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Evidence-based Policy Advice & Innovation Policy beyond Horizon 2020

National Innovation Systems of the Greater China Region

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Outline

- 1. Greater China Region-at-a-Glance**
- 2. Innovation Process: Players Interaction**
- 3. Regional Features:**
 - Taiwan**
 - Hong Kong**
 - Mainland**
- 4. A Comparison**
- 5. Concluding Remarks**

The Greater China Region: at a Glance

	China	Taiwan	Hong Kong
Land (M Km2)	9.6	0.036	0.001
Population (M)	1,338	23.2	7.03
Government	Republic (1949) One Party-led	Republic (1911) Universal Suffrage	HKSAR-PRC (1997) Partial Democracy
Economy	Manufacturing, Agriculture, Nat. Resources	Technology- Intensive Industries	Commerce, Finance, GSCM, Services
GDP-2013, (\$Billions)	9,181.20	489.21	273.66
World Share, %	12.95 %	0.69 %	0.39 %
World Ranking	2nd	25th	37th
2014 Competitiveness Ranking (IMD)	23th	13th	4th

Innovation in the Greater China Region- 2013

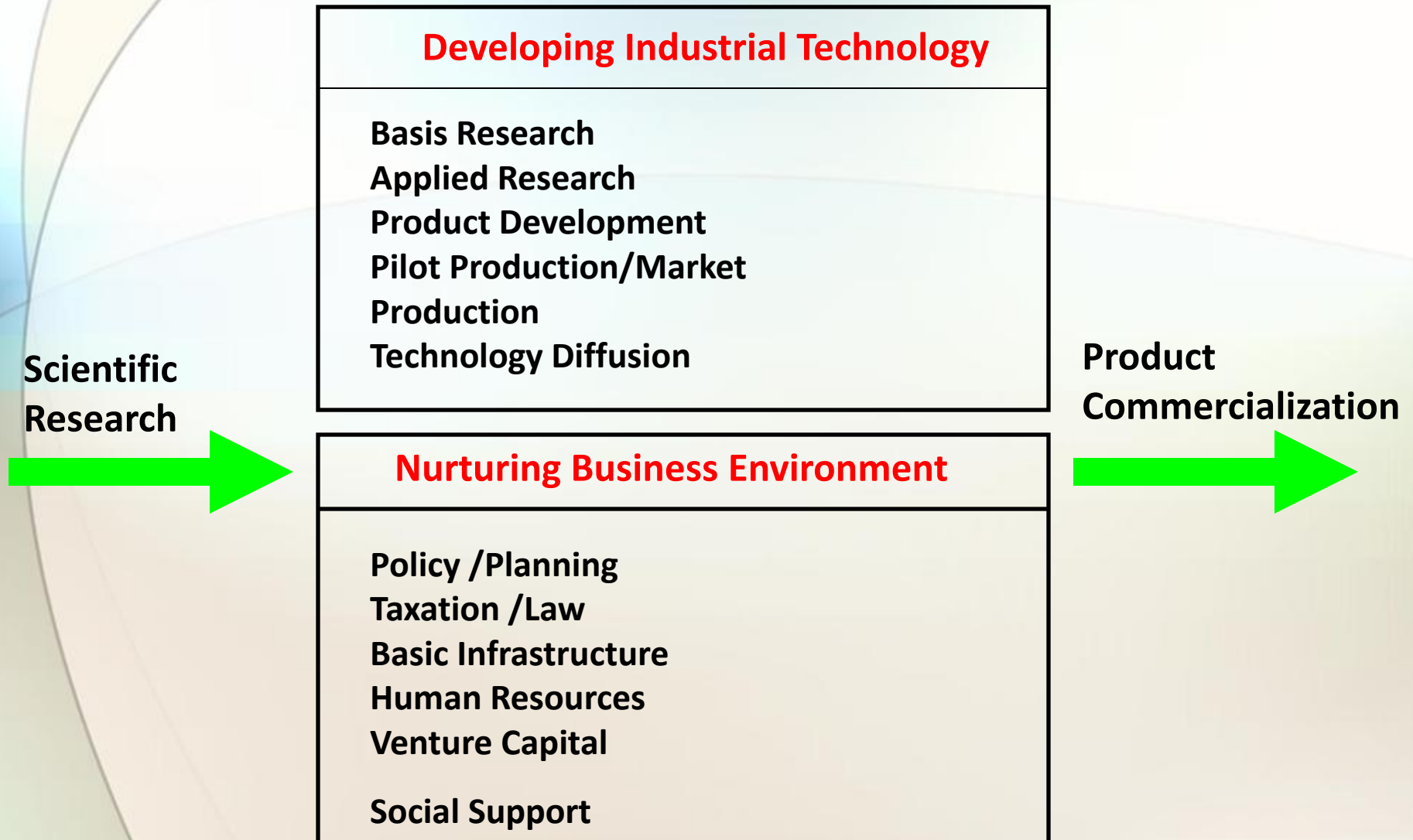
	China	Taiwan	Hong Kong
GDP, US\$ Billions	9,181.20	489.21	273.66
GDP per Capita, \$	6,747	20,929	38,071
Competitiveness			
Education, % GDP	4.09	4.41	3.76
R&D, % GDP	1.98	3.06	0.73
High-Tech Exports	26.27	46.42	16.18
Innovation Capacity	4.95	6.53	6.42
University in World's Top 200 (2013)	6	3	5
Social, HDI(2013)	0.719	0.890*	0.895
Gini Index (2013)	0.55 (h)	0.34(m)	0.53*(h)

