

*1st International Conference on Innovative Process in Amazon -- Interactions
between Institute of Science and Technology, Entrepreneurs, and Investors
Manaus, Brazil, June 8 - 9, 2018*

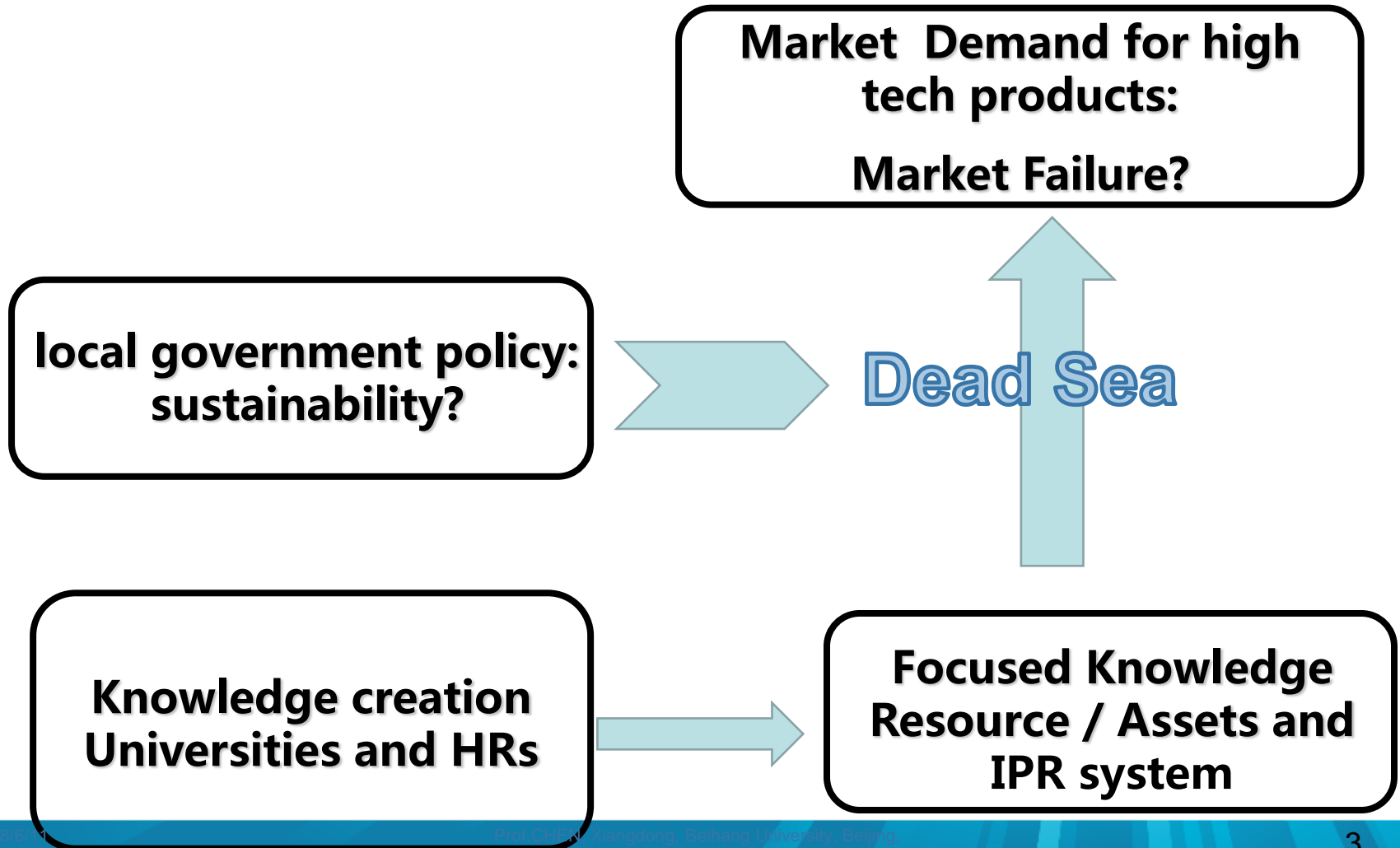
Science Parks in China -- Technology Transfer and Model of Entrepreneurs

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Role of Entrepreneurs in Science Park Models

- **Market Entrepreneurs from universities: Knowledge innovation (知识创新)**
 - **Diversification (多样化)**
 - **The last resource of new ideas (新思想来源)**
 - **Intellectual / Knowledge capital (智力资本、知识资本)**
 - **Intellectual assets or / and intangible property (知识资产、无形资产)**
- **Market Entrepreneurs to connect local industries**
 - **Market tradition / nature of demand and resource supply**
 - **Entrepreneurial Culture and local industrial tradition**
- **Policy Entrepreneurs for Rational Innovation System**
 - **Science park models**
 - **redistribution of resource and output**
 - **financial services and others.**







