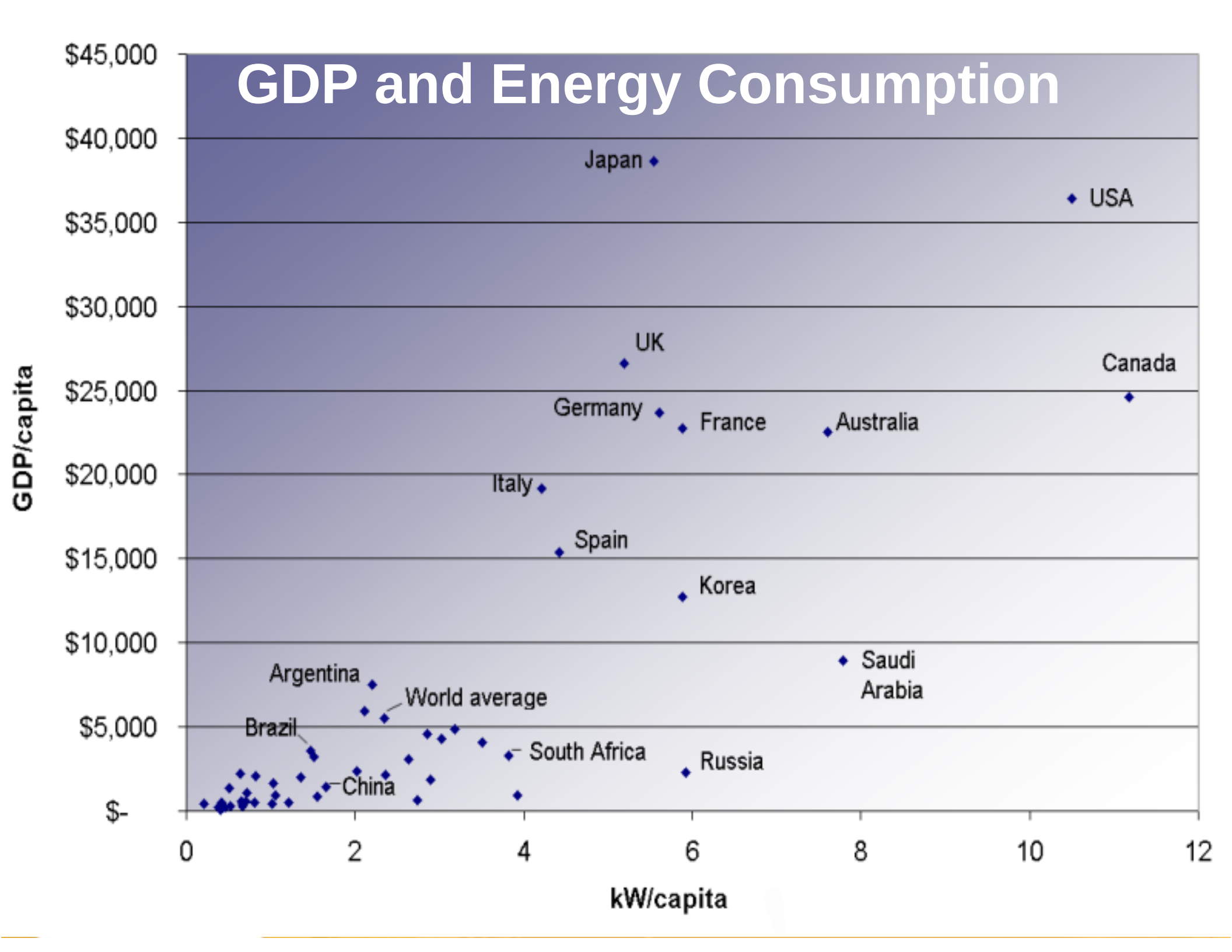
- By 2020, more than 30 mega-cities in the now less-developed world. By 2050, nearly 60 such cities.

- Increased population creates need for more resources. World's electricity supply will need to triple by 2050 to keep up with demand, necessitating nearly 10,000 GW of new generating capacity.

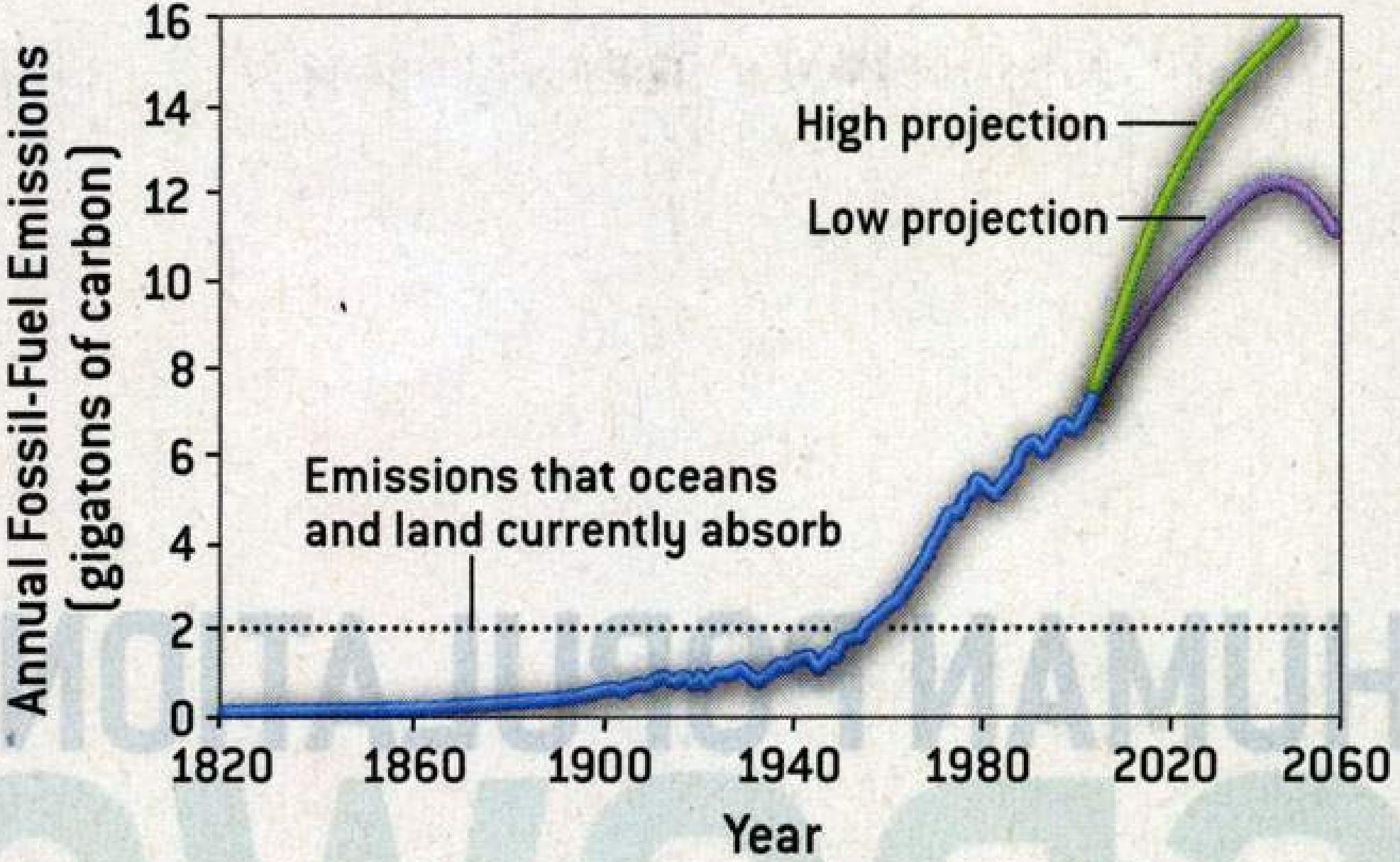
Social Conditions and Access to Electricity



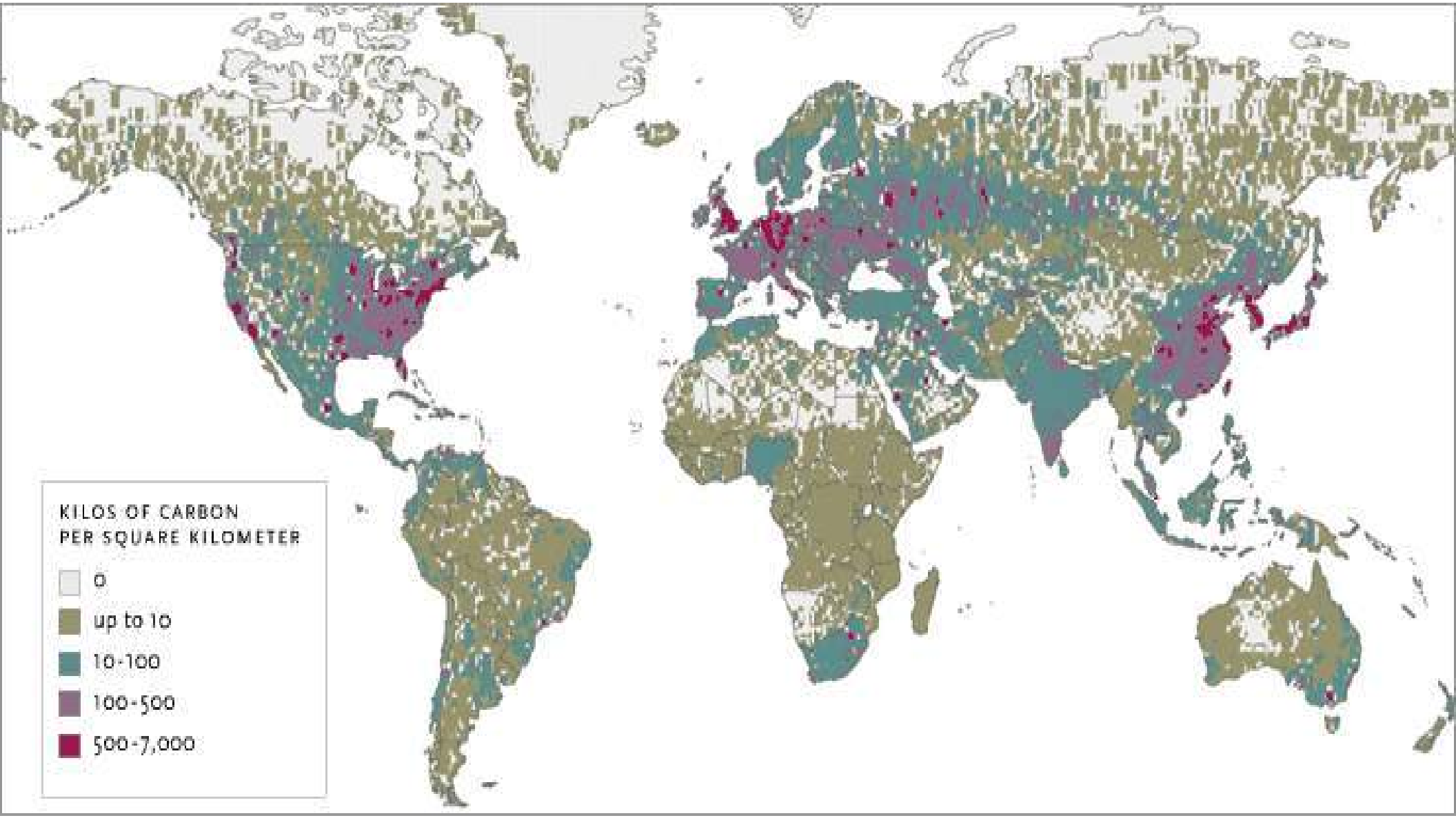
Source: Dr. Chauncey Starr


GDP and Energy Consumption
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
GDP/capita
Japan
USA
UK
Canada
Germany
France
Australia
Italy
Spain
Korea
Saudi Arabia
Argentina
World average
Brazil
South Africa
Russia
China
0
2
4
6
8
10
12
kW/capita