Innovation

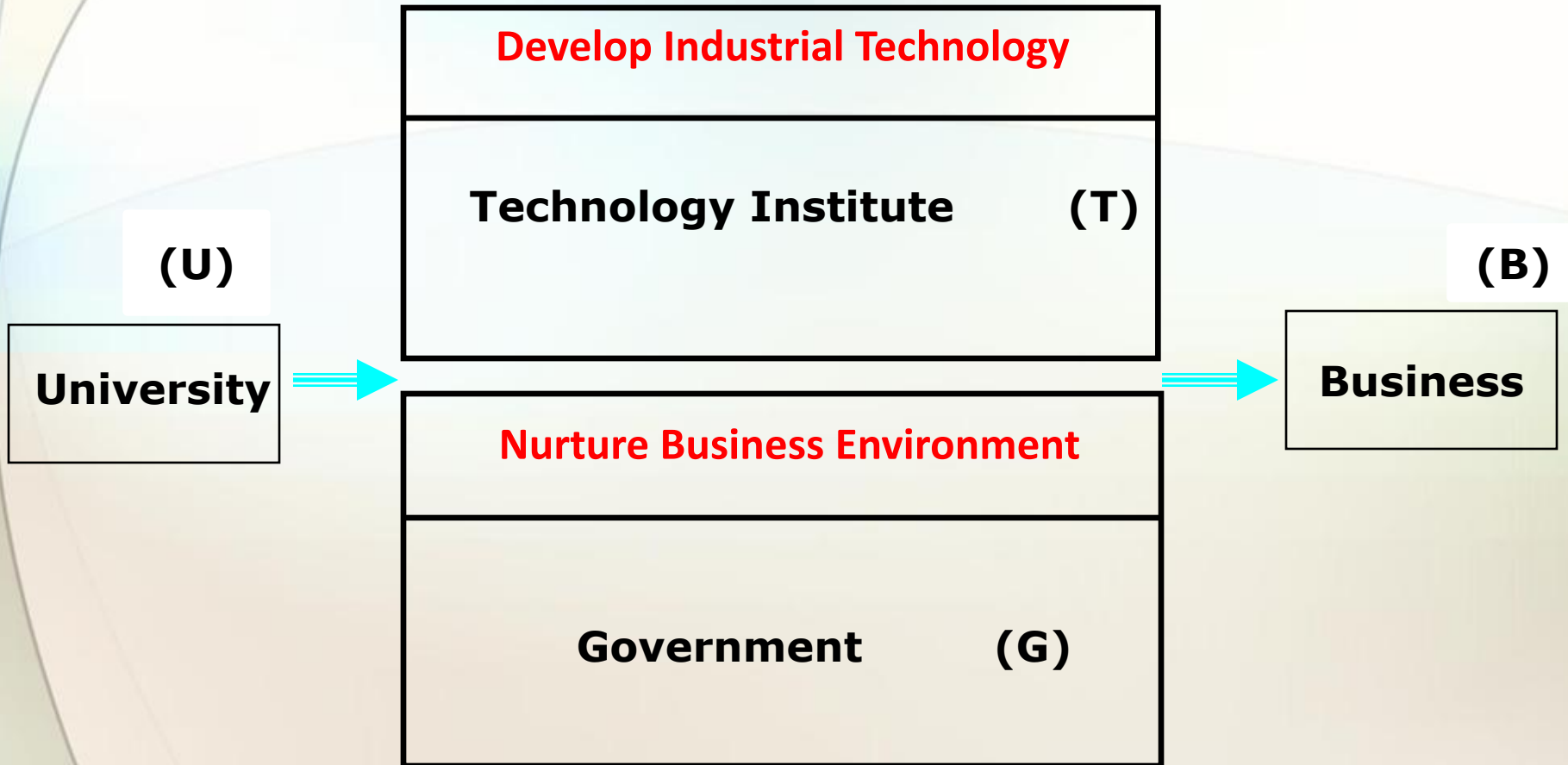
- **Application of knowledge to create wealth and values**
- **Covers many forms:**
 - **Technology/Product**
 - **Processing/Manufacturing/Continuous Improvement**
 - **Business Model**
- **Requiring team efforts of multi-disciplinary talents**
- **Requiring an eco-system that cultivates technology entrepreneurship.**

Source: Otto C C Lin, The Innovation Quartet: From Lab to Market, Shanghai Jiaotong University Press, 2014