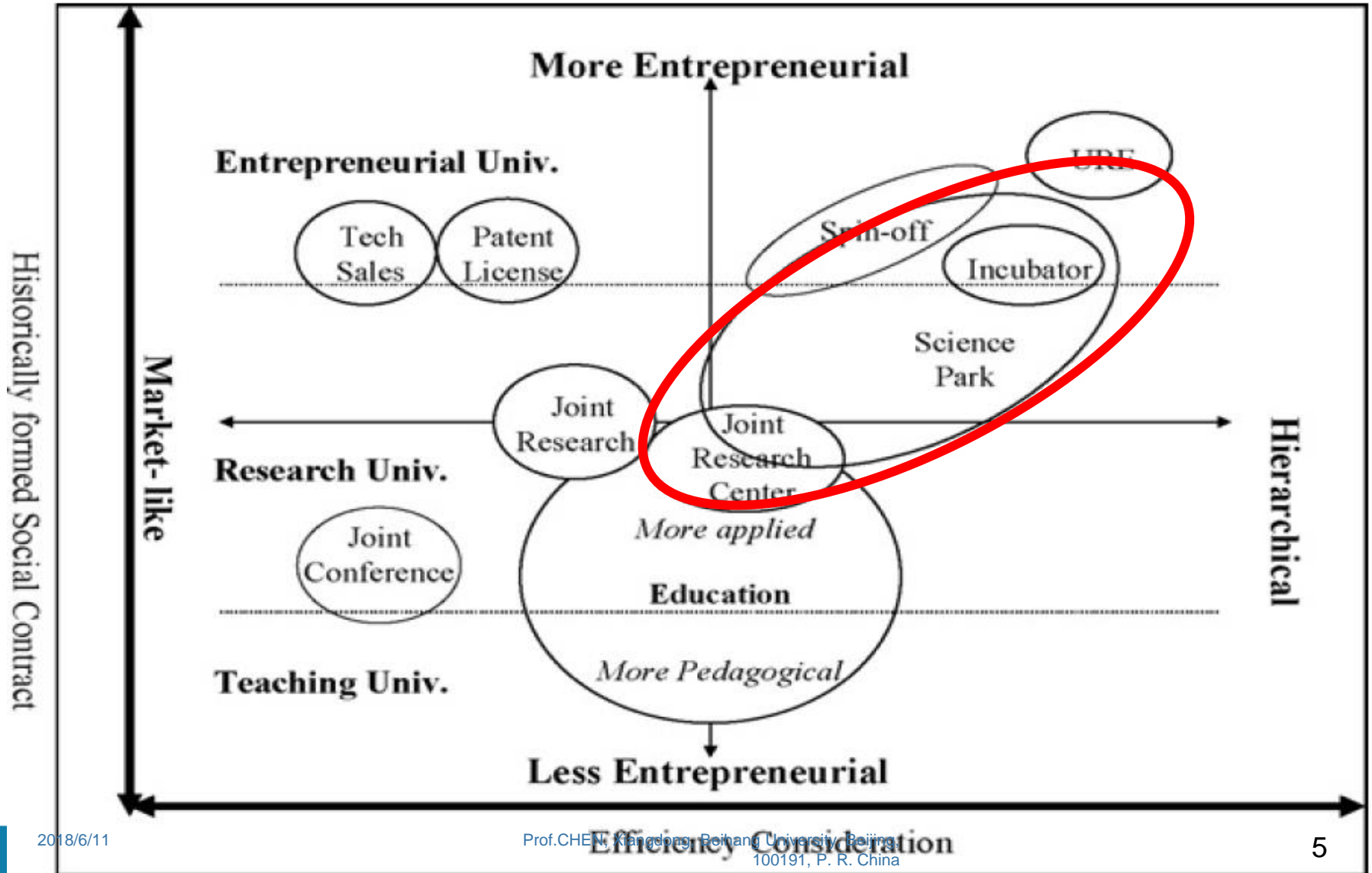
**local government policy:
sustainability?**

**Market Demand for high
tech products:
Market Failure?**

Science Parks

**Knowledge creation
Universities and HRs**

**Focused Knowledge
Resource / Assets and
IPR system**



University run High Tech Business Companies

Highly concentrated
Top 8 out of the Top 100 own 89% of total assets

University-run High Tech Companies (Ranking)

序号	Top 100 Companies	Assets (billion RMB)	Share
1	Tsing Hua University	4.4	36%
2	Peking University (FZ)	4.3	36%
3	Northeast University (Shenyang) DR	0.6	5%
4	Hua Zhong University of S&T (Wuhan)	0.5	5%
5	Shandong ShiDa Group	0.3	2%
6	Peking University (Bioengineering)	0.2	1%
7	Peking University Science Park	0.2	1%
8	Tongji University (Architecture)	0.1	1%