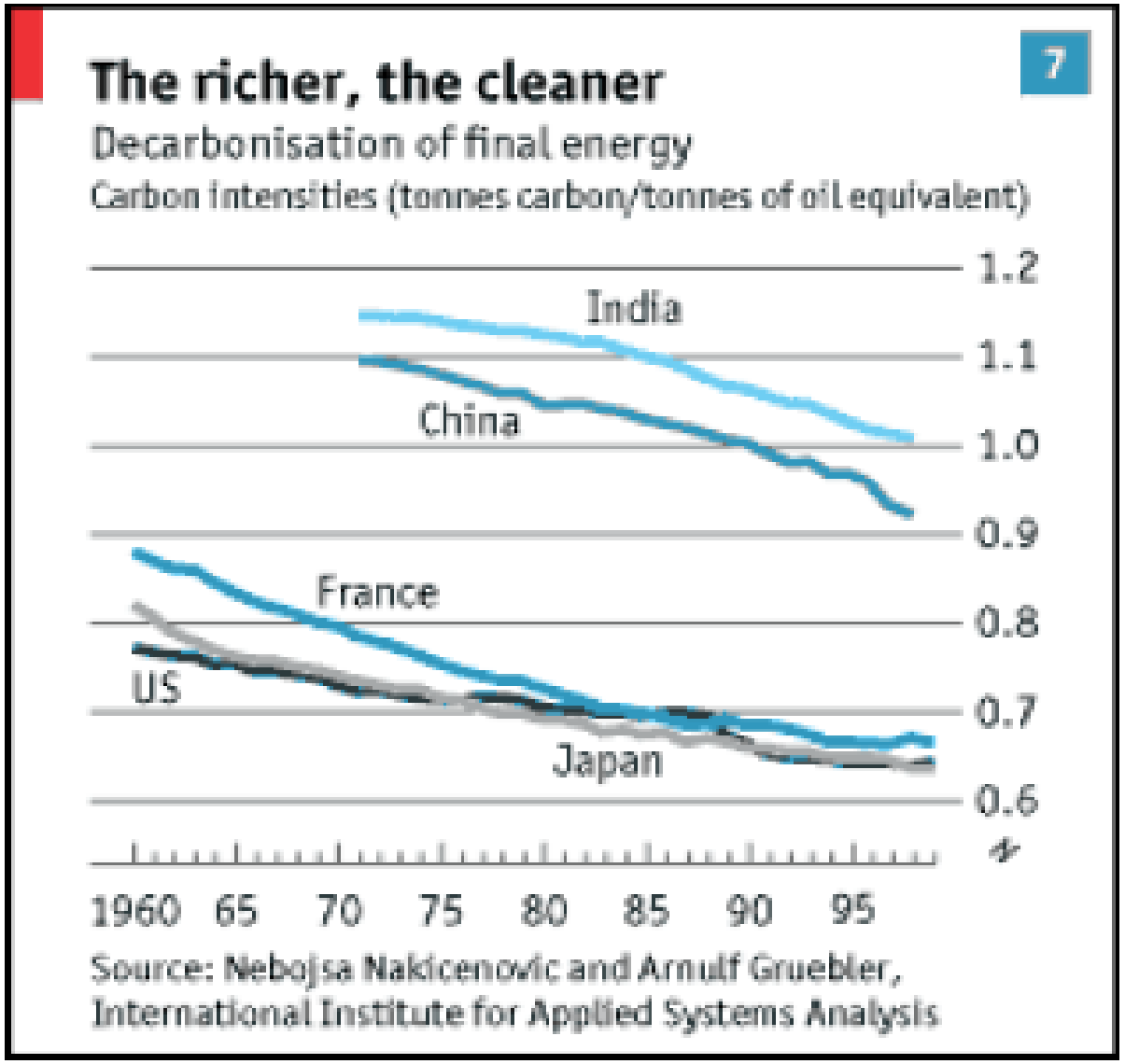
. . . BUT CO_2 EMISSIONS ARE TROUBLING



Context: Global Emissions



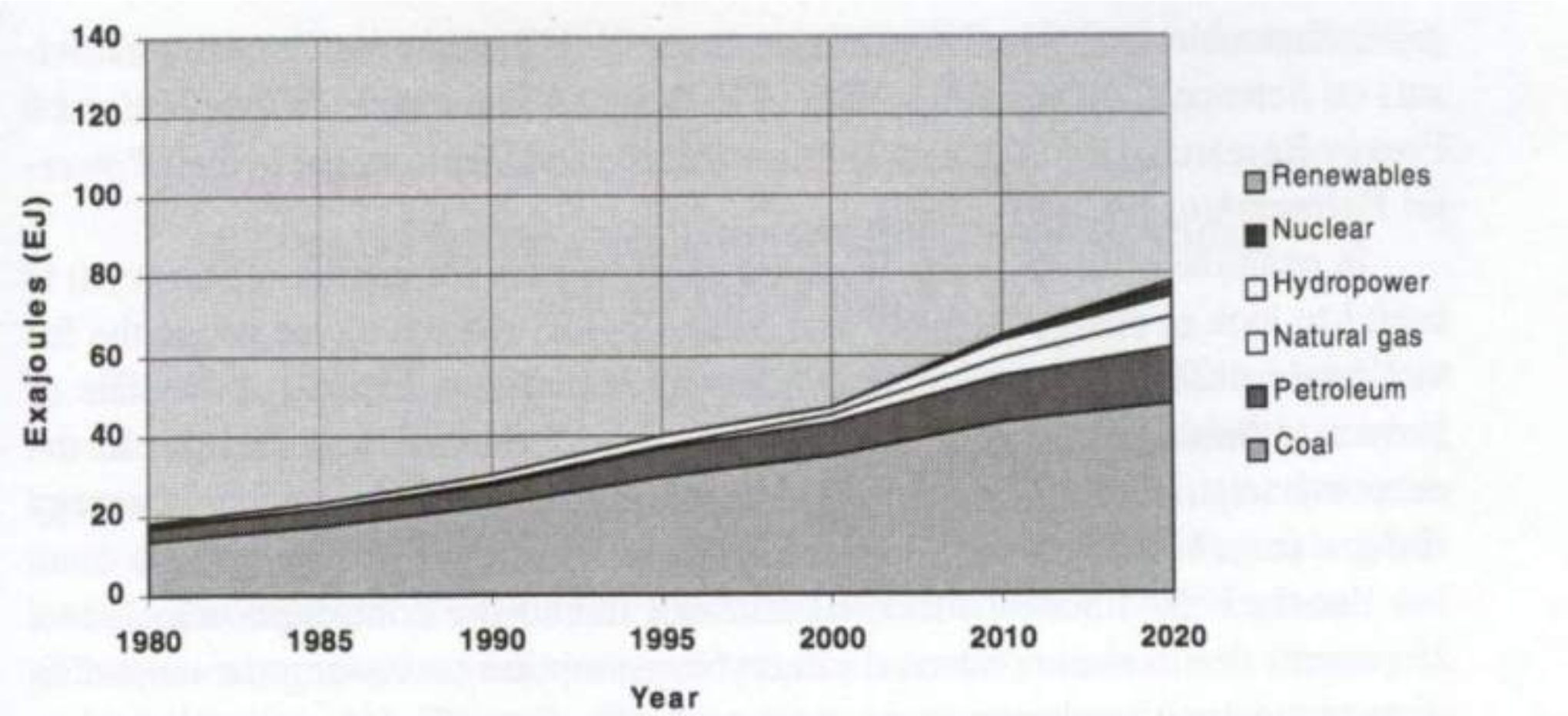
S&T for Sustainable Development



Source: RFF, 2002

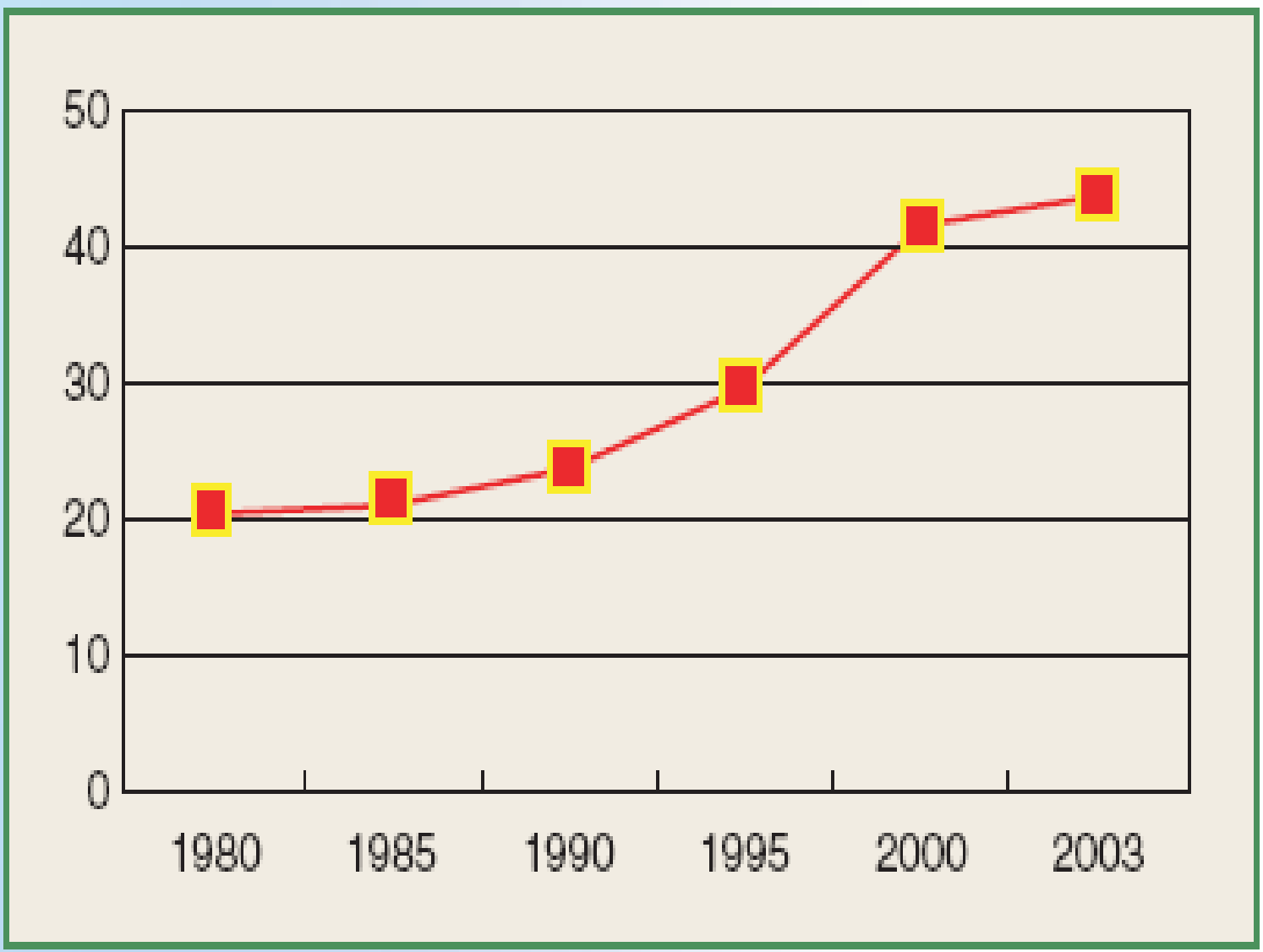
Chinese Commercial Energy Consumption

(Chinese Academy of Engineering, 1997)

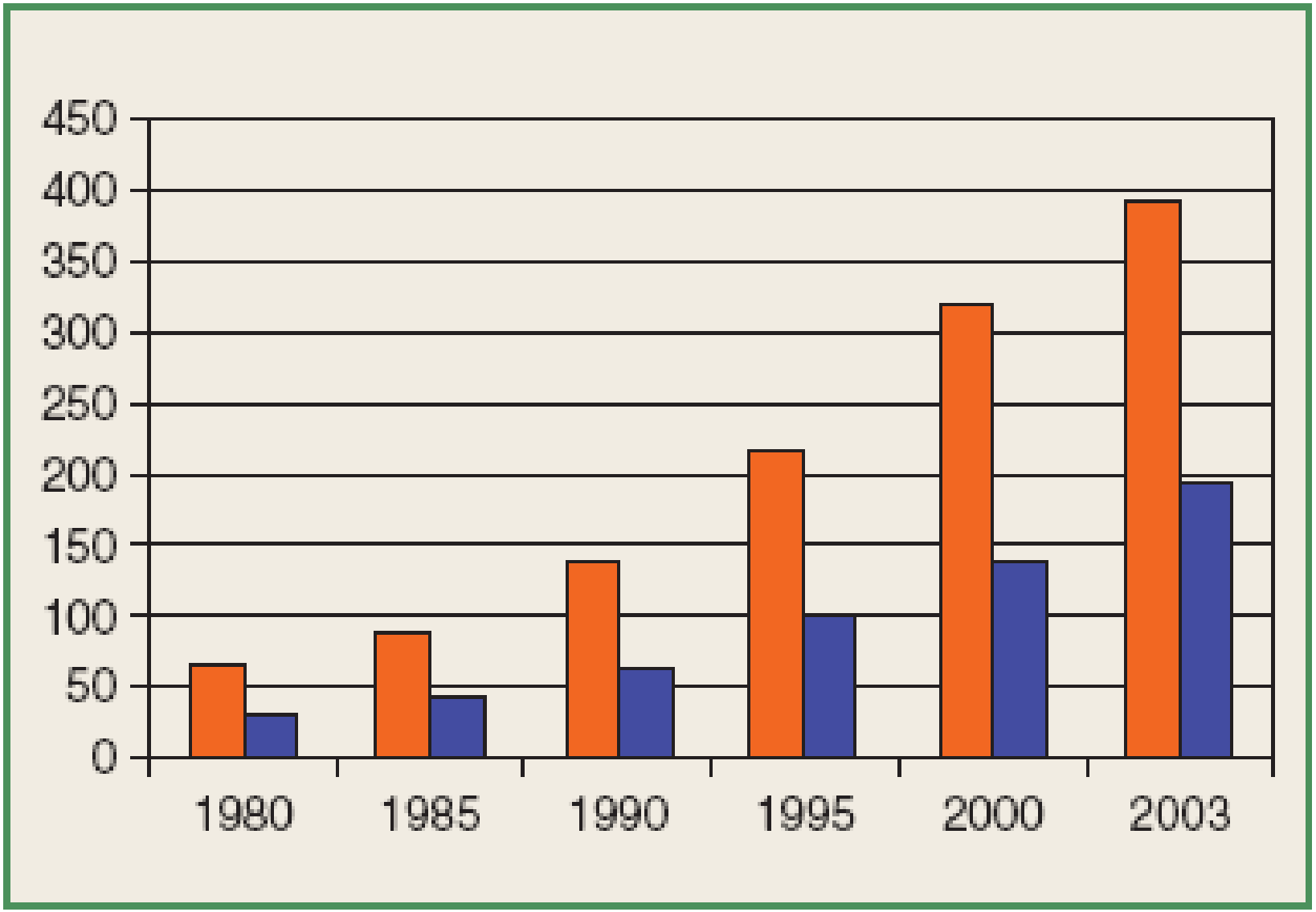


Consider the couplings in GDP and electricity use: quadrupling of GDP between 1980-1995, while doubling the economy's energy demand– due to economic reforms and comprehensive national energy conservation programs since 1980s.

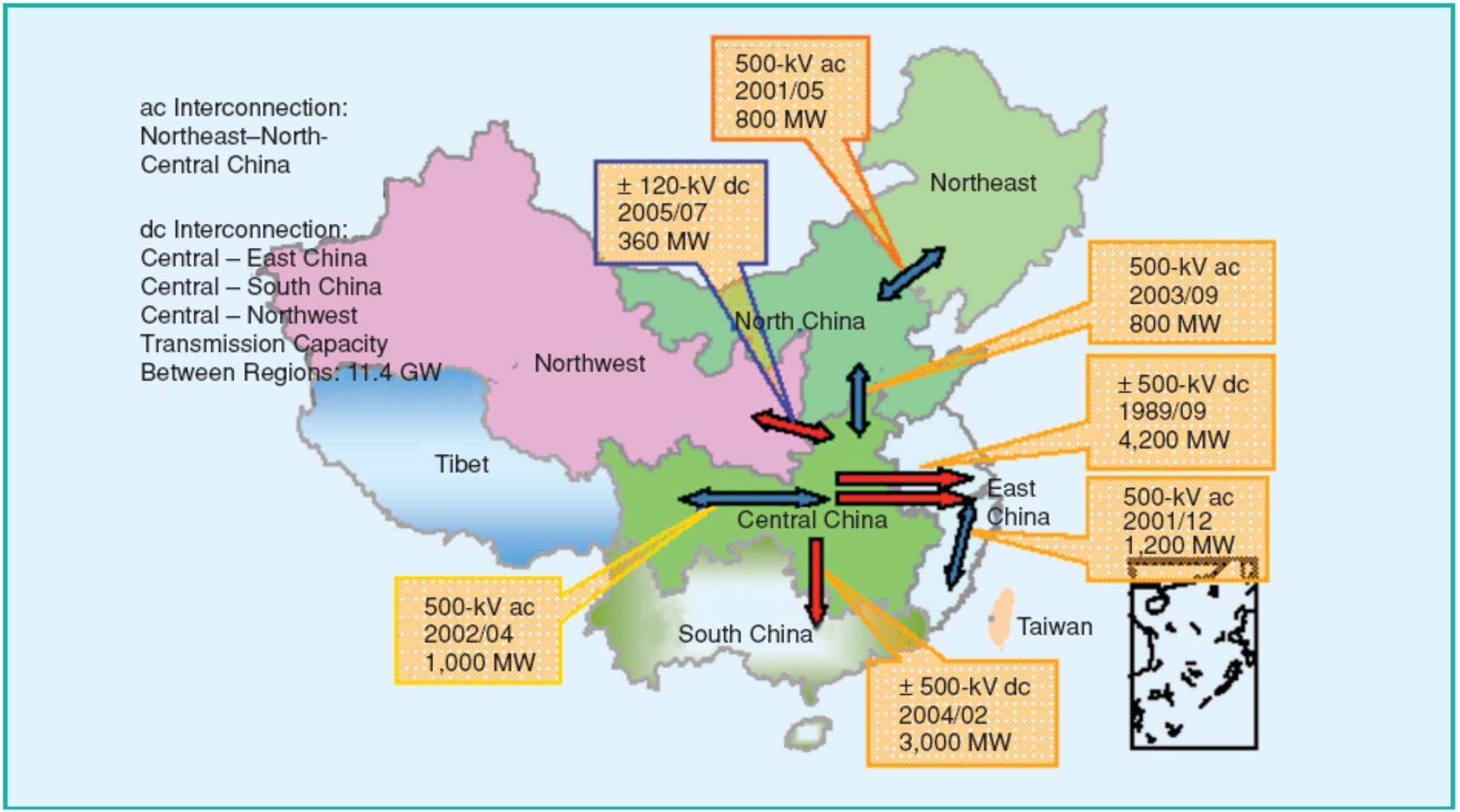
Percentage share of electricity in total energy consumption (increase in the share of electricity in total energy consumption)



Total installed generation capacity in GW (red columns) and annual electricity production in 10 trillion Wh (blue columns)