Innovation: Creating Wealth from Knowledge

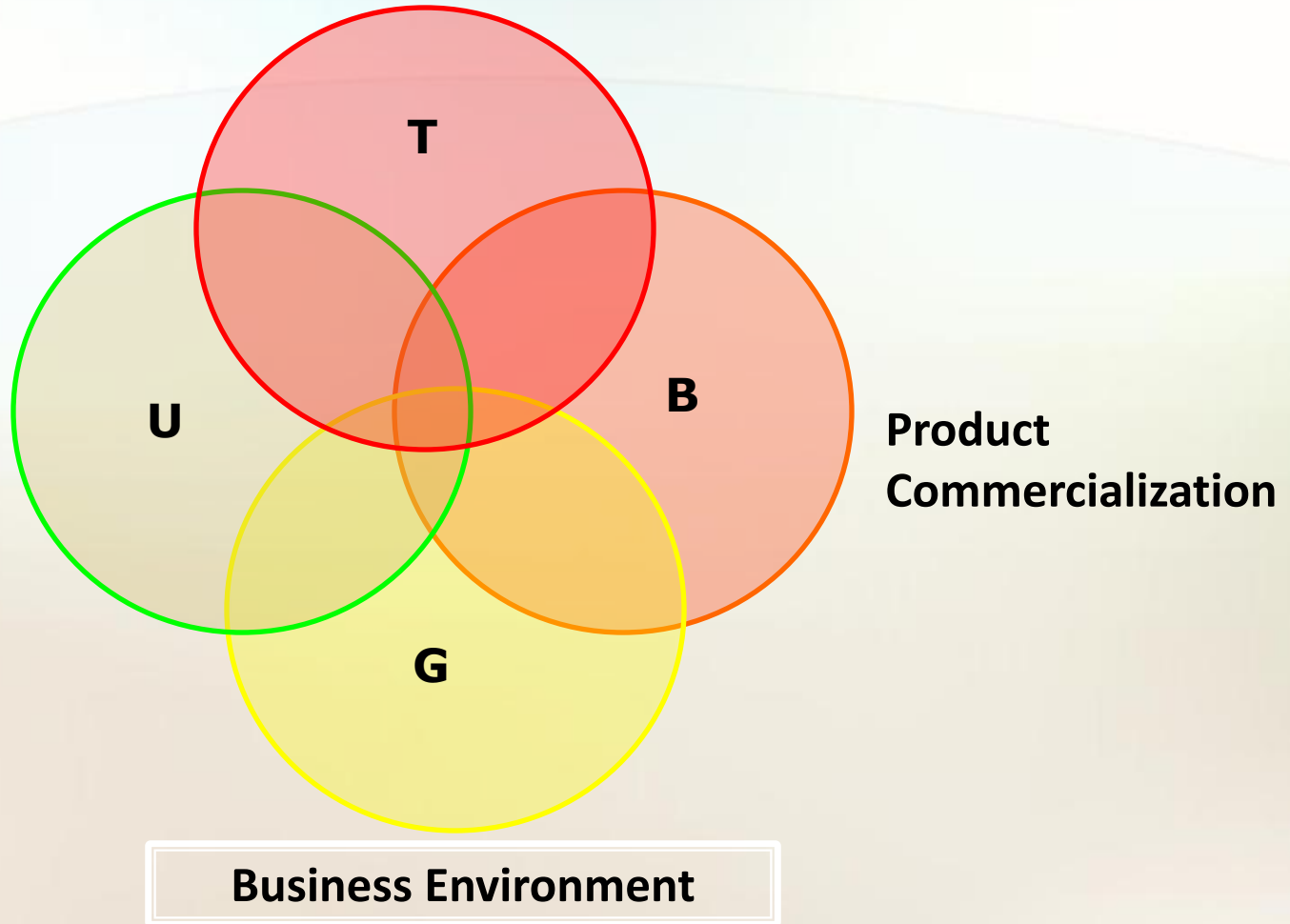


The National Innovation System: The Players



National Innovation System Model 3: Positioning and Collaborating

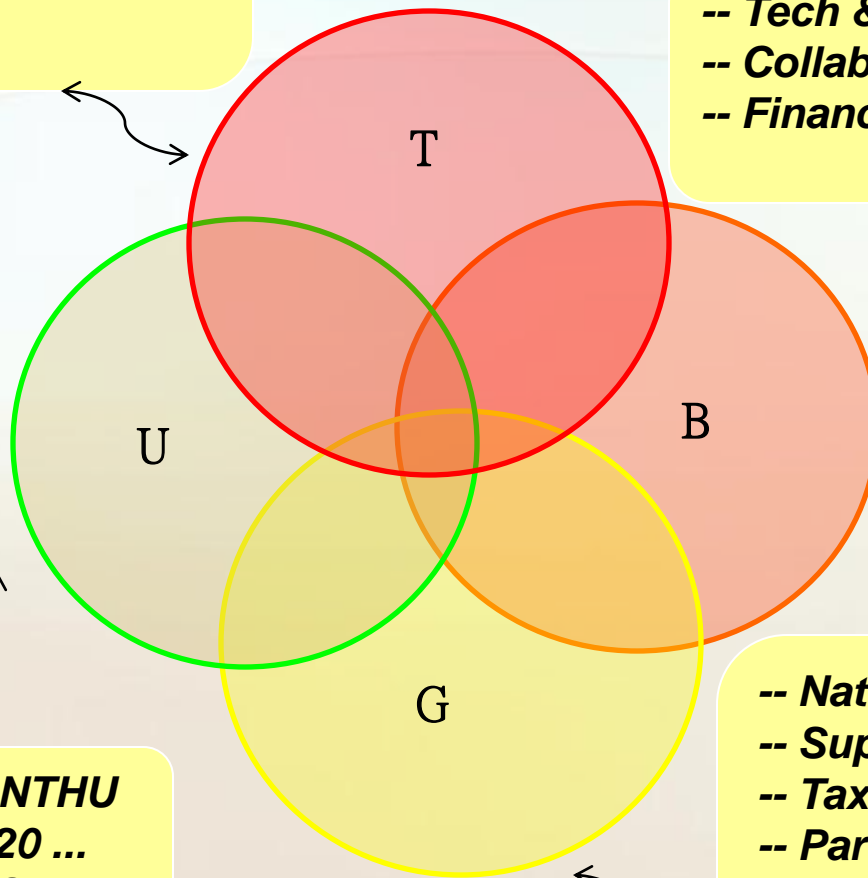
Technology Development



National Innovation System-Taiwan 1

- **Multi-disciplinary: ITRI**
- **Field Specific: Ill, TL, CBD, MIDC, TTRI, CPC, Expos,..**
- **Mobility of professionals & Entrepreneurs**

- **Tech & people transfers with T/U**
- **Collaborative projects with T/U**
- **Financing/ Supports & Tax Credits for Tech Upgrades**