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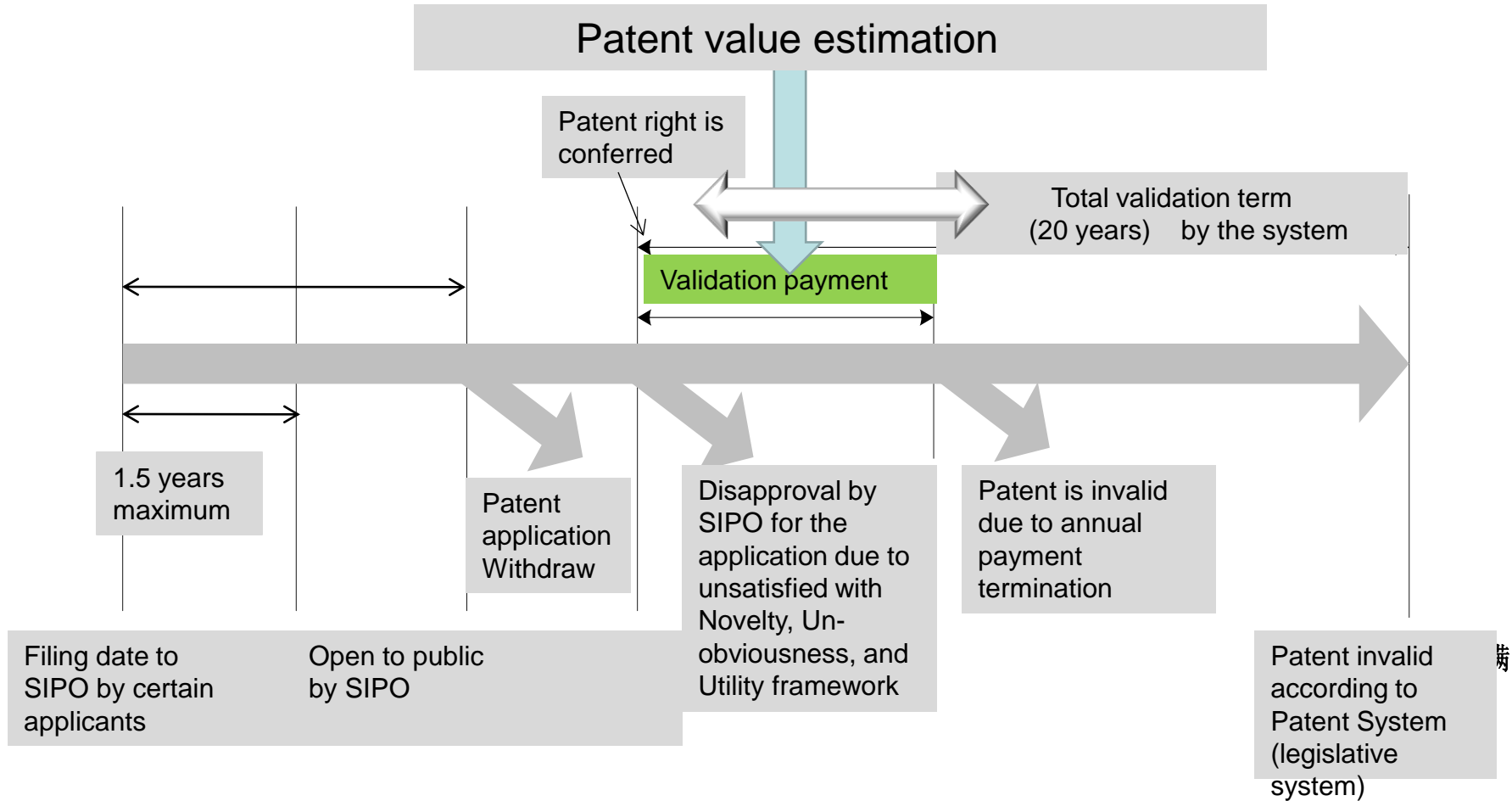
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医疗卫生

东软提供从硬件到软件，从技术到服务，从医院到个人，从中心城

Chinese university patent volume

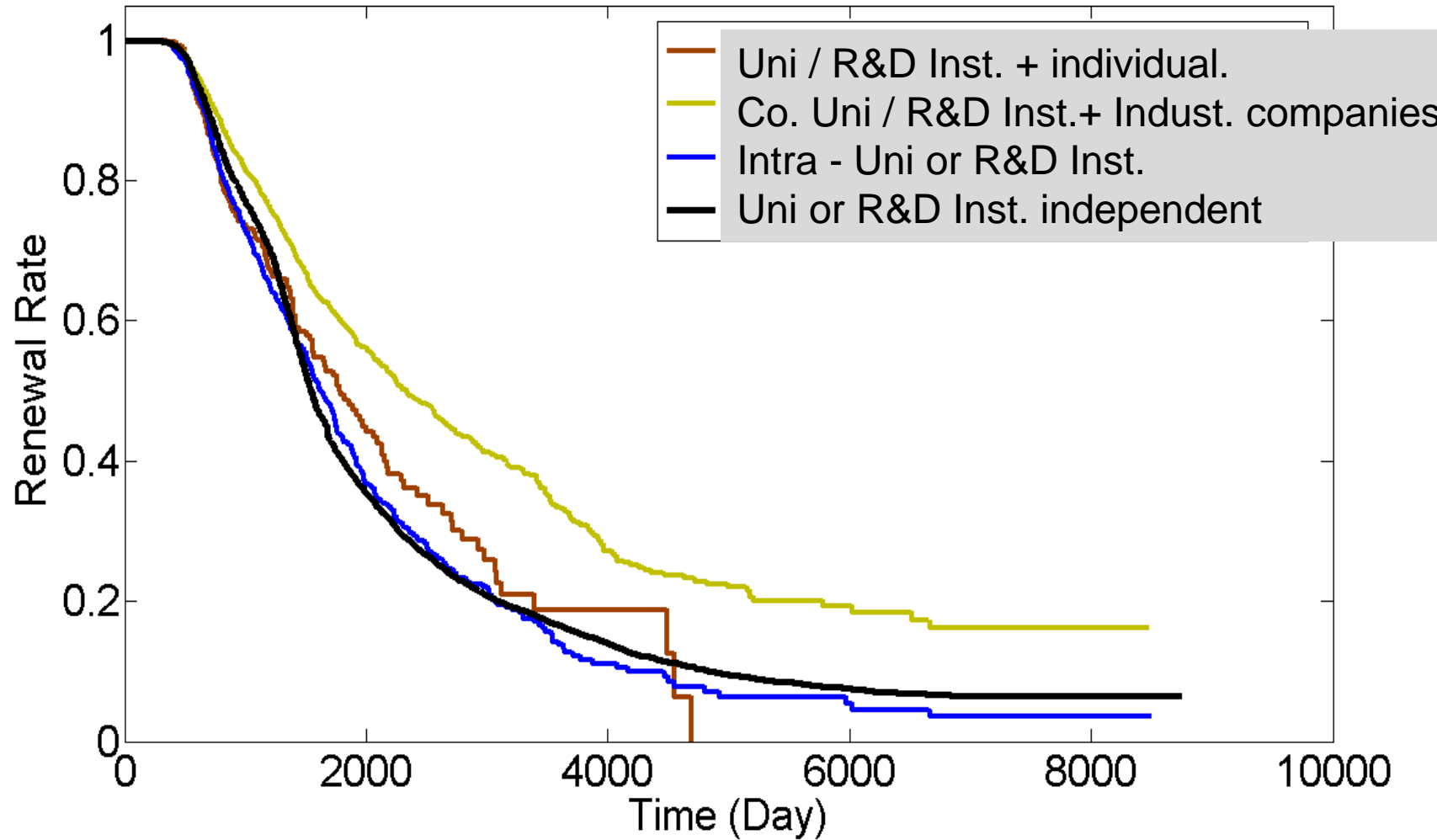
University + Institute	Invention	Utility model	Designs
Filed	1.225 million		
Granted	0.551 million	0.546million	0.0964 million
<i>Filed</i>	<i>8.118 million</i>		
<i>Granted</i>	<i>2.90 million</i>	<i>7.46 million</i>	<i>4.67 million</i>
<i>% of filed</i>	<i>15.09%</i>		
<i>% of granted</i>	<i>19.0%</i>	<i>7.3%</i>	<i>2.1%</i>