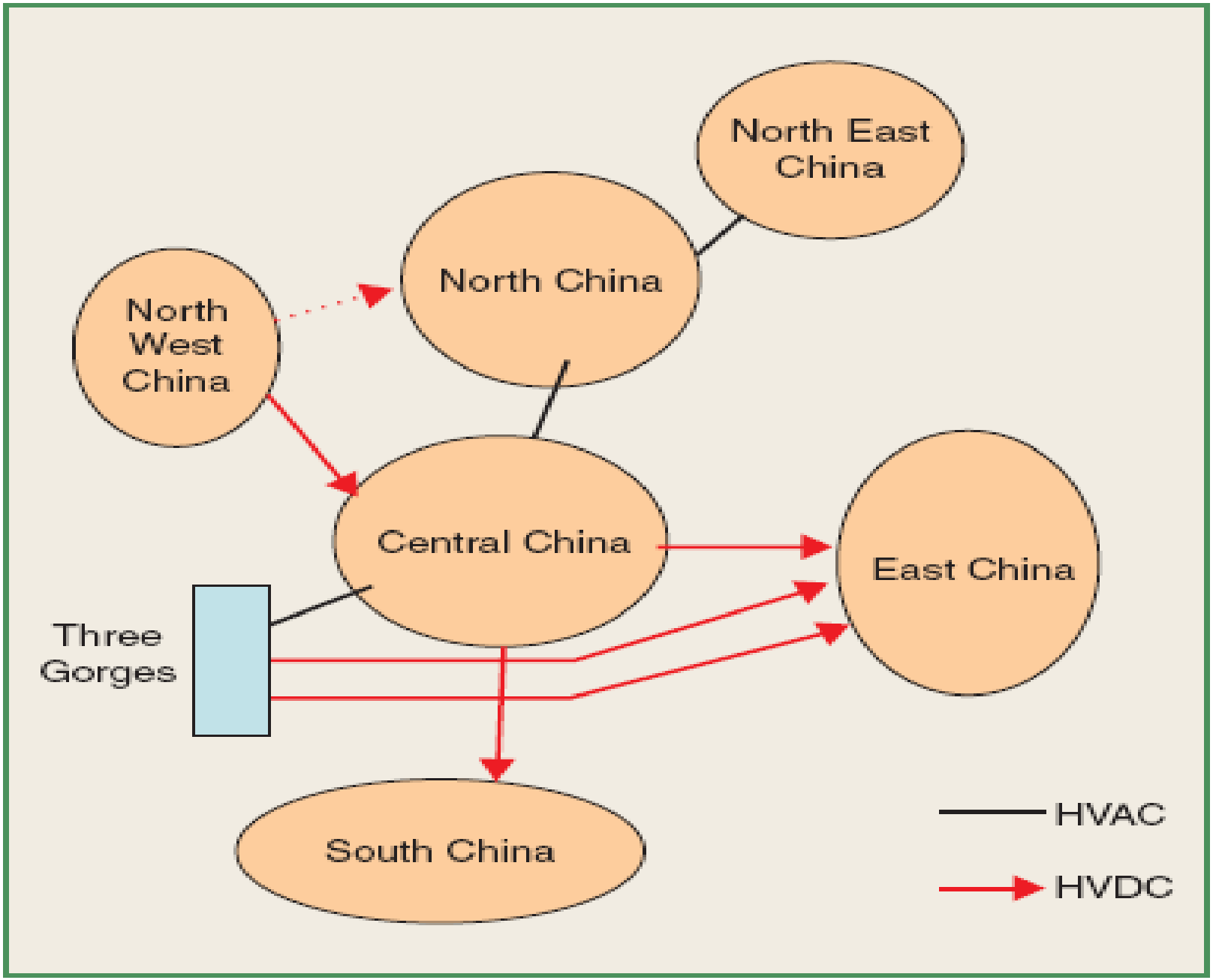
Nationwide grid interconnections of China



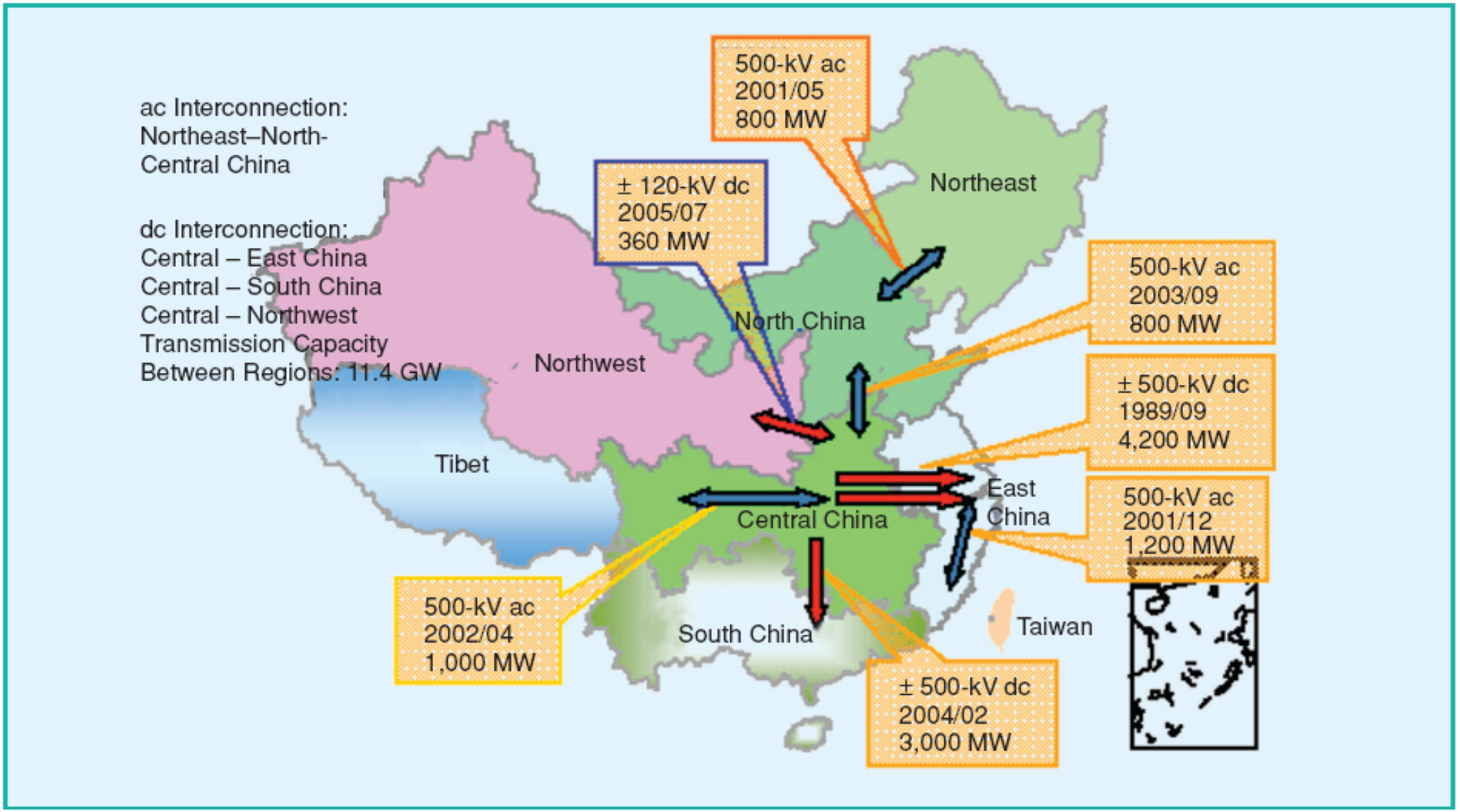
Geographic map of six regional power systems

NC: North China; EC: East China; CC: Central China;
SC: South China; NW: Northwest China; NE: Northeast China

Interconnection of six regional grids in 2005



Nationwide grid interconnections of China



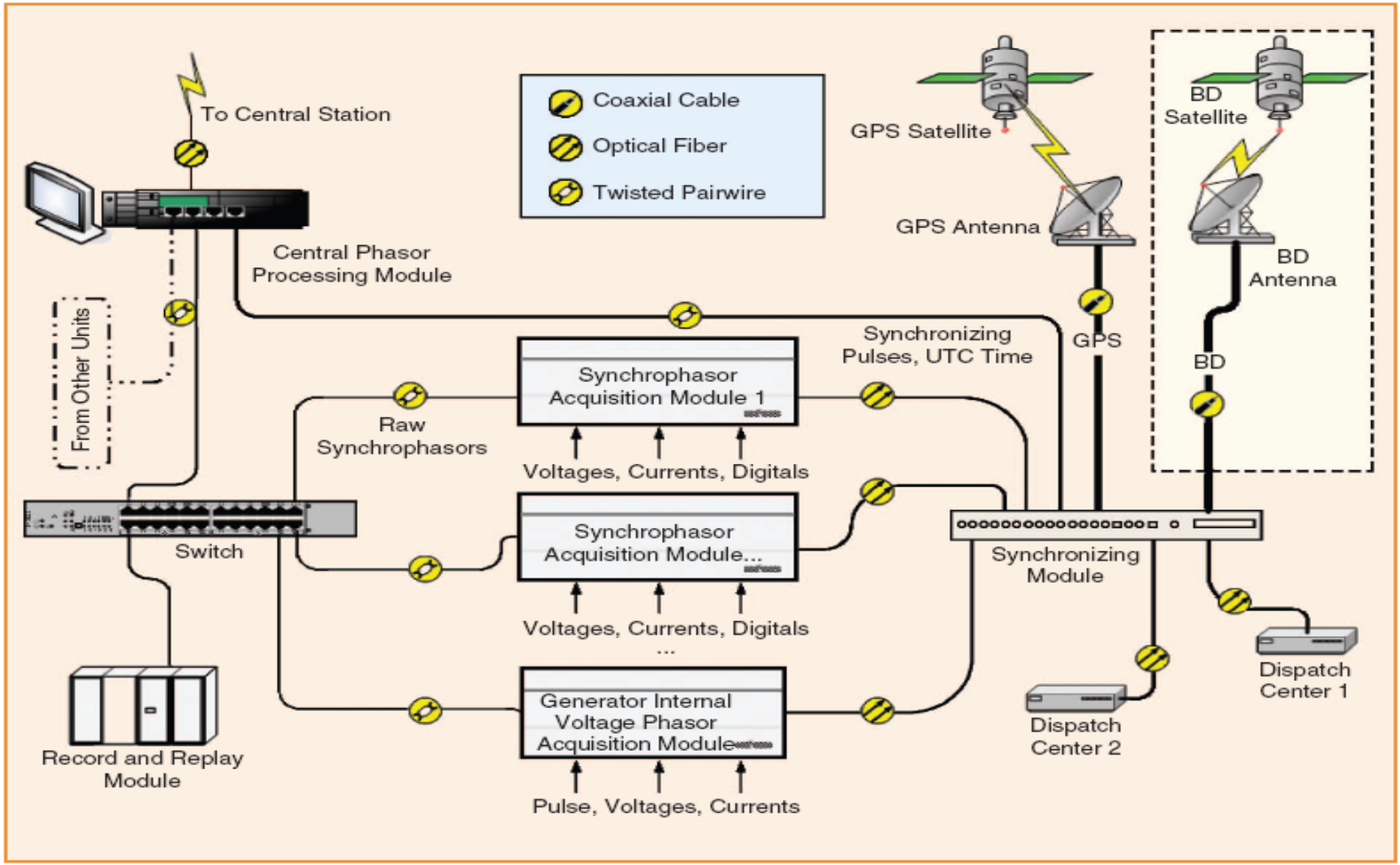
Recently completed hvac/hvdc projects

Grid	Location	Type	Capacity	Length	Completion
CC-EC	3G Gezhouba-Shanghai	±500 kV DC	1,200 MW	1,045 km	1991
SC-SC	Guangxi-Guangdong	±500 kV DC	1.800 MW	980 km	2001
CC-EC	3G Longquan-Shanghai	±500 kV DC	3,000 MW	900 km	2002
CC-SC	3G Jingzhou-Guangdong	±500 kV DC	3,000 MW	950 km	2004
CC-NW	Henan-Henan	±120 kV DC	360 MW	Back-to-back	2004
SC-SC	Guizhou-Guangdong	±500 kV DC	3,000 MW	1,000 km	2004
NC-NE	Hebei-Liaoning	500 kV AC	800 MW	167 km	2001
CC-NC	Henan-Hebei	500 kV AC	600 MW	210 km	2003

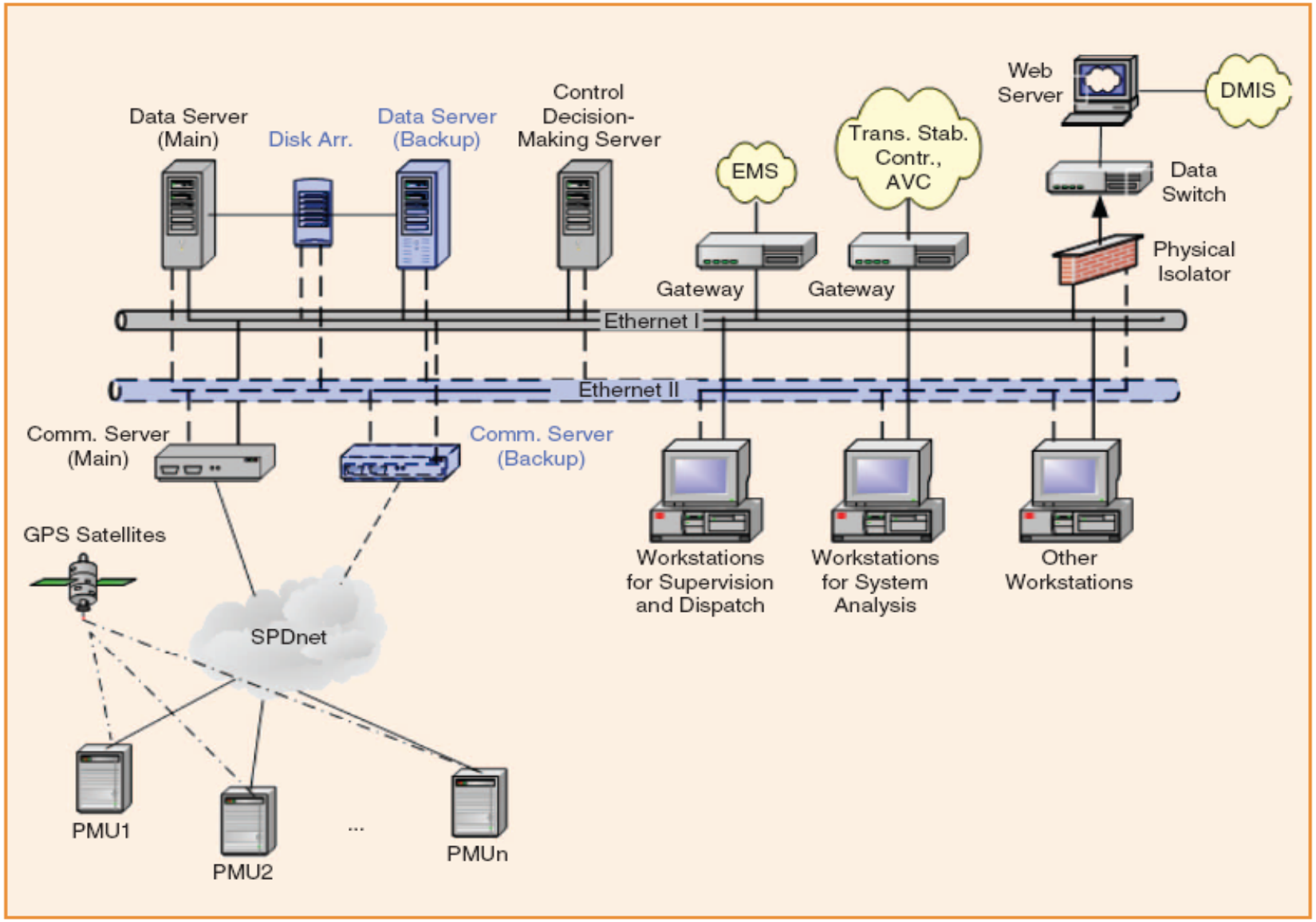
Central to this is the Three Gorges power grid, consisting of 12-GW HVAC from the Three Gorges to the Central China grid and 7.2-GW HVDC to the East China grid. The first HVDC project in China was in 1987 in Zhejiang province with a 100-MW ± 100-kV underwater cable that spans 54 km. The first HVDC line from Gezhouba (Three Gorges) to Shanghai was completed in 1991, and a number of other HVDC and HVAC lines linking regional grids have been completed in the last few years as listed above. Additional planned HVDC and HVAC transmission projects for the 2006–2010 period include: second 3G-Shanghai HVDC link; second Guizhou-Guangdong HVDC link; NC-NE back-to-back HVDC link; NC-CC back-to-back HVDC link; Guangdong-Hainan underwater HVDC link; Yunnan-Guangdong HVDC link; NC-NE HVAC link; NW-NC HVAC link.