- **University: NTU, NTHU, NJTU, NCKU + 20 ...**
- **Academy: Acad.Sinica**

- **National Thrust S/T Programs**
- **Support to R&D (U/T/B)**
- **Tax Incentives for R&D (B)**
- **Participation in VC Funds**
- **Laws for Tech Stocks**
- **Science Park/Incubation Ctr**
- **Industry/SME Policy**

Worldwide Top Ten IC Foundries by Revenue, 2005

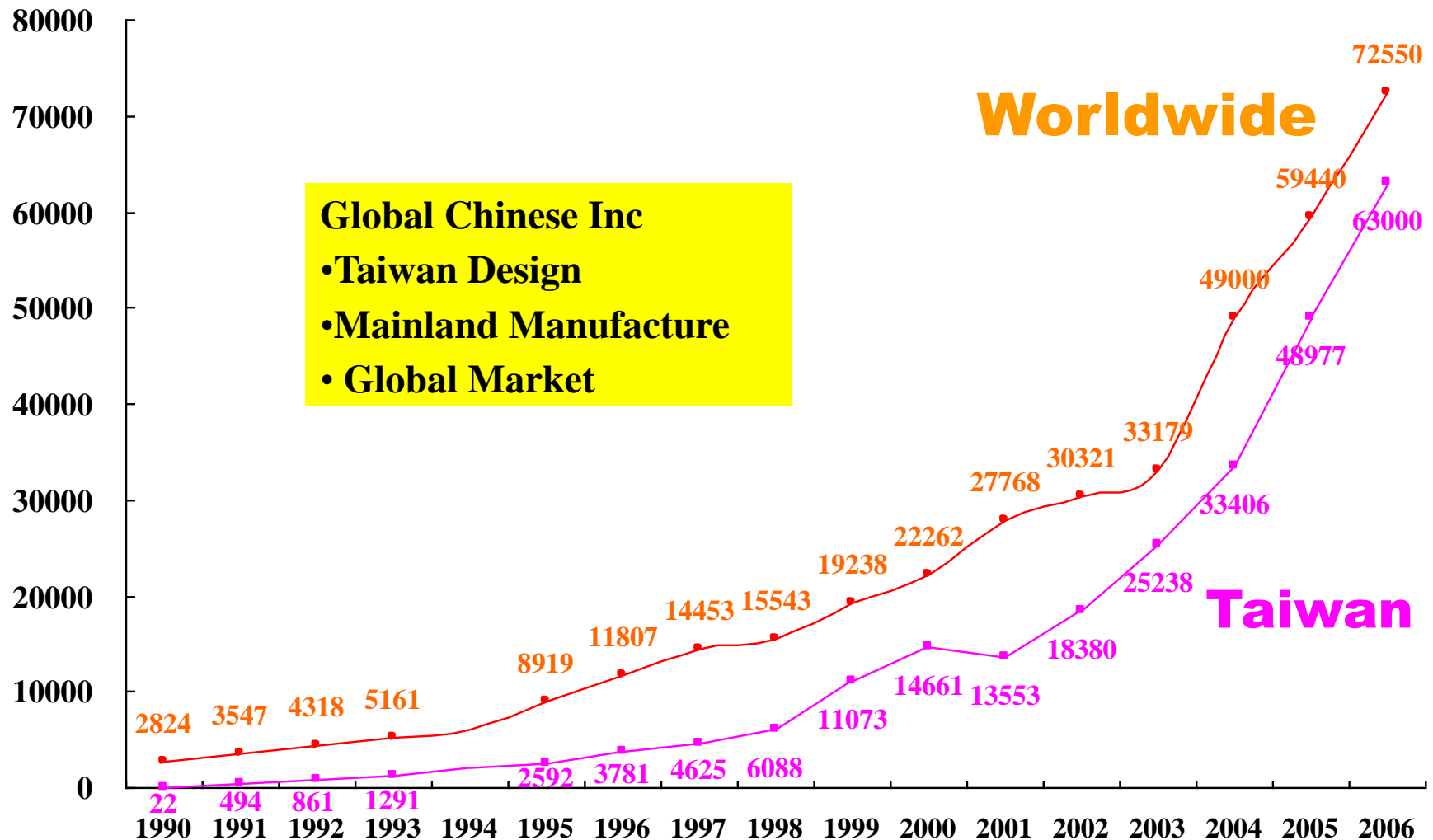
(Ref: L. P. Hsu, 2006)

Millions of Dollars

2004 Rank	2005 Rank	Company	2004 Revenue	2005 Revenue	Change (%)	Market Share 2005(%)
1	1	TSMC	7,668	8,228	7.3	44.7
2	2	UMC	3,497	2,822	-19.3	15.3
4	3	SMIC	975	1,171	20.1	6.4
3	4	Chartered Semiconductor	1,103	1,132	2.6	6.1
5	5	IBM Microelectronics	850	810	-4.7	4.4
7	6	Magnachip (Hynix)	360	396	10.0	2.1
6	7	Vanguard International	393	353	-10.2	1.9
9	8	Dongbu Electronics	333	347	4.2	1.9
10	9	HHNEC	324	305	-5.7	1.7
13	10	X-Fab	178	204	14.6	1.1
		Top 10 Foundries	15,681	15,768	0.6	85.6
		Others	3,150	2,653	-15.8	14.4
		Total Market	18,831	18,421	-2.2	100