Value against average by different organizations (%)

Patent value	Larger firms	SMEs	Universities (985) and CAS	Universities (Non – 985, but 211)	Universities (Non-211)
Value in average	208.5%	74.0%	75.6%	72.8%	69.1%





Science Parks in China

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Development of Science Parks in China

- The National High & New Technology Industrial Development Zone (simplified as NHTZs) in China, can be seen as national level science and technology based industrial park, or science parks
 - launched in August 1988;
 - Totally 145 up to 2015
 - Annual turn over 28.3 trillion RMB, Industrial Production value: 20.5 trillion, estimated 2016



Nature of science parks in China

- Sample based empirical investigation
 - top samples
 - significant indicators / relevant variables
 - potential samples.
 - ...
- Case studies
 - characters of typical Science Parks
 - typical models to be summarized
 - lessons learnt

Investigation Framework over *science parks in China*

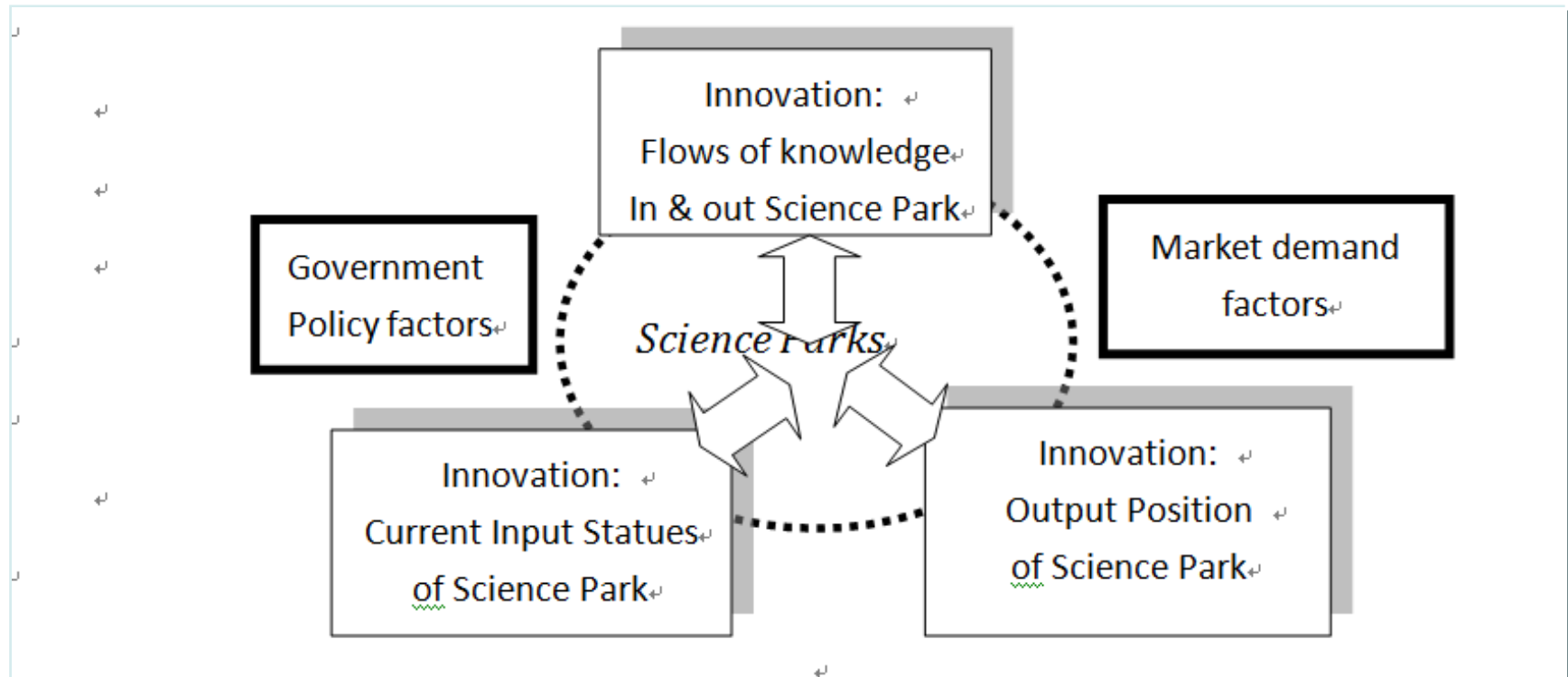


Figure 1 Research framework for investigation on science parks via Innovative Ecosystem perspective



3 dimension investigation – innovation ecosystem perspective

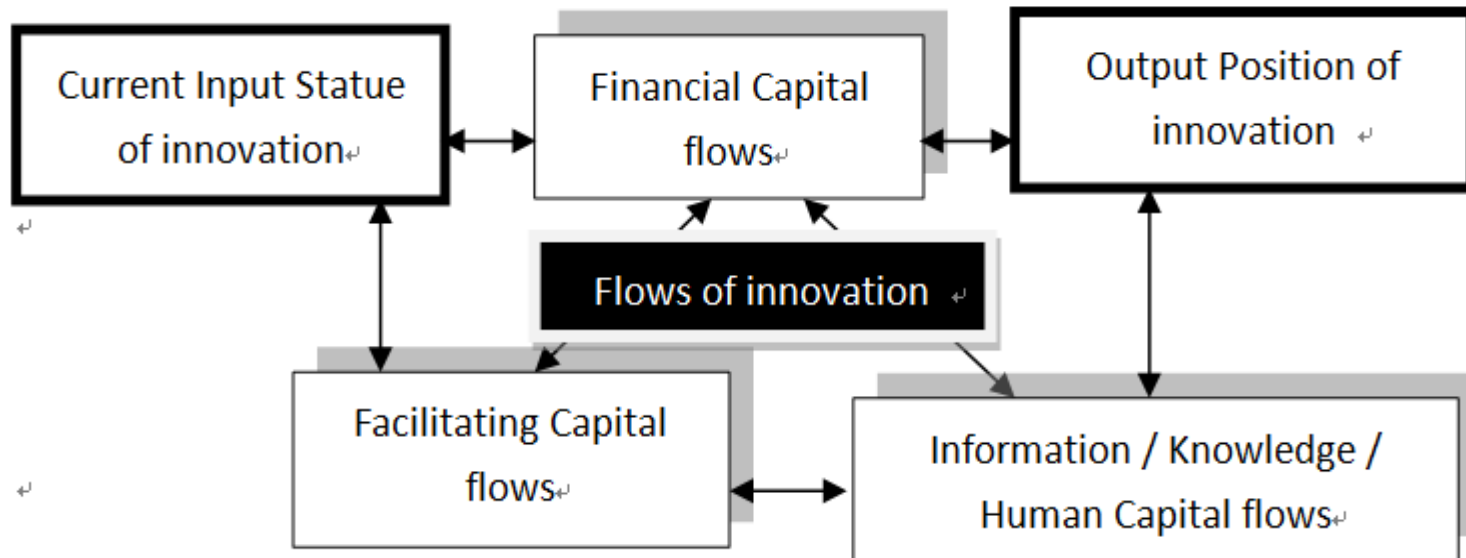


Figure 2 Research framework for investigation on science parks via Innovative Ecosystem perspective





	Level 2 measure	Level 3 measurements
Dominated Input	Capital Measures	Percentage of the R&D expenditure against local production value
		Technology transfer expenditure
		Realized accumulative investment of foreign companies at year end
		Expenditure of entrusted domestic research institutions for conducting scientific and technological activities
		Share capital financed by listed enterprise on a stock market
	Talent Measures	No. of people with degree of bachelor or above per 10,000 persons
		% of people engaged in S&T activities over total employees
	Policy Measures	% of technical expenditure to expenditure in the current year
		Total number of scientific and technological projects
		% of exempted amount of research and development expenditure after deducting income tax in the total research and development expenditure
		Number of national-level scientific & technological enterprise incubator
	Tangible Measures	% of high tech firms S&T instruments to total enterprise number
		Total investment in fixed assets finished in the current year for the actual management area per square kilometer

Output Position

Level 1 index	Level 2 measure	Level 3 measures
Output Position innovation achievement	Knowledge / technological output	Number of newly increased invention patents per 10,000 persons
		Number of articles in science and technology published
		Number of national or industrial standards
	Economic output	% of total income of high-tech industry to operating revenue
	Social output	Profit rate of enterprise sales revenue
		Taxes paid per capita
		Average salary of employed persons
		Number of R&D and manufacture institutions established abroad