PMUs and WAMS central stations in China

Decentralized PMUs and functional modules



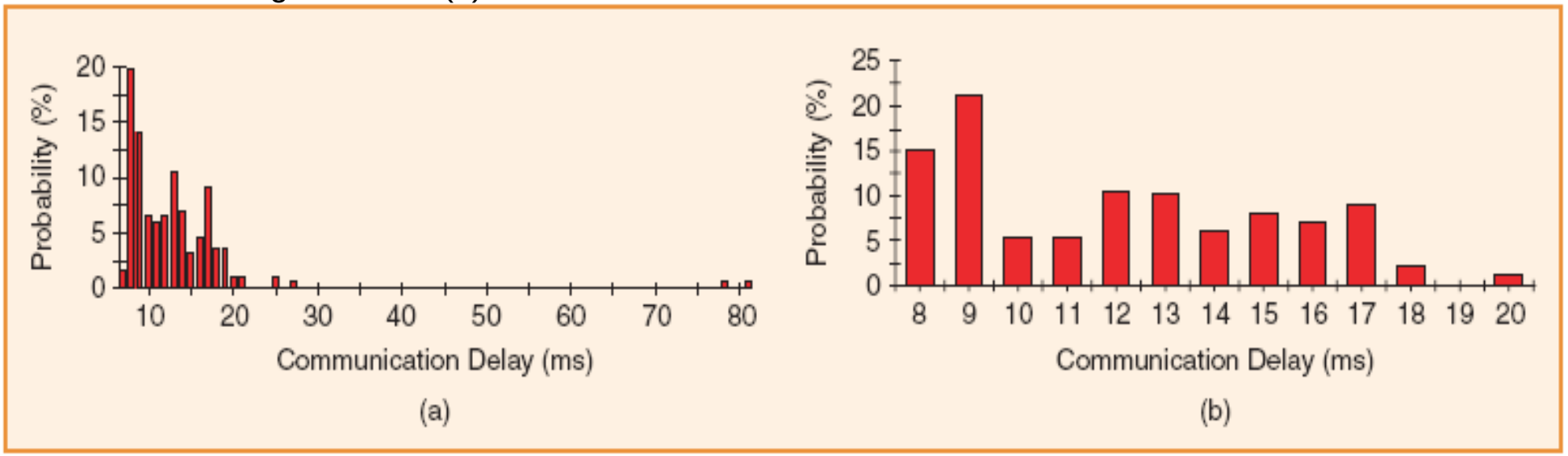
Hardware structure of the WAMS central station



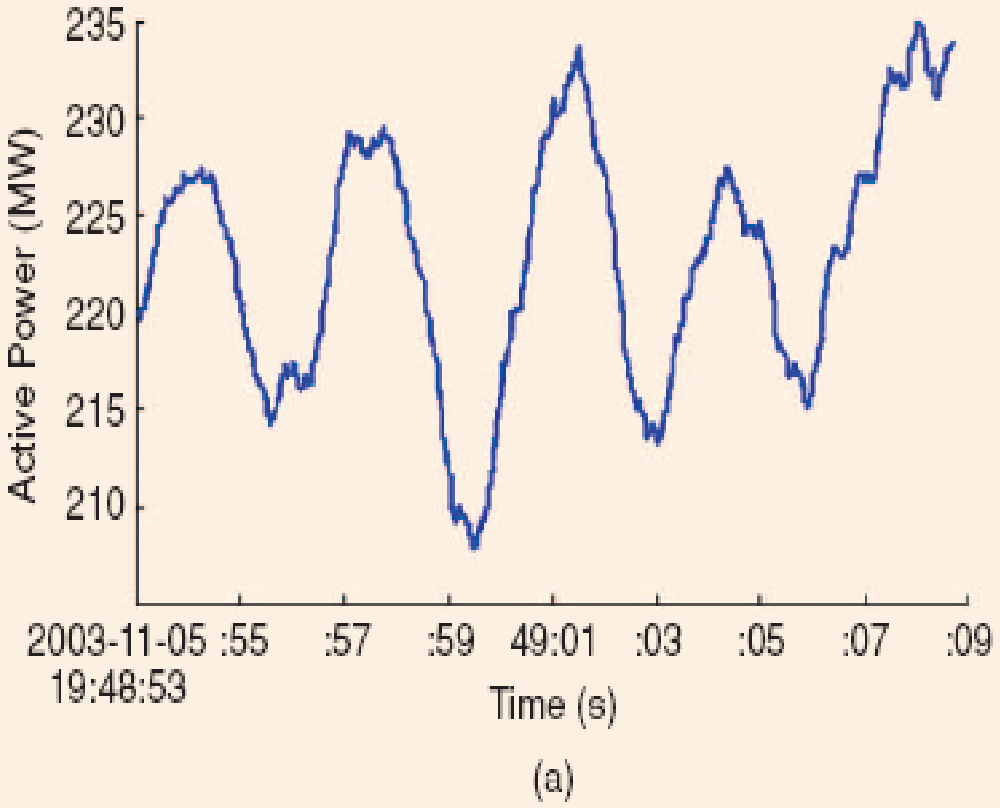
Communication delays between the six PMUs and the central station in Jiangsu Provincial

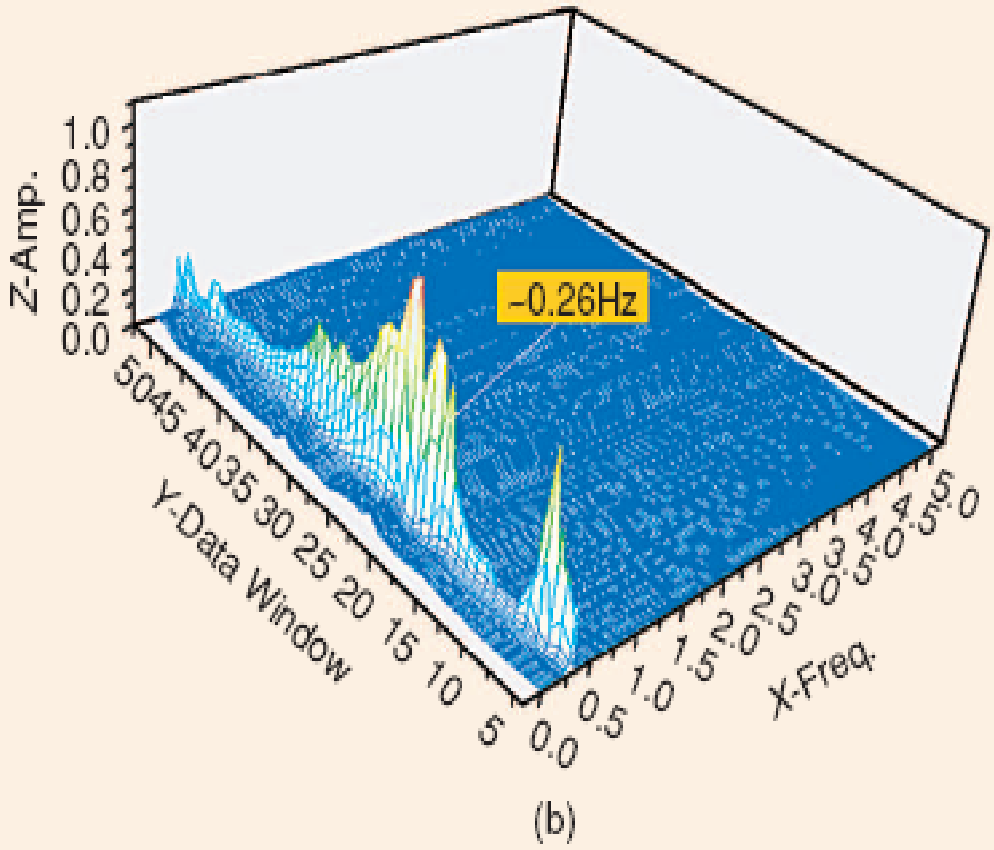
PMU Plants/ Substations	Status of Network	Max. Delay (ms)	Min. Delay (ms)	Avg. Delay (ms)	Std. Deviation (ms)
Xu Tang	Congested	49	23	39	29
Huai Yin	Congested	21	8	13	10
Nan Tong	Congested	22	9	13	9
Peng Cheng	Congested	27	11	14	6
Xin Hai	Congested	39	17	20	8
Yang Zhou 2nd	Congested	81	7	14	62
Yang Zhou 2nd	Idle	20	8	13	12

Communication delays between the PMU at Yang Zhou second power plant and the central station: (a) the network is congested and (b) the network is idle.



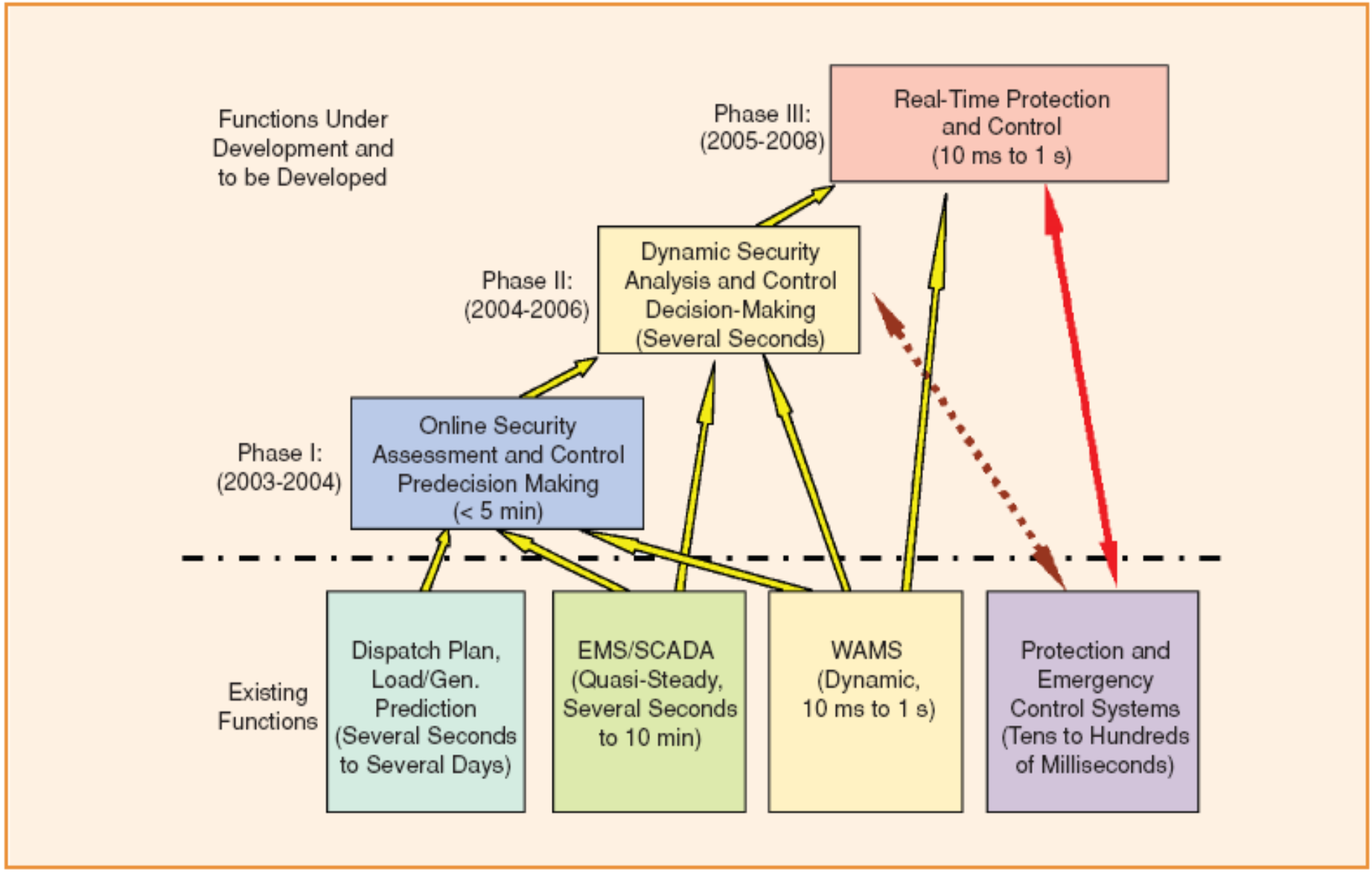
Power oscillation and its online analysis result in the WAMS of Northern—and Central China





(a) the active power along the tie line, and
(b) the frequency spectrum obtained with the online Prony analysis

The three-phase plan of WAMS application in China



Researched and Addressed

Policy Areas to be researched:

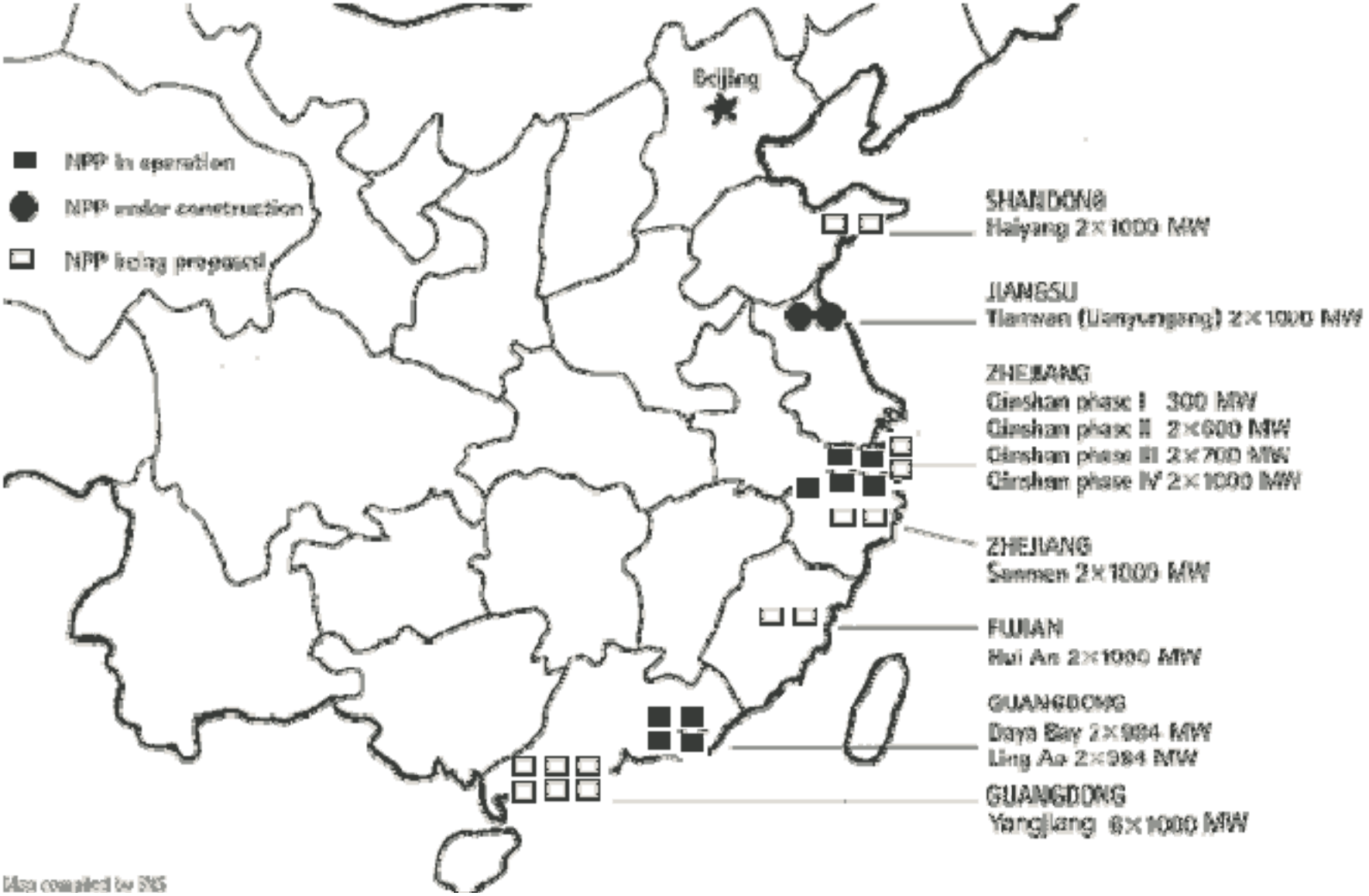
- Nuclear Energy Supply
- Energy Transmission and Distribution
- Environmental Pollution
- Localization of Plant Builds
- Nuclear Weapons

Nuclear Energy Supply

Should China continue to build a nuclear energy supply base?