Notebook PC Production

Shipment, KPCS



Reference: MIC / IDC

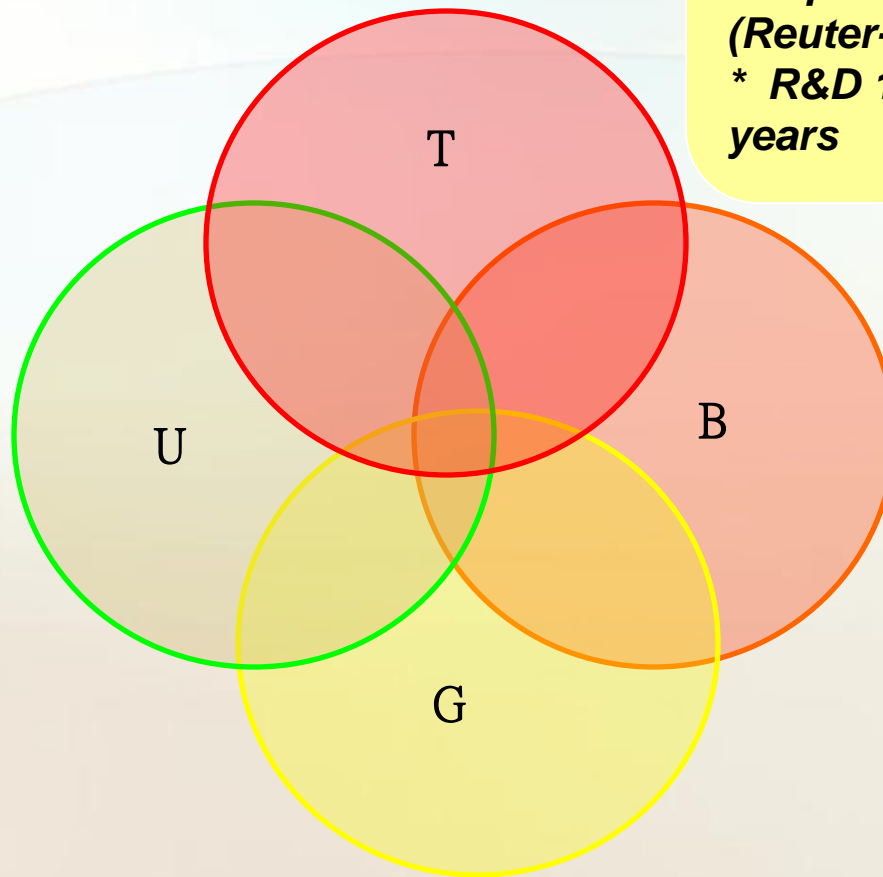
* Estimated for 2000

National Innovation System : Taiwan-2

Technology Development

- * *ITRI - Estimated contribution to GDP (2013): 10-12 %*
- * *Targeted Industry-SMEs*
- * *Top100 World Innovator-2014 (Reuter-Thomson)*
- * *R&D 100 Awards-Multiple years*

Scientific Research



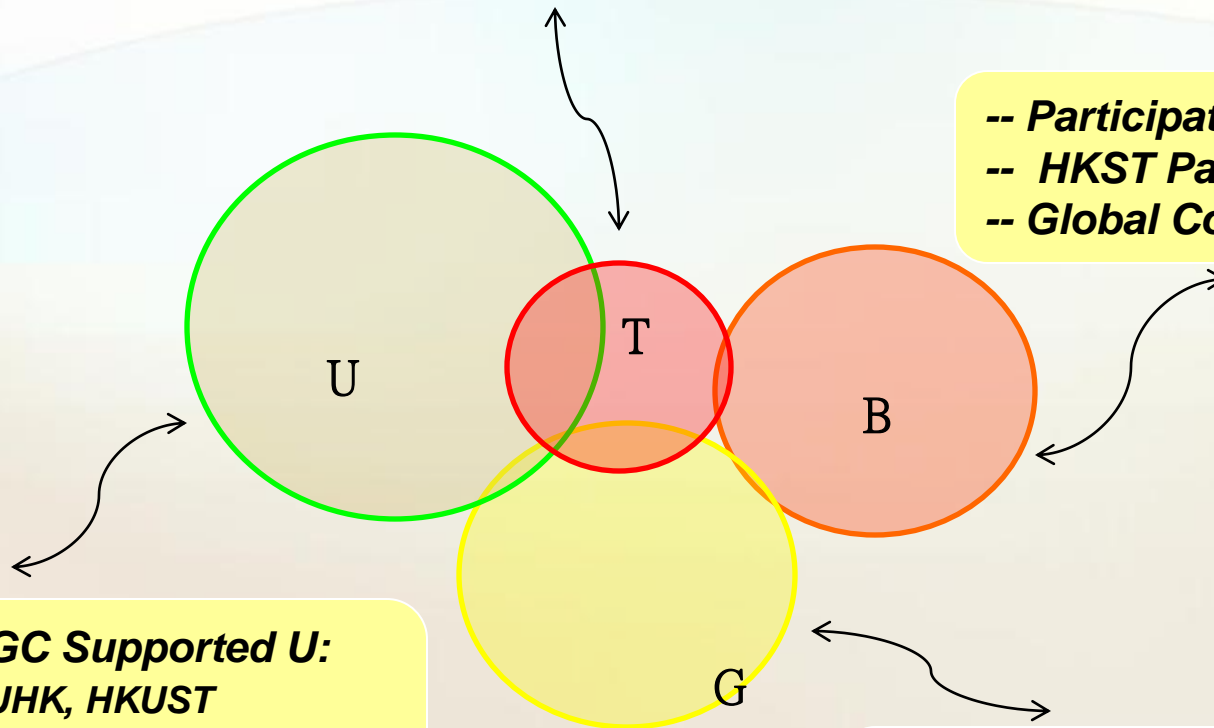
Product Commercialization

Business Environment

National Innovation System : Hong Kong

-- **Field Specific Centres at U:**
NAMI, HKRITA, LSCMI, HKBioL,...
-- **Focused Supports: ASTRI**