“Flow” dimension

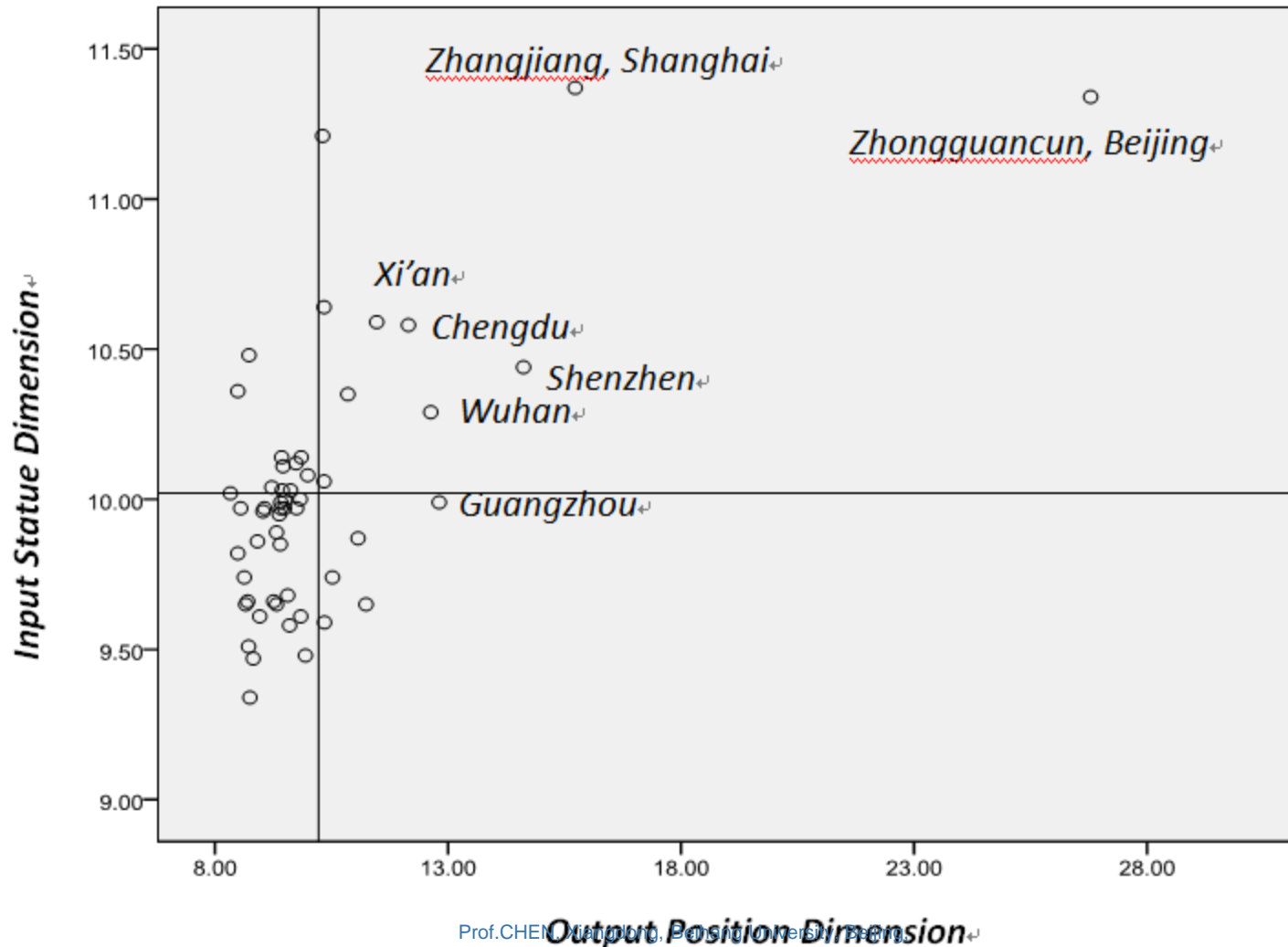
Level 1 index	Level 2 Measure	Level 3 measurements	
System flow	High tech Revenue flow	Volume of business / technical contract per capita	
		% of new product value to the increased value (RMB10,000)	
		% of technical revenue to the total revenue of scientific park	
		% of technical service export to the total export	
		Total guarantee capital	
	High tech Information flow	Number of high-tech enterprise recognized in the current year	
		Number of national science and technology awards	
		Percentage of total number of enterprise newly registered in the current year to the total enterprise number	
	High tech Talent flow	% of returned overseas students increased newly in the current year to the newly increased employees	
		Number of people newly selected and in national "1,000 Talent" program	
		% of current year graduates from universities to total newly hired employees	
			Comprehensive energy consumption to increased value (RMB10,000) industrial enterprises