- Pros
  - Clean Alternative to Coal, Oil, and Natural Gas
  - Smaller Plants produce more Energy
- Cons
  - More Expensive
  - Radioactive Materials
    - Potential Environmental Disasters
  - Public Perception and Sensitivity
- Cost
  - $1,200 to $1,500 per KwH
  - Decommissioning costs are high
  - Costs go on well after end of production
- Benefits
  - Less Dependence on Importation of Oil
  - Use Less Natural Resources

Current and Proposed Nuclear Power Plants in China



Map compiled by ENS

Energy Supply Transmission and Distribution

Should the Chinese Government Deregulate the Transmission Infrastructure?

- Pros
  - Cheaper Operating Costs
  - Channels Owned by Government
- Cons
  - Deregulation of Transmission
  - Potential Terrorist Attacks
- Costs
  - Less Cost in Transportation
- Benefit
  - Efficiency

Environmental Pollution

Should the Chinese Government Utilize Nuclear Energy to Help Curb Pollution?

- Pros
  - Less Emissions
- Cons
  - Radioactive Waste
  - Raises Temperatures of Local Water Resources
  - Meltdown Potential
  - Harmful to Humans

- Costs
  - High Long-term Costs for Safe Storage
  - Decommissioning Costs
  - Environmental Impact (Clean-up, treatment, etc.)
- Benefits
  - Less problems with extraction of natural resources

Localized Plant Builds

Should the Chinese Government mandate Localized Building of Nuclear Power Plants?

- Pros
  - Monetary gains to local towns
  - Knowledge kept locally
- Cons
  - No influx of new ideas
  - Cannot support demand
- Cost
  - Cheaper to use Chinese resources than import
- Benefits
  - Develop Local Talent
  - Less Dependent on Foreign Technology

Nuclear Weapons

Should China maintain its current policy of "Minimum Deterrence" with regards to Nuclear Weapons?

- Pros
  - Need to be Provoked
  - Prevents False Alarms
- Cons
  - Potential to be Hit first with Nuclear Weapons
  - Cannot Respond Quickly
  - Trust in Other Countries
  - Complacency
- Costs
  - Life
  - Nuclear Fallout
  - International Relations
- Benefits
  - Smaller Arsenal
  - Less Nuclear Development

Extrapolations & Meanings

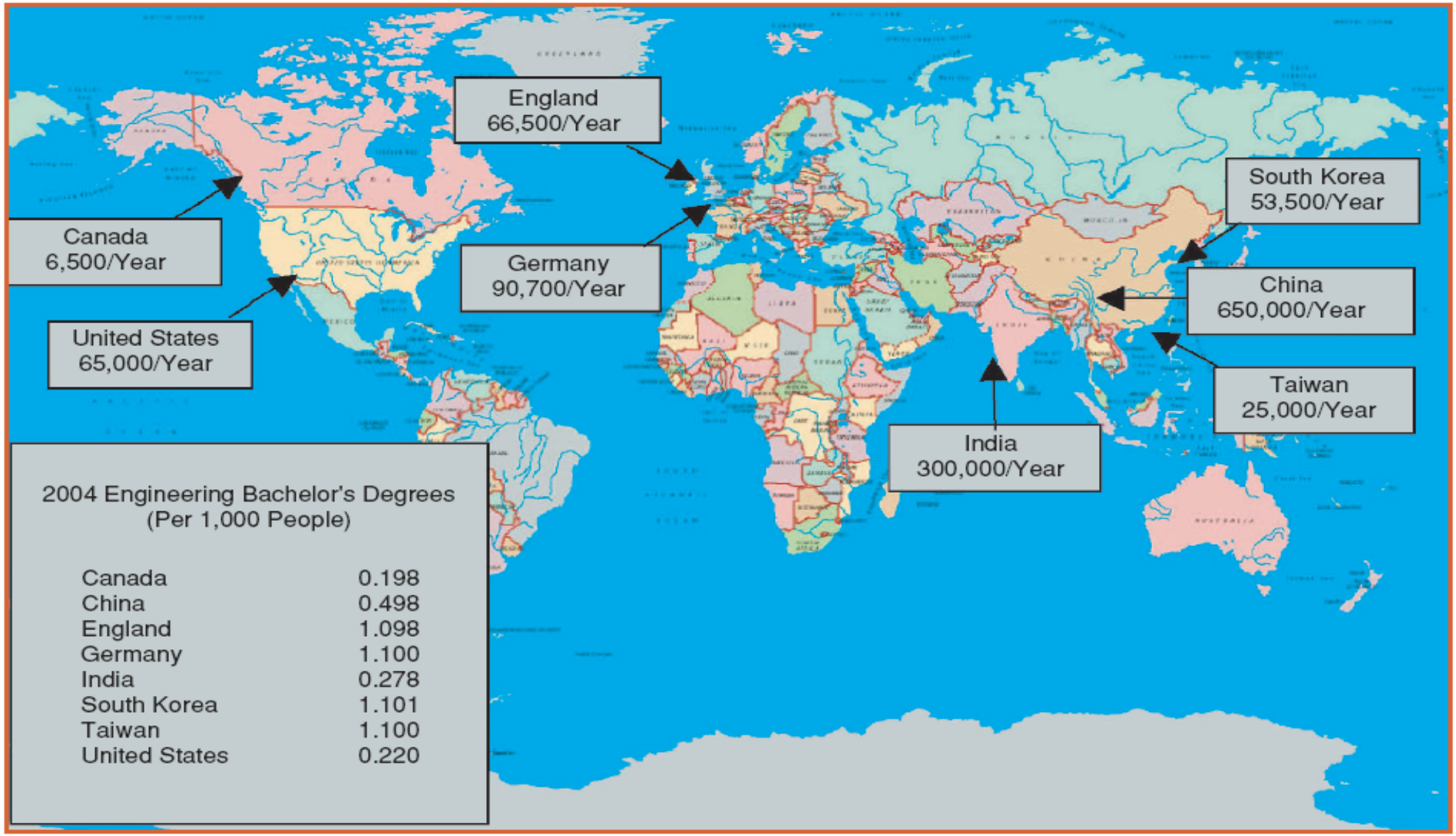
- Look at the results upon the GDP and the country's economic growth
- Understand how and where China's S & T development is leading the country
- What does this mean to the US and the World?
- What were the measures of success and is China reaching its goals

Discussion

- How successful is China in creating and following S & T policy?
- Are the policies effective?
- Are there other things should China consider to bolster its economic strength?

Change

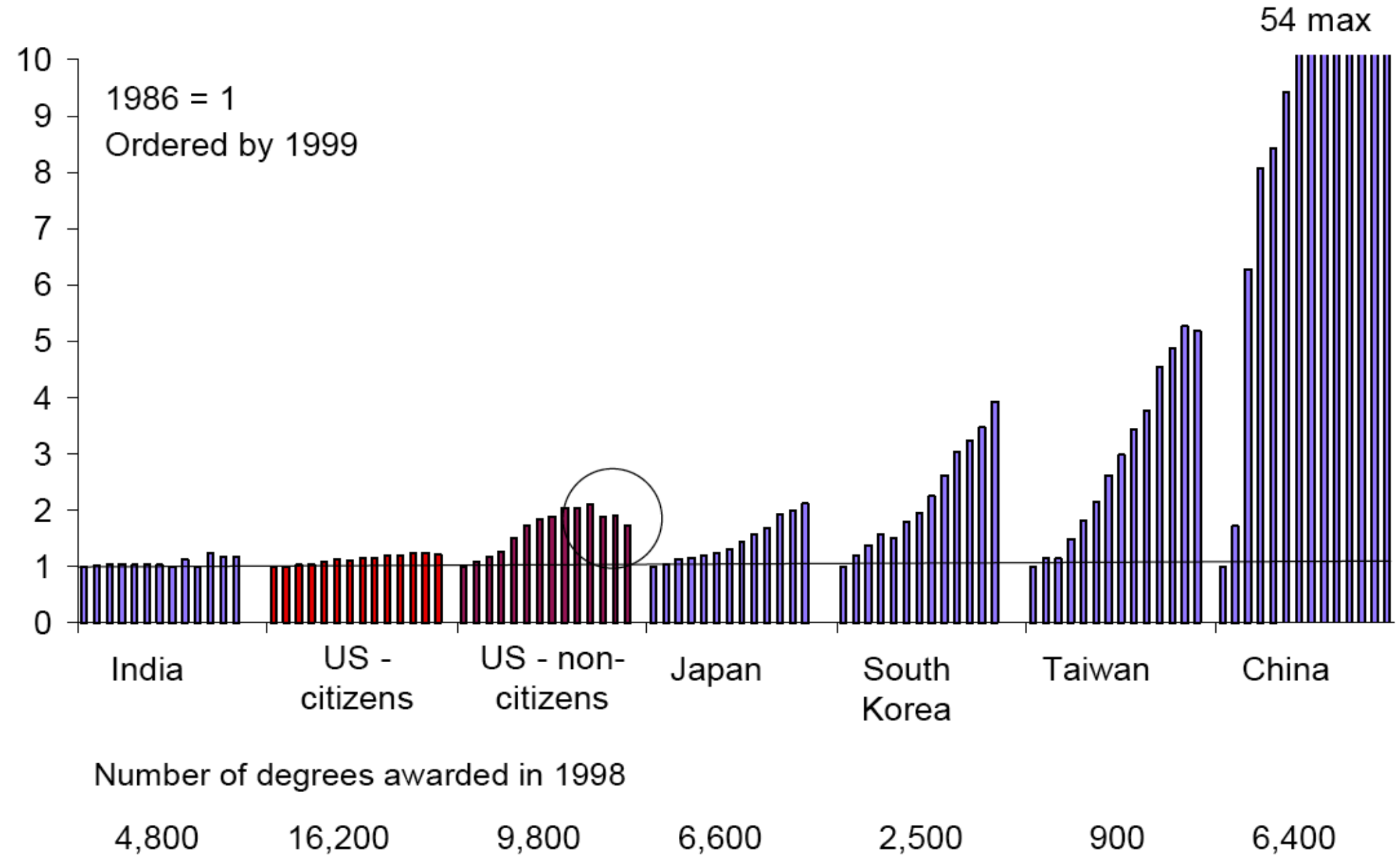
Engineering bachelor's degrees by country



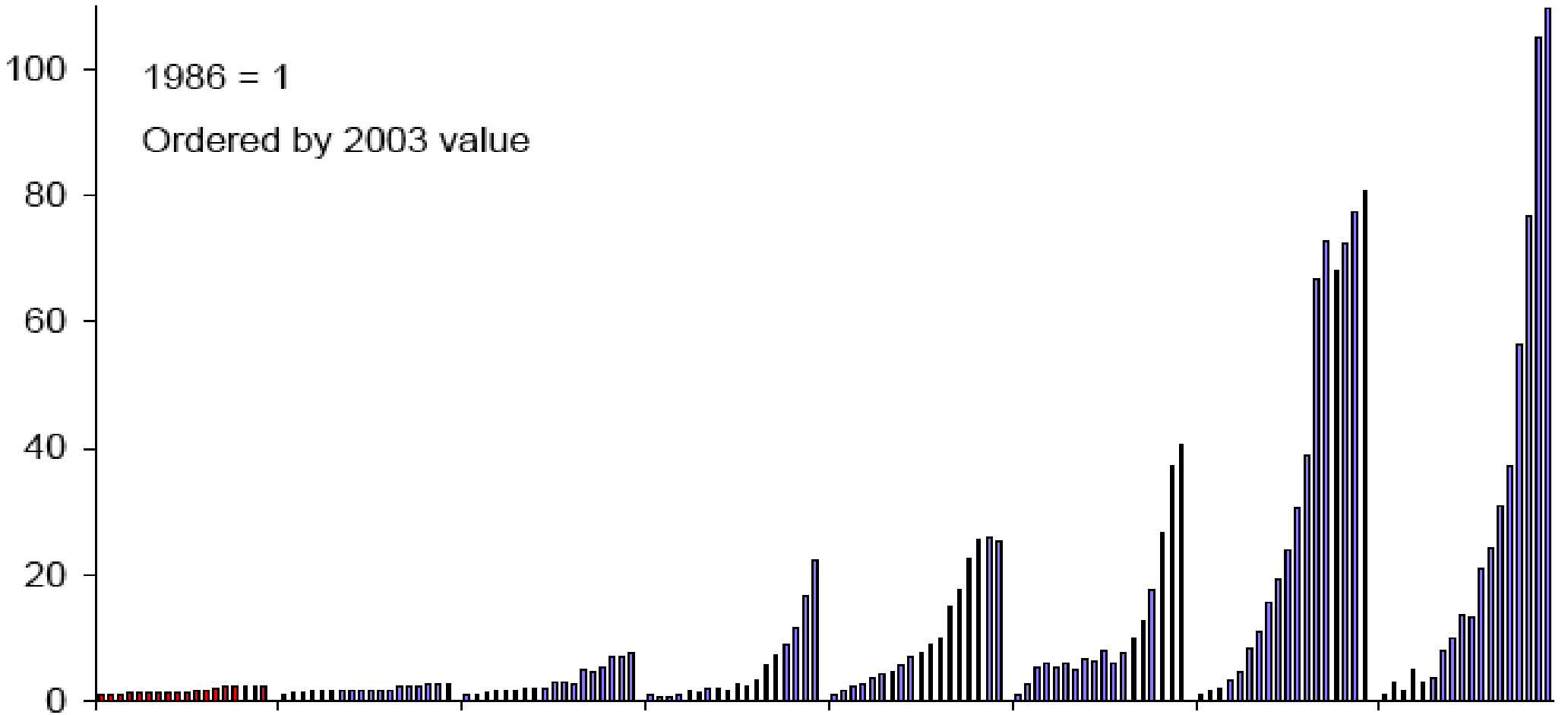
Example: China

- Chinese universities graduate 700,000 new engineers per year (according to recent assessments only about 10%, this percentage is rapidly increasing, are engineers and the remaining are technicians)

Growth in doctoral degrees awarded 1986-1999



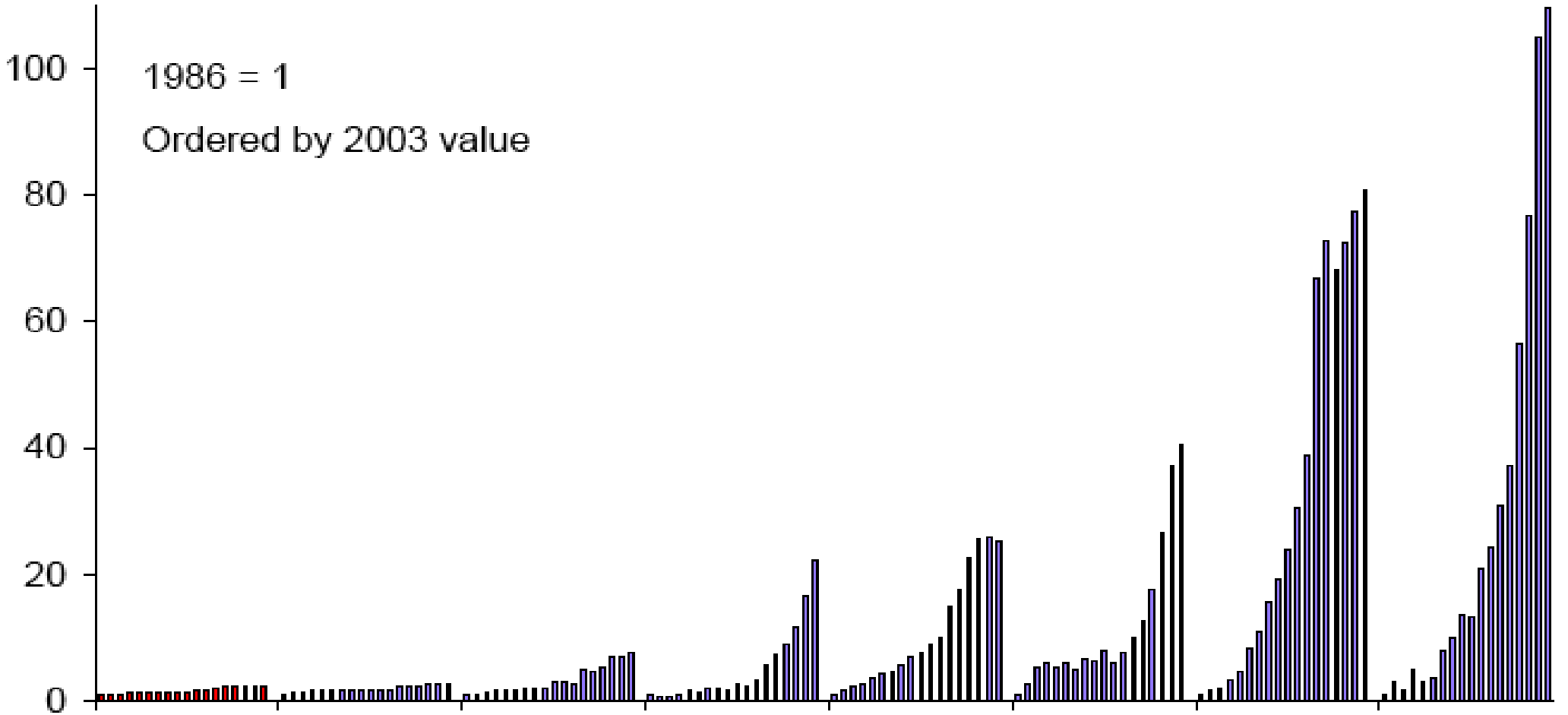
Growth in U.S patents invented in Asia – 1986-2003