-- **Participation in ITF Programs**
-- **HKST Park / Cyberport**
-- **Global Consortia**



--**UGC/RGC Supported U:**
HKU, CUHK, HKUST
City UHK, HKPolyU,
HKBU, LU, OU

--**ITF R&D Supports**
to U and U/B collaborations
ESPRI for Entrepreneurship

Higher Education: QS Top Universities Ranking-2013 (1)

Name of University	2013 Asia Ranking	2013 World Ranking (a)	Remark
HKUST	1	34 (1st)	Hong Kong
University of Hong Kong	2	26	Hong Kong
Nat'l Univ. of Singapore	3	24	Singapore
Seoul Nat'l University	4	35	South Korea
Peking University	5	46	China
KAIST	6	60 (3rd)	South Korea
Pohang UST	7	107 (5th)	South Korea
Chinese U Hong Kong	8	39	Hong Kong
Tokyo University	9	32	Japan
Kyoto University	10	35	Japan
Nanyang Tech University	11	41(2nd)	Singapore
City University HK	12	104 (4th)	Hong Kong
Tokyo Institute Technology	13	66	Japan
Tsinghua University	14	48	China
Osaka University	15	55	Japan

Remark: (a)- Ranking on QS Top 50 under 50, 2013/14

Higher Education: QS Top Universities Ranking-2013 (2)

Name of University	2013 Asia Ranking	2013 World Ranking (a)	
Yonsei University	16	114	South Korea
Tohoku University	17	75	Japan
Nagoya Univesity	18	99	Japan
Korea University	19	145	South Korea
Kyushu University	20	133	Japan
Sungkyunkwan University	21	162	South Korea
National Taiwan University	22	82	Taiwan
Fudan University	23	88	China
Hokaido University	24	144	Japan
Hong Kong Polytechnic Univ	25	161(8 th)	Hong Kong
UST-China	26	174	China
Shanghai Jiaotong University	27	123	China
Nanjing University	28	175	China
National Chiao-tung University	29	230	Taiwan
National Tsinghua University	30	199	Taiwan

Remark: (a)- Ranking on QS Top 50 under 50, 2013/14

National Innovation System: China

Five Parallel Systems

- **Chinese Academy of Sciences**
- **Universities led Institutes**
- **State Ministries led S/T Institutes**
- **Provincial/City Governments led Institutes**
- **R&D Organizations of Businesses**

Source: XUE Lan, LIANG Jeng, Liu X.L., Mo R.P., Research Report on China's Innovation Policy, 2011

China's S&T/R&D Expenditures-2011 (in Billion RMB)

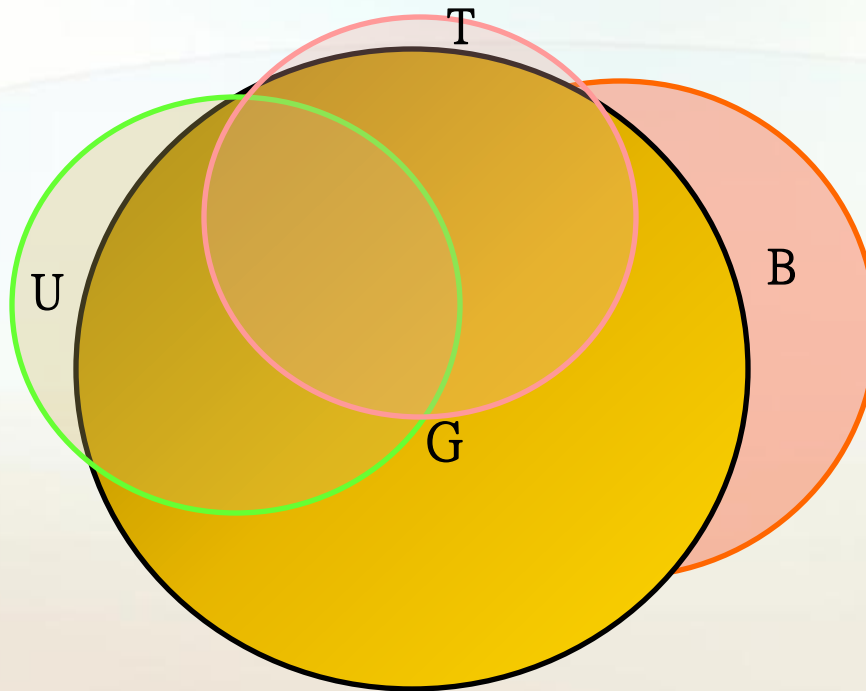
(Reference: Yutao Sun and Cong Cao, Science, 29 August 2014)

AGENCIES	S&T EXPENDITURE	R&D EXPENDITURE				
		BASIC	APPLIED	DEVELOPMENT	MEPs	TOTAL
MOST	27.67	4.69	8.86	7.76	0.013	21.33
CAS	18.95	8.3	7.46	0.25	0.425	16.44
NSFC	14.66	14.66				14.66
MOIIT	6.21	0.16	1.74	0.025	4.2	6.13
MOE	3.88	3.13	0.44	0.12	0.03	3.72
MOA	3.25	0.22	1.97	0.004	0.42	2.61
MOH	2.47	0.06	0.606	0.001	1.56	2.22
NDRC	0.073		0.062	0.004	0.001	0.068
71 Agencies	88.349	31.568	26.796	8.29	7.076	73.731
Other Agencies (Est.)	105.865	--	--	--	--	60.937
Central Gov't	194.214					134.668