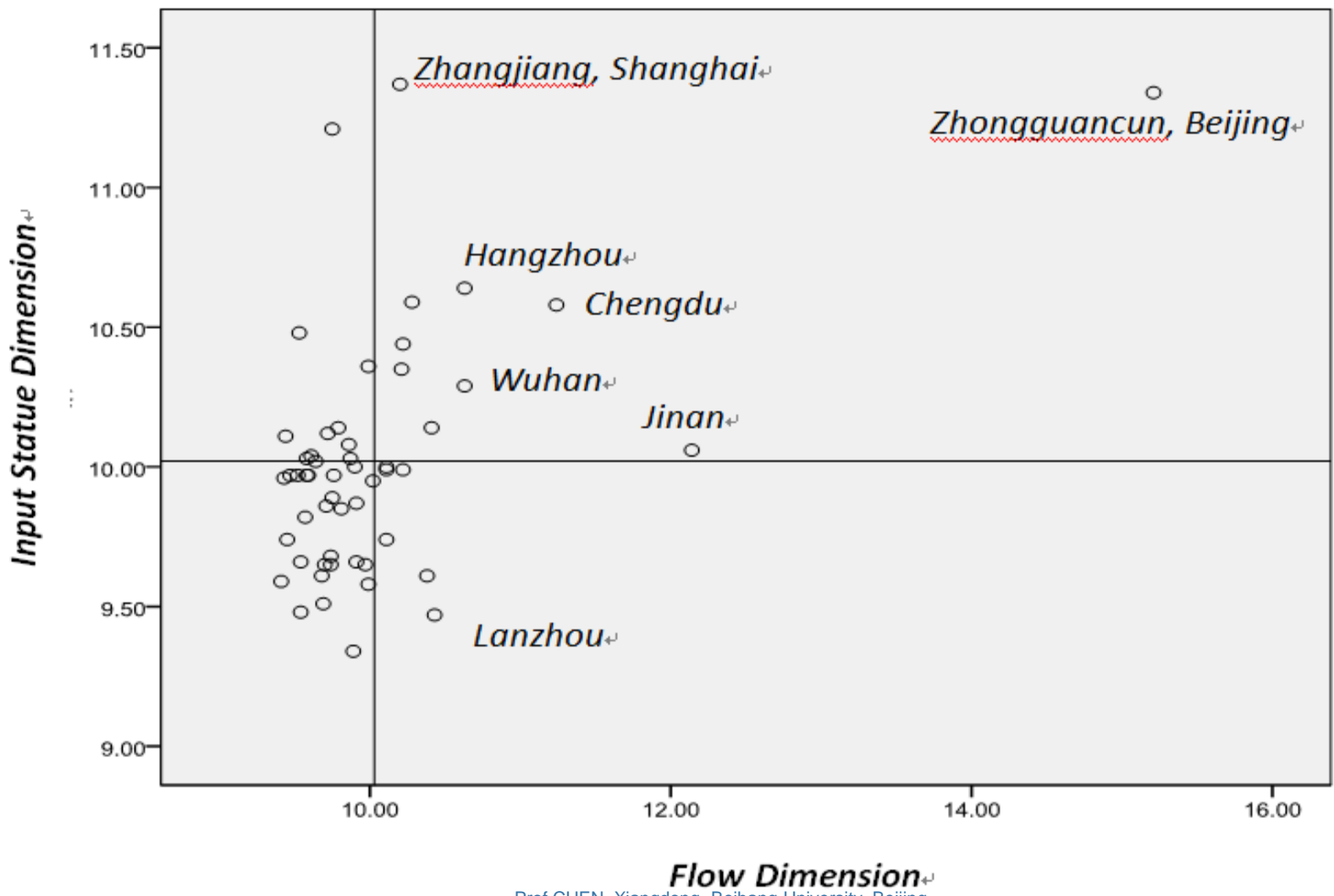




Top 10 NHTZ's of 54 sample science parks

NHTZ	Current Input Statue	System Flows	Output Position	Summary
BEIJING	11.34	15.21	26.79	53.33
SHANGHAI	11.37	10.2	15.73	37.3
SHENZHEN	10.44	10.22	14.62	35.28
CHENGDU	10.58	11.24	12.15	33.96
WUHAN	10.29	10.63	12.63	33.55
GUANGZHOU	9.99	10.22	12.81	33.02
JINAN	10.06	12.14	10.34	32.53
XI'AN	10.59	10.28	11.47	32.34
HANGZHOU	10.64	10.63	10.34	31.6
HEFEI	10.35	10.21	10.85	31.4
<i>STD</i>	<i>0.469</i>	<i>1.573</i>	<i>4.902</i>	<i>6.535</i>
<i>STD (total)</i>	<i>0.436</i>	<i>0.868</i>	<i>2.738</i>	<i>3.775</i>
<i>STD (NT)</i>	<i>0.318</i>	<i>0.260</i>	<i>0.661</i>	<i>0.825</i>





- Different model of technology transfer in different science parks in China?
- Characters of Creative Transfer Mechanism
- Important lessons?



- **Fairly larger numbers of high tech and Start Up companies**, such as Lenovo, Baidu, Eastern Capital, Yongyou Software, etc., usually characterized by their own unique intellectual property;
- **Fairly larger numbers of advanced R&D centers from MNEs**, such as from Intel, Microsoft, IBM, AMD, Oracle, Nokia, Siemens, Ericsson, Fujitsu, ABB, French Telecom, NEC, etc.
- **Fairly larger numbers of universities and national labs**, such as 32 prestigious universities, represented by Tsinghua University and Peking University, 206 key science & technology institutes, 112 national key labs, 95 national engineering (technology) research institutes, and 38 national engineering labs. ;
- **Fairly larger numbers of advanced talents in academic and high tech business fields**, such as 591 national academicians from Chinese Academy of Sciences and Chinese Academy of Engineering, about 40% of total numbers all over the country; and 1.59 million high tech firm employees, among them, 172 thousands PhDs and master degree graduates, plus 16 thousands of overseas returned scholars with their 6000 Start Ups (accumulated numbers);
- **Fairly larger numbers of science & technology oriented venture capitals and financing funds**, such as various S&T banks, angel funds, venture funds, Start Ups foundations, credit financing brokers, intellectual property brokers, industrial property transfer brokers, etc..
- More importantly, **fairly strong cultural for entrepreneurial motivations.**