United States	Japan	Hong Kong	India	Taiwan	China	South Korea	Singapore
Number of patents in							
87,600	35,500	250	76	350	5,300	370	4,000

Source: CHI Research, Inc. International Patent Indicators, 2004,

Growth in U.S patents invented in Asia – 1986-2003



Number of patents in	United States	Japan	Hong Kong	India	Taiwan	China	South Korea	Singapore
	87,600	35,500	250	76	350	5,300	370	4,000

Source: CHI Research, Inc. International Patent Indicators, 2004,

Issues with IP in China(問題)

- Copyright Piracy – $2.5 - $3.8 Billion per year
- Cultural issues - “Impossible to separate the inventor’s activity from the society of which the inventor is part”
- Judges lack of experience in dealing with IP issues
- Struggling with balance between economic development and protection of IP rights
- Law implementation needs improvement.
- Foreign pressure – primarily from governments. Only 5% from foreign companies.
- 95% of product piracy cases involve violations against Chinese companies.

http://www.bizasia.com/intellectual_property_/b38fc/toyota_pursues_intellectual.htm
https://asiamedia.ucla.edu/article.asp?parentid=34148
https://www.signosandiego.com/news/world/20060310-0049-china-productpiracy.html

Specific Examples of IP issues in China

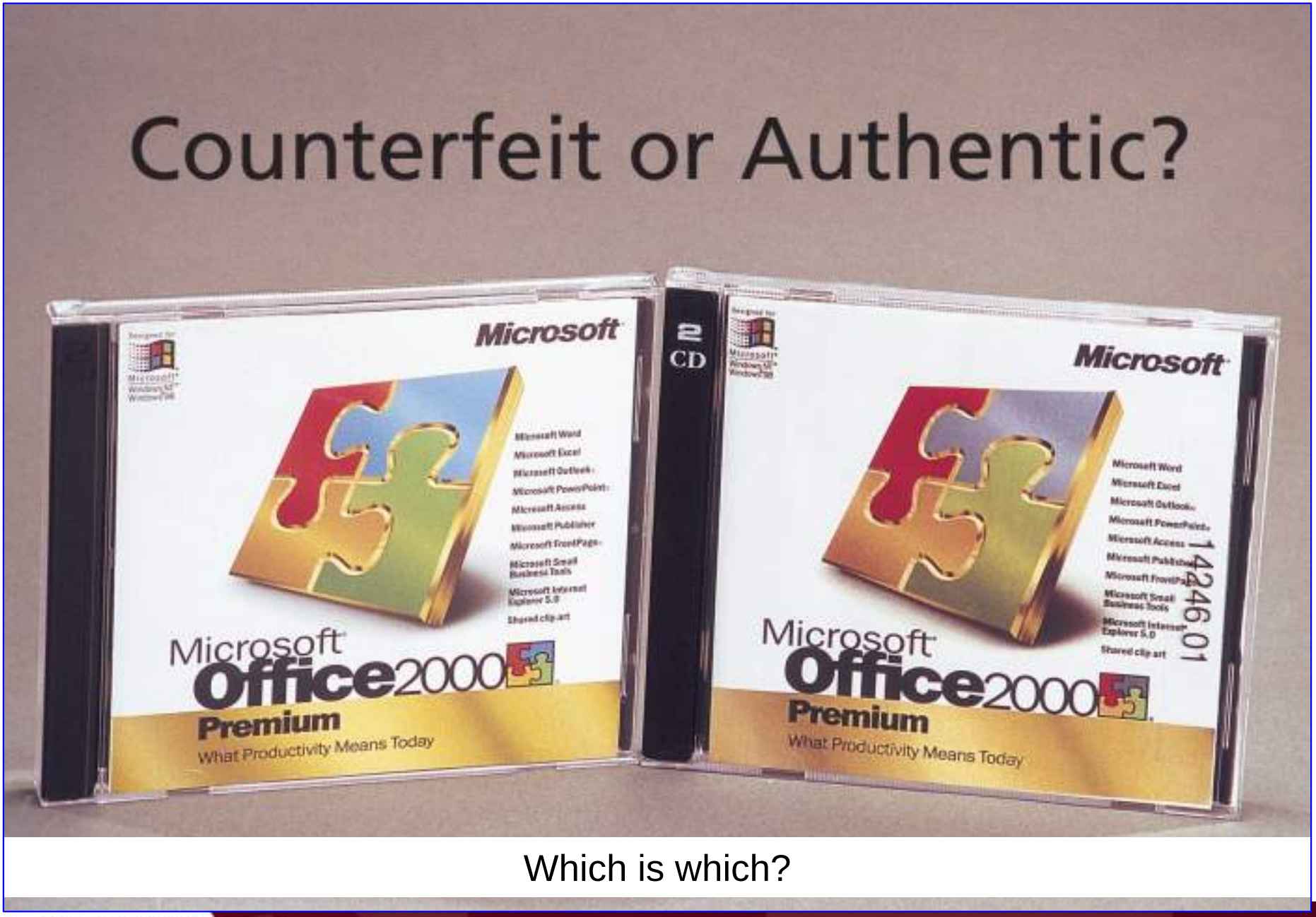
- Software Piracy is unauthorized copying, distributing or downloading of copyrighted software.
- Patent Infringement encroachment upon the domain belonging to a patentee that is described by the claims of her/his patent
- Patent Trolling involves finding and procuring patents, then suing infringers of those patents. Can also be used to look at "unpatented" patents from other countries and establishing them in China or Korea.

What Is Software Piracy?
(什麼是軟體盜版?)

Three of the most common forms of software piracy are:

- End-user copying: Organizations installing or using software on more computers than they are licensed to support.
- Distribution: Selling or distributing illegally copied software, including counterfeit products.
- Downloading: Making unauthorized copies from the Internet.

Piracy Examples (秘密)



Which is which?

Piracy Examples (是一部巨大电影)

Software Piracy: Statistics and Facts
(軟體盜版: 統計和事實)

- More than one third of adult Internet users say they have downloaded commercial software online without paying for all the copies they made. *(Source: "Quantifying Online Downloading of Unlicensed Software – Survey of Internet Users," IPSOS Public Affairs, May 2002)*

- 25% of users who download software say they never pay for it. *(Source: IPSOS, May 2002)*

- Last year, piracy cost the software industry an estimated $11 billion. *(Source: "2009 Global Software Piracy Report," International Planning and Research Corp., June 2002)*

- The loss to the economy has significant impact, including more than 111,000 jobs lost, $5.6 billion in lost wages and more than $1.5 billion in lost tax revenue. *(Source: "2001 State Software Piracy Study," International Planning and Research Corp., October 2002)*

IP Loss Costs for Software

Asia / Pacific	Loss Costs	Western Europe	Loss Costs	North America	Loss Costs
China	$1.1 Billion	**United Kingdom**	$1.2 Billion	**North America &**	$10.5 Billion
Japan	$1.7 Billion	**Germany**	$1.1 Billion	**Canada**	
India	$376 Million	**France**	$964 Million		

Patent Infringement Examples (違反例子)

- General Motors vs. Chery
  - Design, Unfair Competition and Trade Secrets
- Toyota vs. Geely Group
  - Copied logo and deceived customers by claiming its cars used Toyota engines
- Starbucks vs. Xingbake
  - Copied it's logo and used it Chinese language name

http://www.dega.dk/ref.aspx?id=803

GM Spark

http://www.dega.dk/ref.aspx?id=803

Not yet settled…

Chery QQ

http://www.dega.dk/ref.aspx?id=803

Toyota loses it's infringement claim against Geely

Toyota

Geely

http://www.dega.dk/ref.aspx?id=803

Starbucks Wins….($50,000)

http://readbetweentheps.blogspot.com/2006/01/starbucks-vs-xingbake-ipr-protection.html

Patent Costs

Country	Patent Cost
China	$3000-5000
Germany	$14,361
USA	$14,370
Japan	$30,498

Source: http://www.technology.gov/Reports/JapanPatent/pages.pdf
Source: http://www.goodwinprocter.com/publications/frank_s_yearpatent_1_03.pdf

Patent Trolling

- Unprotected patents are fodder for counterfeiters, competitors and pirates from countries with low IP protections.
- A Great Wall of Patents – filing for patents in China for copied products.
- Japan currently experiencing 17,000 hits per day from China and 50,000 per day from Korea on their patent website
- Issues for U.S. Patents
  - Patent Pendecy taking up to 30 months
  - 18 month rule is handing over IP to China
  - Backlog of over 500,000 patent apps
  - Counterfeiters are directly using US patent information to file their own patents in China.

http://www.eetuk.com/bus/news/showArticle.jhtml?articleID=183701296

US Patent and Trademark Office (USPTO) Role

- USPTO
  - Initiated STOP initiative which is a program to stop international piracy and counterfeiting and protect US small and medium sized enterprises overseas.
  - Provide toolkits for businesses with IP issues in China, Korea, Mexico, Taiwan and Russia.
  - Created China Road show in FY2005 for businesses contemplating entering the China market. Topics included Chinese laws and regulations regarding IP.
  - Increased technical assistance in China including training on IP judicial infringement interpretation, criminal copyright infringements, and IP enforcement in Southern China

http://www.uspto.gov/web/offices/com/annual/2005/040204_intel_policy.html

Patent Reform Act of 2005

- Introduced to the House June 8, 2005
- Bill addresses:
  - Patent Quality
  - Limitation of litigation abuses
  - Harmonization of US patent laws with our key trading partners
  - Proposes shift from first-to-invent to first-inventor-to-file
  - Broadens scope of prior user
  - Limitation on treble damages for patent infringement
  - Publication of all patent applications after 18 months
- Changes continue to original bill as it moves through Congress

http://www.uspto.gov/web/offices/com/annual/2005/040204_intel_policy.html

Laws and Treaties (法律和條約)

- Chinese Laws
  - Intellectual property rights can be traced back to Tang Dynasty (618-907 AD)
  - First patent-specific law enacted in 1889
  - Modern patent law began in 1950
  - Cultural Revolution in mid-1960's brought an end to the recognition of intellectual property
  - Adopted trademark laws in 1982
  - Adopted patent laws in 1985
    - "First to File" model
  - Adopted copyright laws in 1986 through 1990
- International Organizations / Treaties / Conventions
  - Became a member of the World Intellectual Property Organization (WIPO) in 1980
  - Became a party to the Madrid Agreement for the International Registration of Trademarks in 1989
    - US is still not a party to the agreement
  - Became a party to Berne Convention for the Protection of Literary and Artistic Works in 1992
  - Became a member of WIPO's Patent Cooperation Treaty in 1994

http://beijing.usembassy.gov/iprpatent.html
http://www.chanlaw.com/ipinchina.htm

Enforcement (執行)

- Three potential courses of actions for rights holders
- Administrative Adjudication
  - Local officials decide if infringement occurred
  - Quick, but no money to rights holders and very small fines
  - Most popular course of action
- Civil Litigation
  - Civil courts decide if infringement occurred
  - Costly and low damages
  - Increasing in popularity
- Criminal Prosecution
  - Government decides whether or not to prosecute and if infringement occurred
  - Complaints include referral criteria too vague, process permits too much discretion, and minimum evidentiary threshold too high
  - Small percentage of all actions taken

Litigation Awards (享受類?)

•A $25,000 infringement award does not mean much to a US company but is a significant fine for the Chinese when compared with average annual income

Equivalent Value of a $25,000 Infringement Award

	Average Annual Household Income	Infringement Award
China	$ 793	$ 1,336,492
China (Urban)	$ 1,307	$ 811,007
China (Rural)	$ 406	$ 2,614,407
United States	$ 42,409	$ 25,000

Source: http://www.stats.gov.cn/english/newsandcomingevents/t20060302_402308116.htm

Source: http://www.census.gov/prod/2003pubs/p60-221.pdf

Source: http://www.fenwick.com/docstore/publications/Corporate/IP_Strategy_&_Practices.pdf

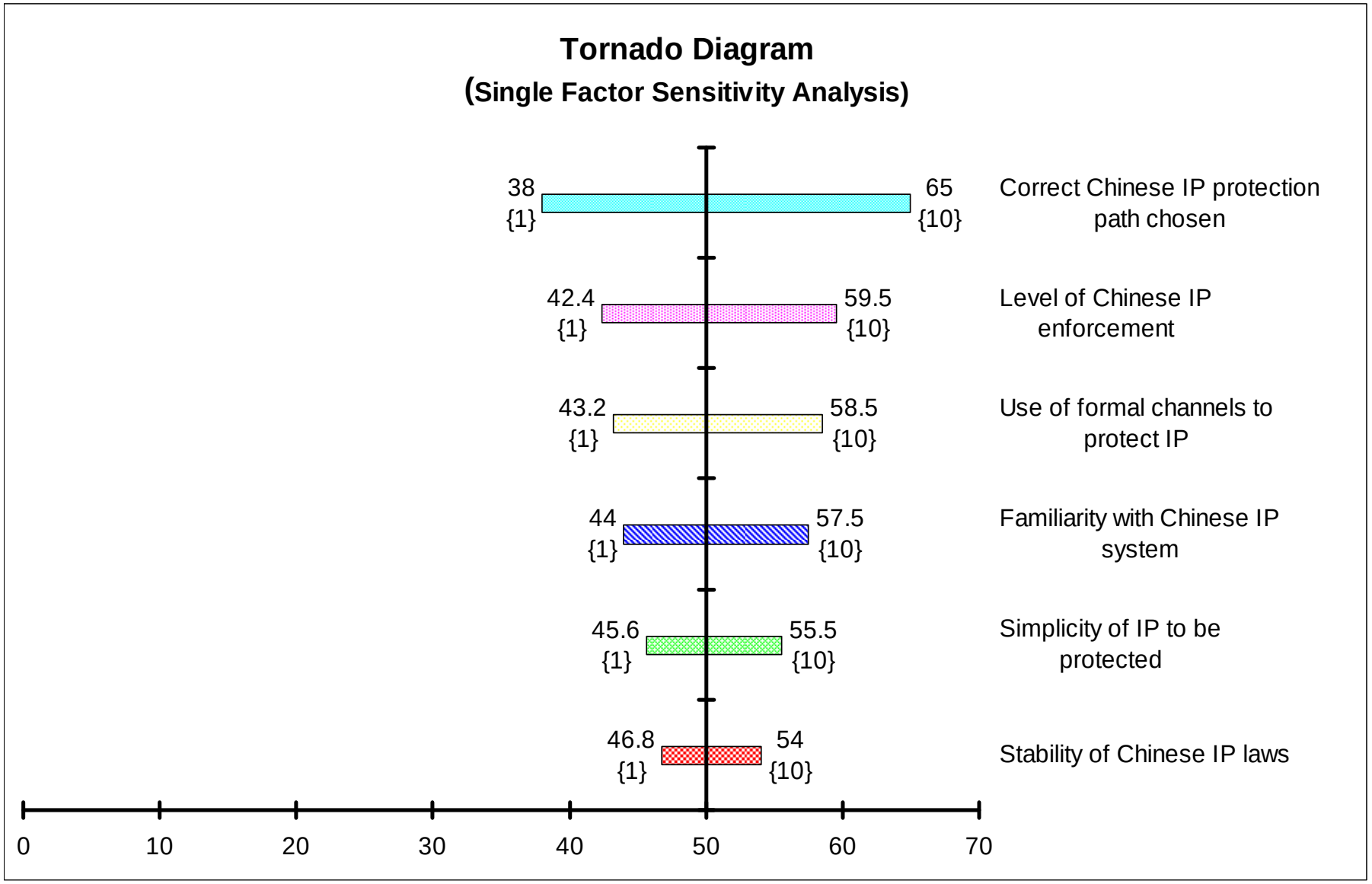
Risk Assessment Example
(風險評估例子)