National Innovation System : China

Technology Development

Scientific
Research



Product
Commercialization

Business Environment

Innovations System of China: Strength

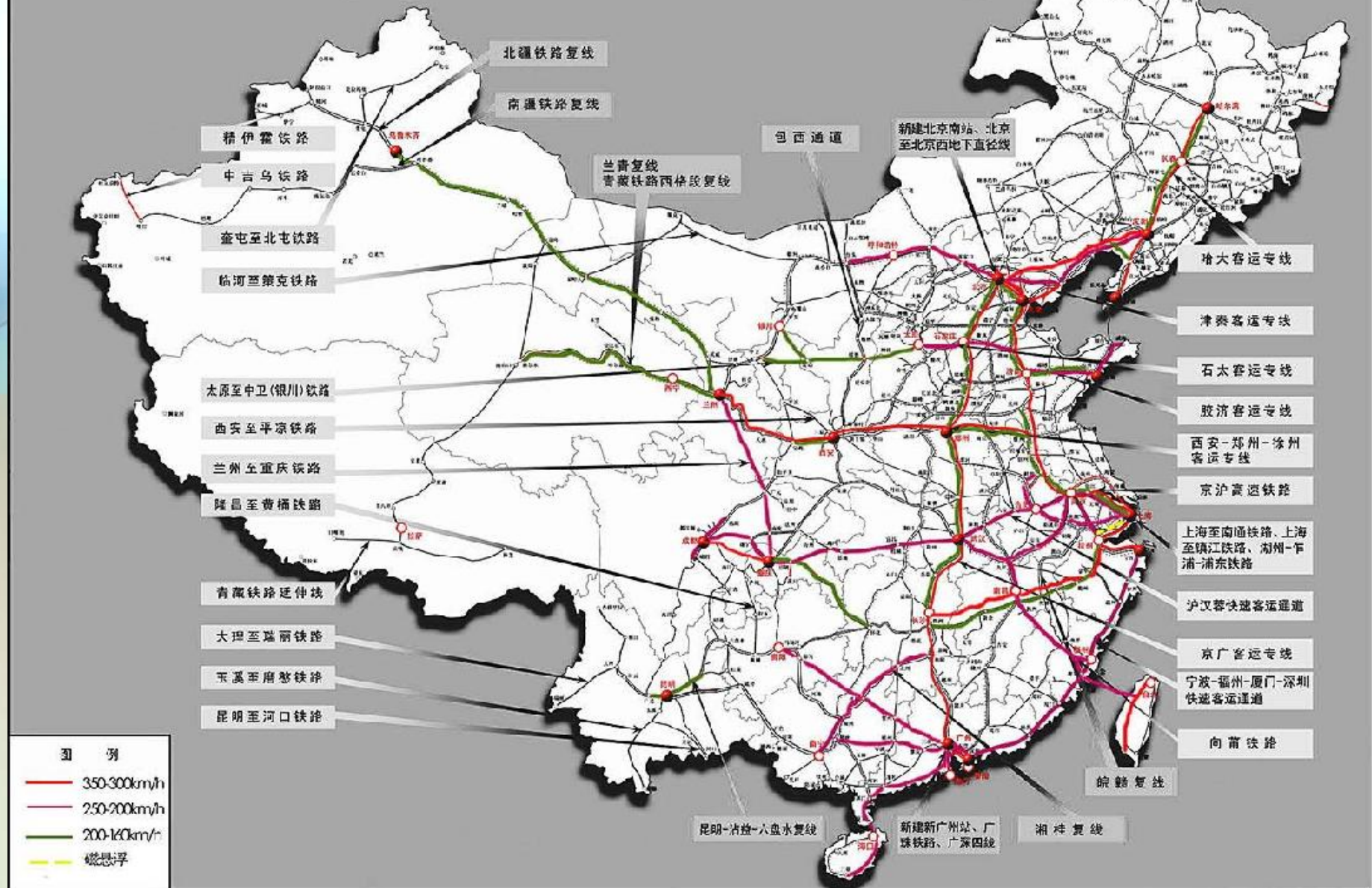
- **Clear Mission and Policy Commitment**
- **Organizations to Execute**
- **Pragmatic Approaches**
- **Focus on Near- Term Application**
- **Wide-spread: Scaling Factor**
- **Large Human Resources Pool**
- **Leverage of Pillar Industries and National Programs**

Innovations in China

Case Example: High-Speed Rail

- **Key Milestones-**
 - 1993 Train services averaged 49 km/h, ~58,600 km total
 - 1996 “9th Five Year Plan : Speed-Up Campaign”
 - 2004 7,700 km of tracks upgraded to run at average 160 km/h
 - 2007 Gz-Sz runs first HSR with 200 to 250 km/h
 - 2008 Bj-Tj, PDL, 120 km, China’s First HSR at 350 km/h
 - 2009 Wuhan-Gz, PDL, 968 km, designed at 350 km/h
 - 2011 Bj-Sha, PDL, 1318 km, designed at 380 km/h
 - 2013 11,028 km, 52% of World services of >250 km/h
 - 2015 Target: 18,000 km total (~ 47% of 300-350 km/h)
- **Annual Ridership- Million Passengers**
 - 2007, 135m; 2009, 152m; 2011, 186m; 2013, 210m; 2014, 227m
- **The Network: 4V+4H; by 2020, 5V+6H+8L**
- **Technology: Train, Power, Bogie, Track, Signaling, Control, Design, Infrastructure and operations over vast geographical area with different climate conditions**
 - Tech Transfer/JVs Mfg- Bombardier, Siemens, Alstom, Kawasaki H,
 - After 2008, All China
- * **Exports: Turkey, Venezuela, Argentina, and possibly, US, Russia, Saudi Arabia, +**

2020年高速铁路网



Innovation System of China: Weakness

*** Overlapping Positioning and Roles of Players**

• Government Dominance:

Planning, Funding, Executing, Reviewing, Evaluating

- Complex Organizational Structure**
- Disproportionate Distribution of Resources**
- Duplication of Programs**
- Short –term Growth Driven**
- Varied Technology Diffusion Process**
- Inadequate Project Management and Review**

Ref: 1. D. Brenitz and M. McPhree, “Run of the Red Queen”, Yale University Press, 2011

2. Yutao Sun and Cong Cao, “ Demystifying Central Government R&D Spending in China,” Science, Vol 345, Issue 6000, P.1006,2014

3. Otto C C Lin, The Innovation Quartet: From Lab to Market, Shanghai Jiaotong University Press, 2014

Major Challenges for Greater China Region

(Ref. Otto C. C. Lin, 2011)

Mainland

Party Reform
Rule of Law
Regional Polarization
Environmental Erosion
Innovation System

Democracy-participation of citizenry
Independent Judiciary
Social Justice-Wealth Gap
Low Carbon Economy
Globalization/Localization

Taiwan

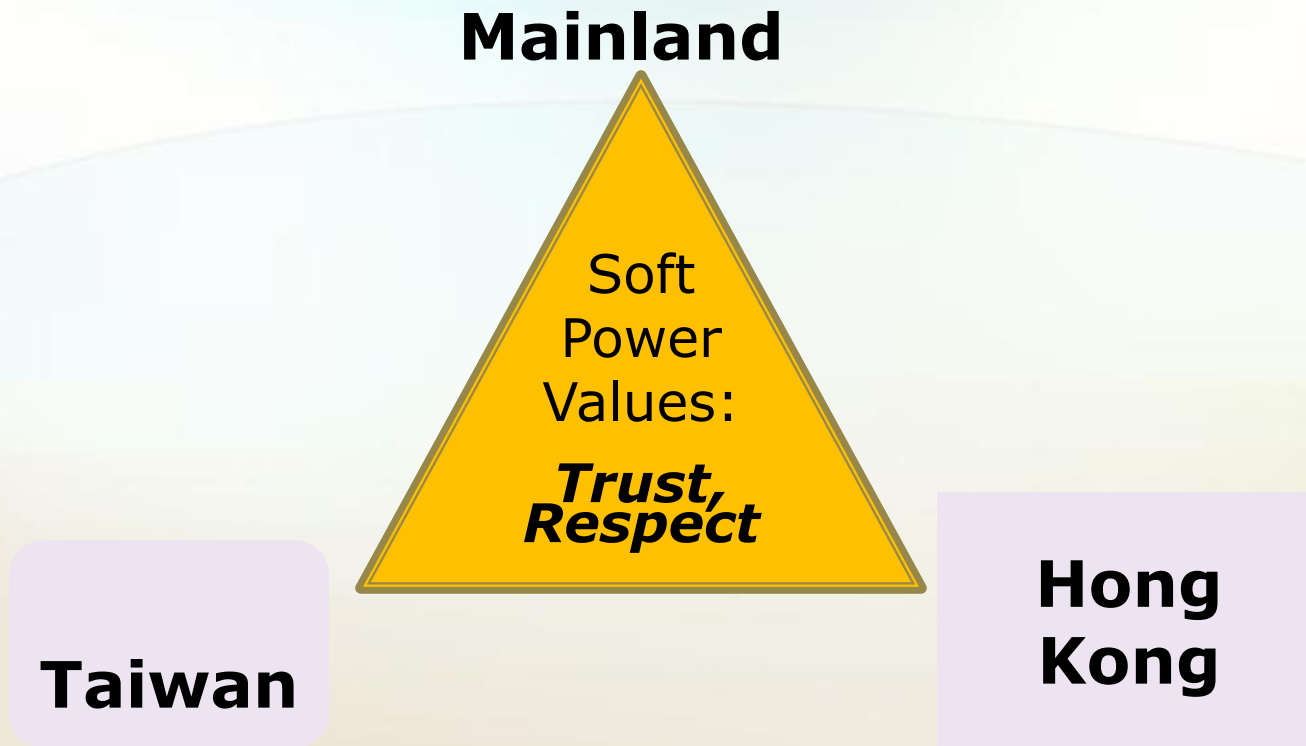
Separatists Movement
Judiciary Reform
Elections Reform
Infrastructure Upgrade
Sustainable Innovation

Hong Kong

Parliamentary Reform
Universal Suffrage
Government-Business Ties
Innovation Mindset/
Narrow Economic Base
Wealth Gap

A View of Major Challenges for the Greater China Region

(Source: Otto C. C. Lin, 2011)



Concluding Remarks

- During the last 30 years, China Mainland, Taiwan and Hong Kong all have achieved remarkable economic development, despite vast difference in size, population and socio-political structure and innovation system.
- Success of innovation depends largely on an eco-system conducive to interactions of the institutional players: government, university, business and the institute. Each player should have a defined positioning and role and interact with other concertedly. Entrepreneurs are key movers who connect various players of the system and bring about innovation to become businesses.
- Hong Kong's world competitiveness was helped by education of skilled professionals to augment its strength in trade, finance and supply chain management. Taiwan's smooth transformation to a technology economy was facilitated by leadership of government and technology institutes in nurturing innovation and entrepreneurship. China's remarkable economic growth was attributed to national commitment and policy, ability to leverage on infrastructural projects such as HSR and, aided by emerging entrepreneurship.
- Successful entrepreneurship requires not only technology and marketing expertise but also soft power attributes.
- Looking onward, they all faced significant challenges which the need of re-vamping the innovation system and policy measures, promoting deeper co-operations, and cultivating soft power characteristics such as trust and respect.

Thank You!
Comments and Critiques are Welcome.

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