Project Characteristic Question	Rating	Weight	Score
Correct Chinese IP protection path chosen	8	3.0	24.0
Level of Chinese IP enforcement	6	1.9	11.4
Use of formal channels to protect IP	8	1.7	13.6
Familiarity with Chinese IP system	4	1.5	6.0
Simplicity of IP to be protected	5	1.1	5.5
Stability of Chinese IP laws	5	0.8	4.0
		Overall Score	64.5

Overall Score	Risk Level
10-28	Highest
29-46	Higher
47-64	Moderate
65-82	Lower
83-100	Lowest

http://home.cinci.rr.com/estople/omrat/omrat.htm

Risk Assessment Sensitivity Analysis
(几乎完成)



http://www.tushar-mehta.com/excel/software/tornado/

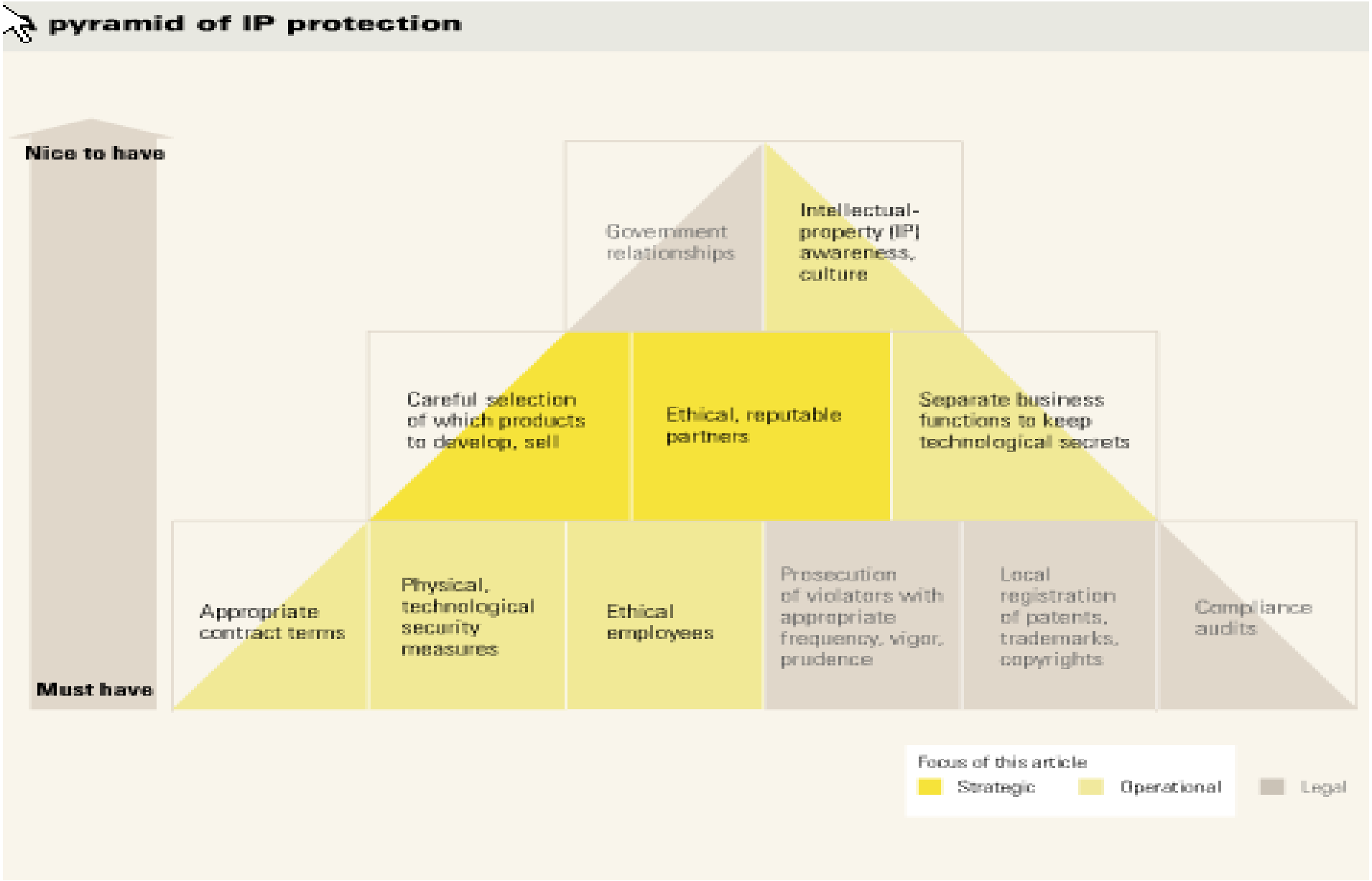
How to Protect your Intellectual Property
(怎麼保護您的知識**產權**)

The best offense is a good defense…and vise versa

- Go on the defense…
  - Employ legal measures…A first-to-file principle
  - Control the production process
  - Focus on human resources
  - Know how to choose suppliers and distributors
  - Keep eye on competitors
- …And the offense
  - Take legal action
  - Conduct surveillance of suppliers and distributors
  - Control employee turnover
  - Advocate aggressively

http://resources.alibaba.com/article/4117/IP_protection_best_practice_tips.htm

Protecting IP in China



http://www.mckinseyquarterly.com/article_page.aspx?ar=1643&L2=21&L3=35&srid=17&gp=0

Customs Regulations
(三個另外星期類)

- Articles bearing marks that are counterfeit or inappropriately using a trademark are subject to seizure and forfeiture.
- Travelers are permitted an exemption and allowed to import 1 item of each type provided that the article is for personal use and not for sale for once every 30 days.
  - E.G. Person arrives with 3 purses all different trademarks, or all the same trademarks, would be permitted only one purse.

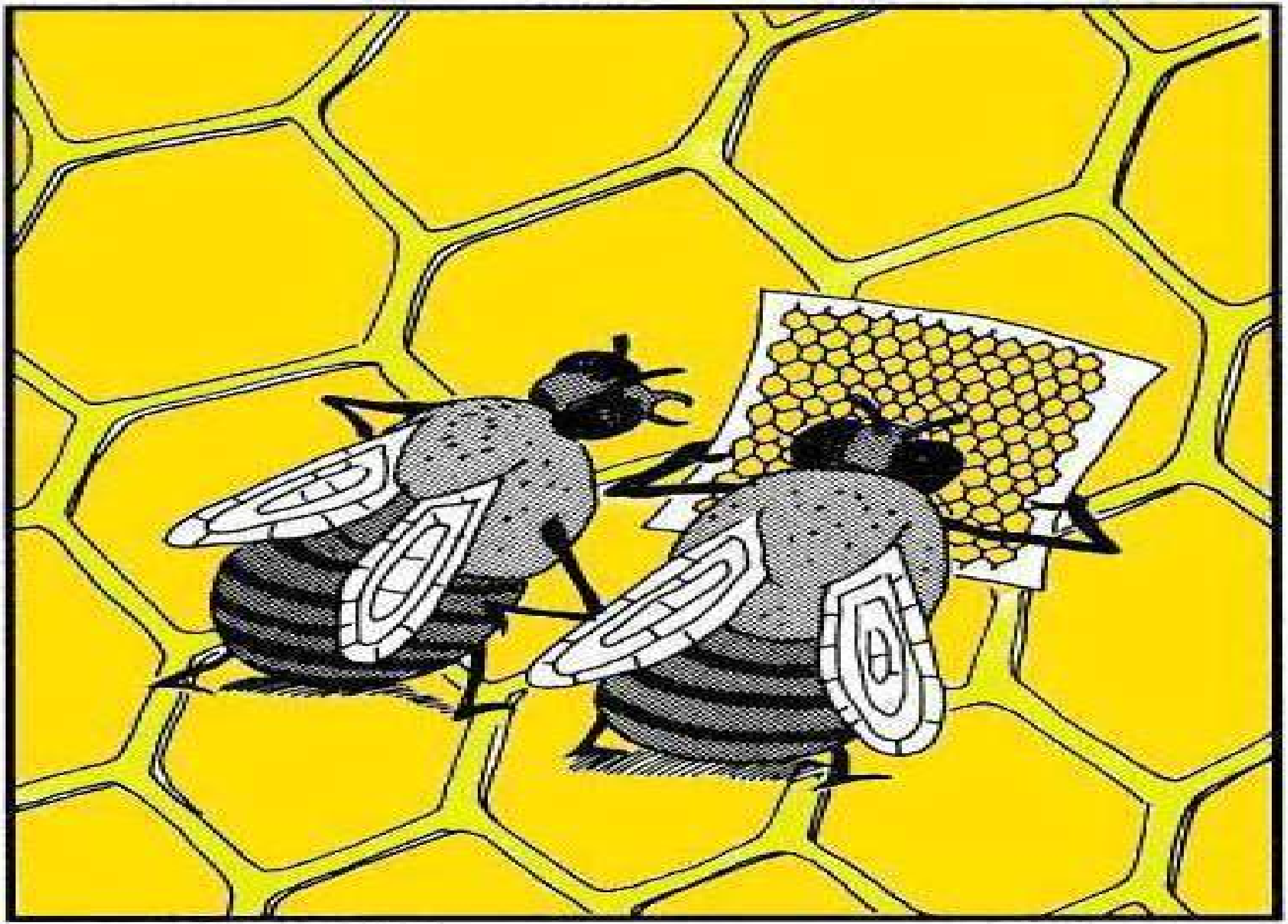
IP and Globalized Technology Impact

- For developing countries:
  - understanding IP issues is necessary in their efforts to integrate into world economies
  - evolving system of stronger IP rights in new technologies can ultimately lead to gains in innovation and information
  - Wisely managing IP may lead to additional foreign investment, more licensing of high-quality technologies, and more access to advanced knowledge goods

http://assets.cambridge.org/052184/1968/excerpt/0521841968_excerpt.pdf

Future of IP in China
(教授买整体类啤酒在我们做这里之后)

- As China's economy transitions from manufacturing based to one that produces IP, their laws will change to protect their interests
  - This is the same progression that the US underwent



So, Where are we exactly?

The (Economic) Ages of Humankind

- Hunter/Gatherers (~1 Million - ~5K BC)
- Agriculture (~5K BC - ~1850 AD)
- Industrial (~1850 AD - ~1950 AD)
- Information (~1950 AD - ~2040 AD)
- Bio/Nano (~1995 - ~2040)
- Virtual (~2015 - ?)

- Hunter-Gatherer - “Nature Provided”
- Agriculture - Controlled Nature (Plants/Animals)
- Industrial - Mechanized Agriculture
  [1800-97% Farmers,Now-2%]
- IT/BIO/Nano - Automating Industry/Agriculture
- Virtual - Robotization of
  IT/Bio/Nano/Industry/Agriculture

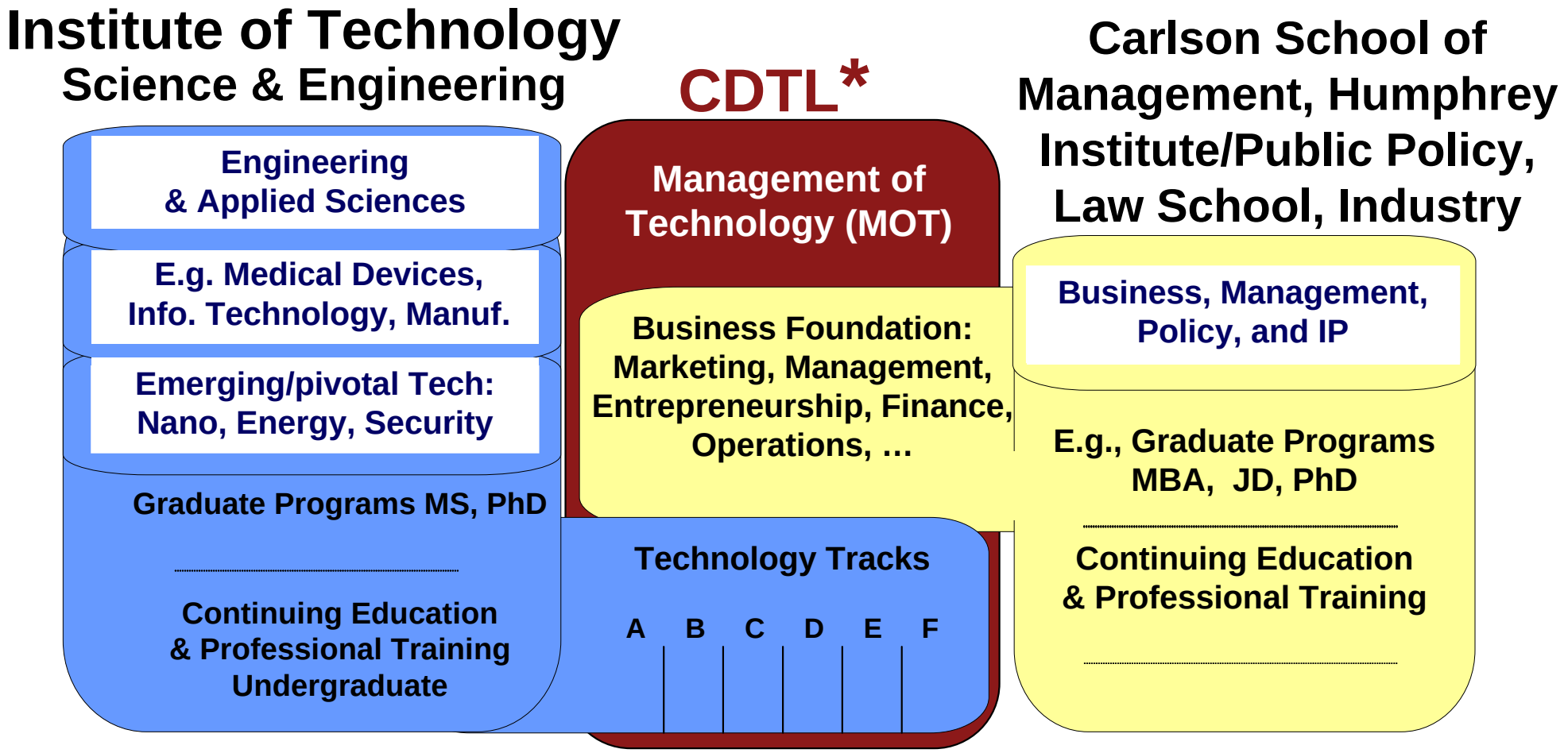
→ Technology MATTERS

Center for the Development of Technological Leadership (CDTL) at the University of Minnesota

- Established in 1987 with an endowment from Honeywell Foundation
- Expertise in the interface of business, strategy, science, technology, innovation, and policy
- Housed in the Institute of Technology (engineering, mathematics, and physical sciences college)

Tactics and Strategies to Help You Lead the Way

Managing and Leading at the Interface…

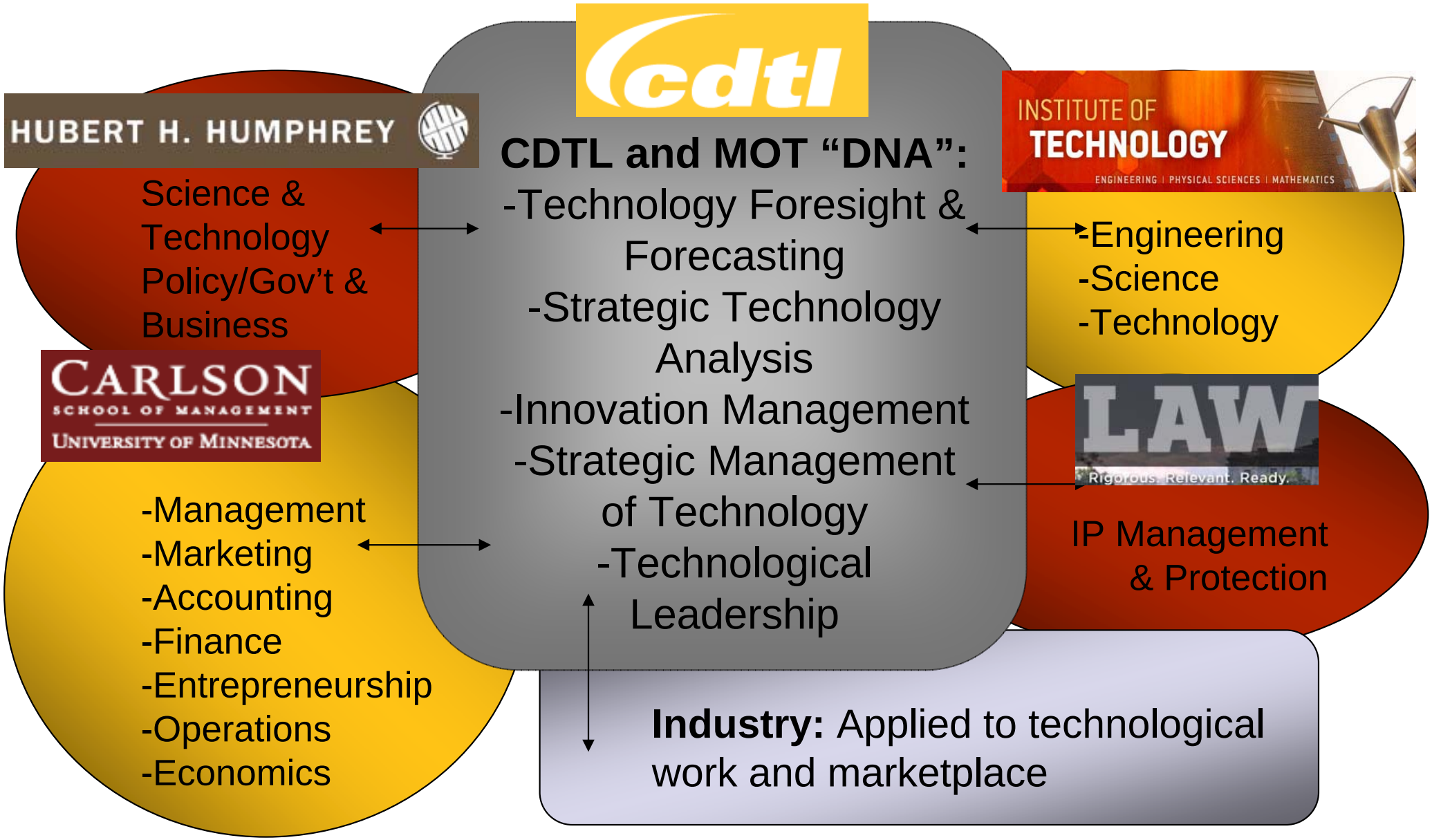


*Technology Foresight & Forecasting, Strategic Technology Analysis, Innovation, etc.

What Does CDTL Do?

- Offer UM Regents' Approved Master of Science degrees
  - Management of Technology
  - Infrastructure Systems Engineering
- Certificate Programs
- Research & Consulting
- Technology Futures Forum
- Foresight After Four
- Signature Series
- Short Courses and Seminars

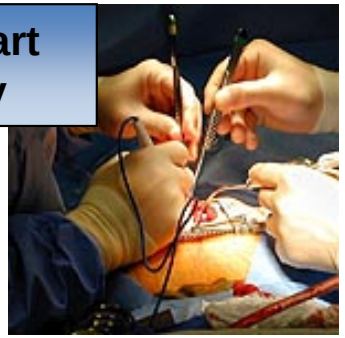
Leadership and Management at the Interface:



Entrepreneurship

- Institute of Technology Founders2005 Survey of alumni who have started businesses:
  - 15,000 alumni responded
  - 3,024 have founded one or more companies
  - 4,150 active companies, worldwide, employing 551,000, with annual revenue of $90B
  - 2,600 active companies in Minnesota, employing 175,000, with annual revenue of $46B
- Faculty also active in start-ups, often with former graduate students.

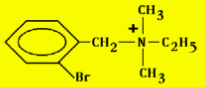
Open Heart Surgery



Pacemaker

Taconite

Brethylium



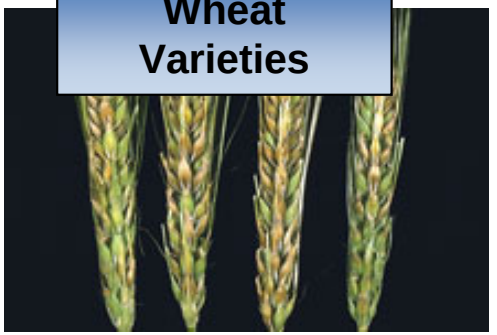
Navigus

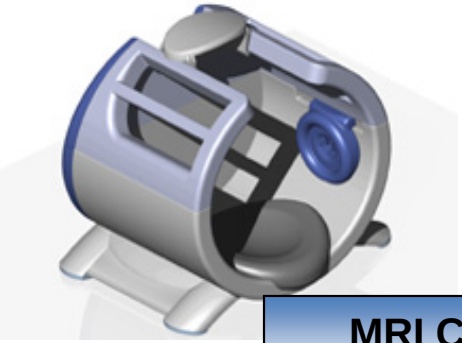
Ziagen

ZIAGEN abacavir sulfate

Vest Airway Cleaning System

Wheat Varieties





MRI Coil

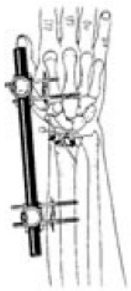
Grape/Wine Varieties

ANGELVAC

PRRS Vaccine

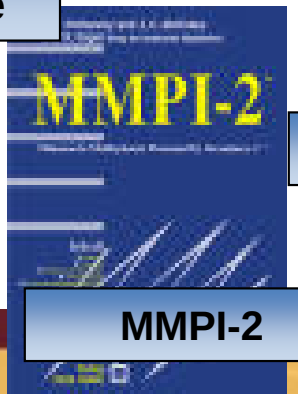
Flight Data Recorder

Gentle Leader Head collar



Radius Plate

Heads-up Display



MMPI-2

Seatbelt

Globally Interlocked Dynamics:
Understanding the Full Impacts of Decision Pathways

To unfold the full potential of social progress requires an integrated understanding of the many dimensions of social development, their underpinnings, and the role of science and technology.

Technology as a Hinge

- In the past, we have been unable to account for all areas on the interlocking fan
- Decisions have been made with incomplete information
- New technologies now permit us to identify forcing functions, critical junctures, and pinch points
- Goal: To target our constrained development resources to maximize benefit and minimize unintended consequences

Contrasting Stories of Development

1) Southern Coast of Taiwan: An example.

2) Advanced Industrial Societies.

3) Mali: Another example

- "Industrial Cuisinart"
- Grind grain, husk rice, saw wood, pump water, charge batteries
- Female literacy up -- due to more free time & the need to account for operation, earnings, salaries
- Meal quality improved
- Social shifts between men & women

Results of Uneven Distribution of Technology Benefits

In developing nations:

- Population dislocations
- Social upheaval
- Massive debt

In developed nations:

- Crumbling infrastructure
- Environmental pollution
- Unhealthy lifestyles

Resource Allocations: From Primitive Countries Survival, to Underdeveloped Countries, to Developing Countries, to Developed Industrial Economies

Observation: We don't know the tipping point at which conflict over uneven distribution of resources will impact developed nations on a large scale.

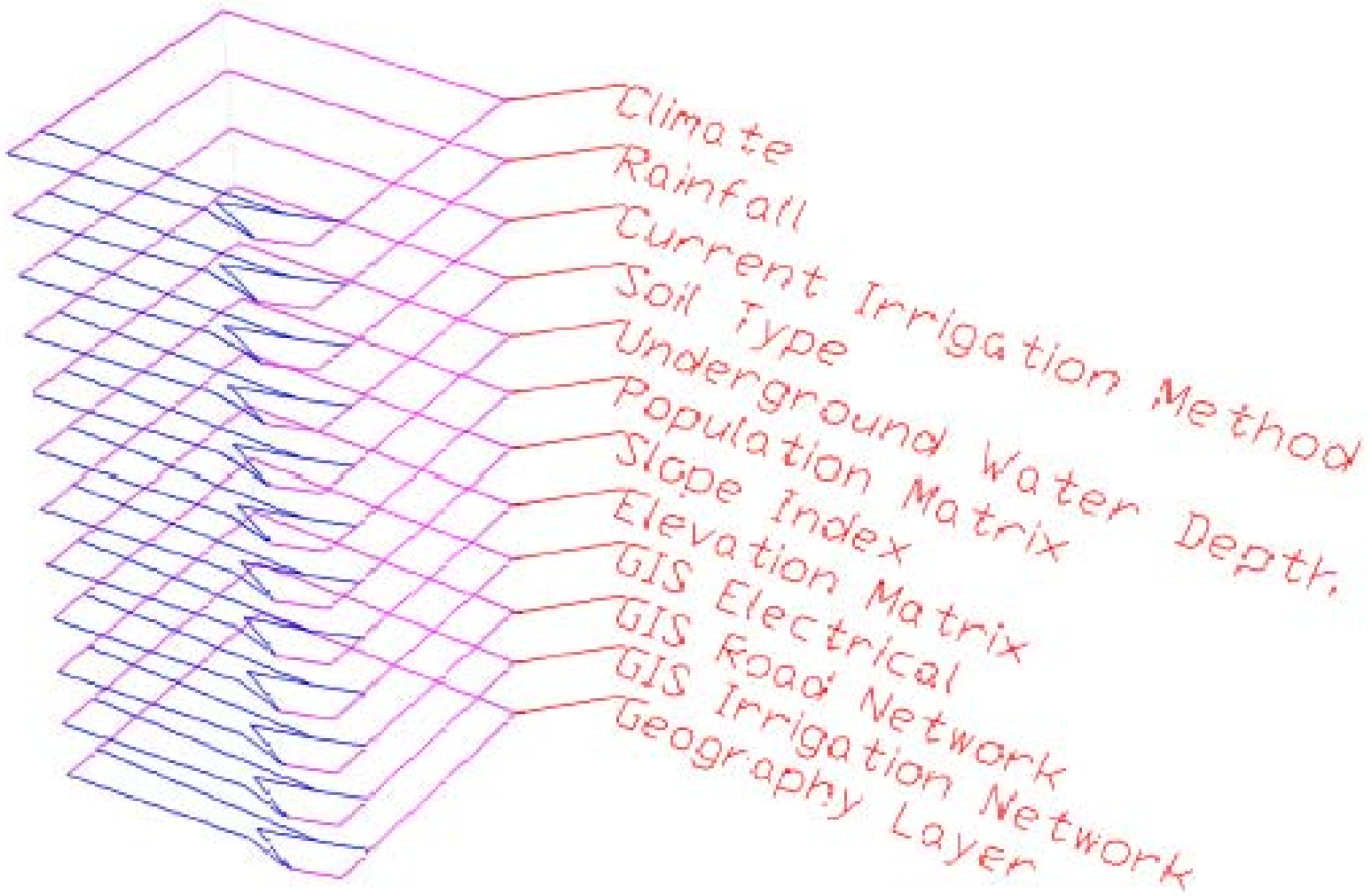
Global Transition Dynamics

• The **aim** is to produce an aggregation of the real time interaction of worldwide activities in technology, health, society, ecology, and economics.

• The **concept** is an outgrowth of past efforts of Drs. Starr and Amin to include large system risk analysis into national decision-making.

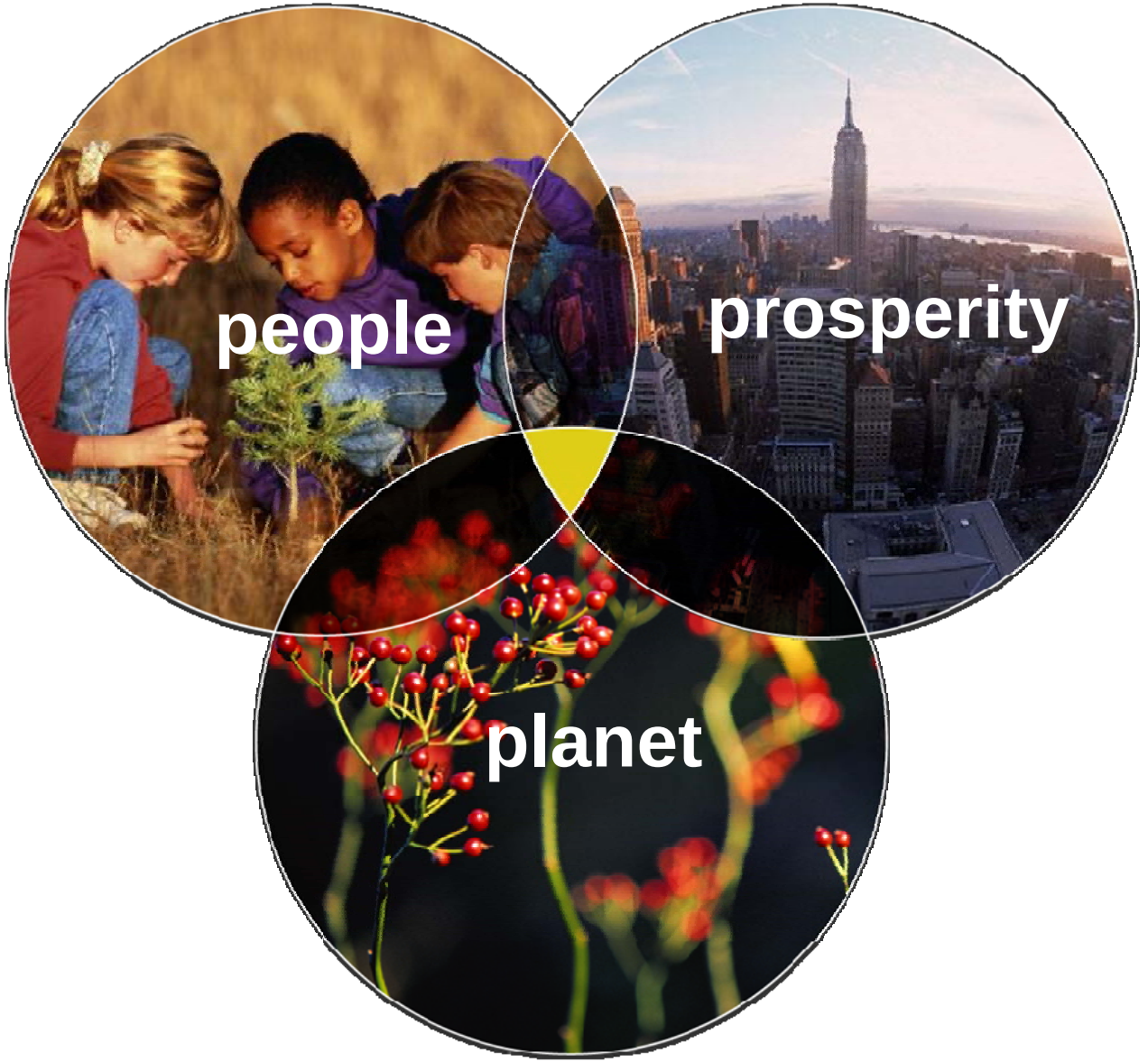
• The **product** would be an area-specific-probabilistic-vision of alternative key development decisions in each country, including pinch points, and forcing functions and their future consequences.

Example: EGYPT
Analysis-- Factors Affecting Agriculture



Technology is empowered by people:

Technology requires human skills, discipline and creativity to make it worth something



Discussion and the Road Ahead:

- What are the key issues facing increased opportunities and collaborations bridging China with MN, our nation and the world?
  - **What is your vision for the future– what will it look like or how will it perform in 2010-2025?**
  - **What are the difficult challenges to overcome to achieve your vision?**
  - **What enabling technologies and policies are needed to address these?**
  - **What critical issues should we consider in beginning plans for 2010 and beyond?**


May others benefit from your lead.
Thank you