Indicators from ZGCs

Year / Num. E; Prod. V. Expt V.Tech Incm Tech Dv. Exp Incm Sales Exp \$

2000	6 171	634	174	163	18	249	579	18
2001	8 011	744	303	215	25	167	875	31
2002	9 673	837	334	306	33	125	917	29
2003	12 030	893	315	419	59	192	728	33
2004	13 957	1 172	465	562	60	284	1 355	54
2005	16 452	1 552	657	810	100	630	1 839	95
2006	18 149	2 099	982	1 189	94	927	2544	138
2007	21 025	2 387	1 218	1 473	210	1 196	3 221	197
2008	18 437	2 307	1 091	1 693	273	1 146	3 327	207
2009	16 949	2 272	1 016	2 094	336	1 072	3 204	208
2010	15 720	2 862	1 113	2 478	475	1 189	3 949	227
2011	15 026		932	2 845	538	997		237

Times increased 2.43 4,51 5.35 17.45 29.89 4.00 6.82 13.16



Science Parks in ZGCs -- Major Industrial Sectors (production value) (0.1 billion RMB)

Years /	IT& Electron	Biopharm.	New Matrl	Adv. M.	New Energy	Total
2001	977.12	47.24	72.98	94.00	29.87	1 287.06
2002	874.22	67.74	90.24	317.95	34.11	1 485.16
2003	839.44	97.83	118.36	236.55	85.17	1 607.75
2004	926.78	116.46	157.49	286.44	178.33	1 876.32
2005	1 465.50	134.20	188.92	341.67	222.49	2 611.12
2006	1 855.05	155.21	230.62	450.86	340.33	3 447.54
2007	2 353.98	160.38	254.81	461.53	326.21	3 850.42
2008	2 022.70	307.16	272.19	513.51	355.66	3 805.10
2009	1 874.73	262.76	231.99	710.04	691.02	4 193.02
2010	2 026.21	320.91	390.67	1 044.30	958.25	4 988.02
Times increased	2.86	10,00	9.19	16.73	93.03	5.47



- Investment and financing, such as Shanghai Equity Exchange Center (for OTC operation) and S&T banks, including more than 10 financial guarantee organizations, 150 investment banks for start-ups.
- Flexible policies, attracting heavy investment from some 2000 domestic and overseas high tech companies and MNEs, including SMIC (Semiconductor Manufacturing International Corporation), Roche Group, Pfizer, AMD, etc..
- Easy transfer of overseas technologies,
- Differences:
 - Closer ties with international high tech multinational companies. less policy operations, in Shanghai,
 - More domestic university / national research institute linkages and stronger policy innovations in Beijing case.



ChengDu High Tech Zone

One of the six pilot science parks in China in early 1990s;

Space: 130 SKM,

Population: 878.7 thousand;

Production value added: RMB 117.82 billion,

Output; 0.96 billion RMB per SQKM, 155 times than the province, and 11 times higher than Chengdu City

Per capita GDP 32.000 USD

Ranked No. 4 in 2014 by MOST among 114 science parks in China;

Next to Beijing (ZGCs), Shenzhen, and Wuhan (East Lake).

0 2.5 5 10 千米



Cheng Du case: Entrapreneurial actions in manaderail level - phase I

- Initiation via **Top-down** channel: since 1990
 - Administrative measures were given to the “Provincial-City Collaborative Managerial Team”
 - *land and space for the development*
 - *function designs (construction) on industries, agricultura, and urban development.*
 - *Investment call with better policies (494 btwn 1990 and 1995);*
 - *Industrial value chain on 3 leading sectors - IT, bio pharma, fine mechanical. for further investment interests (1995 -- 2005)*
 - *policies for entrepreneurial talents and returned scholars....*

表2 1991 - 2005 年成都高新区高新技术企业统计表

年份	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
certified	23	42	35	18	18	23	31	36	69	101	115	83	162	115	112
practical	23	65	116	134	152	175	206	242	272	378	493	524	605	700	812



Cheng Du case: Entrapreneurial actions in manaderail level- phase II

- local enterprise support: since 1996
 - *background -- local economic growth (25% betwn 1995 and 2005)*
 - *local comopanies registered in the HTPs -- 96%;*
 - *local leading industries:*
 - *initially designed: 9 sectors*
 - *local registered companies 70%*
 - *various kinds of companies, not necessarily high tech.*
 - **3 sectors emerging as leading sectors after 2005, with policy modreation**

Gov. -- Investment Co. since 2004, as financial support for high tech firms including: **equity type investment / financing services / strategic management consultancy / equity management service** ,



Cheng Du case: Entrapreneurial actions in manaderail level - phase III

- “**bottom up**” globalization

- *foreign investment (higher quality)*

- *Intel investment (375 million USD) , more than 100 companies*
- *MNEs as leading power, with local integrated suppliers*

表3 2006 - 2014 年成都高新区实际利用外资统计表

年份	2006	2007	2008	2009	2010	2011	2012	2013	2014
实际利用 外资(亿美元)	6.51	9.08	12.29	7.97	9.02	11.97	16.15	21.18	21.40

1.07/Inv

表4 2006 - 2014 年成都高新区外贸出口统计表

9.67/Inv

8.43/Inv

年份	2006	2007	2008	2009	2010	2011	2012	2013	2014
外贸出口额(亿美元)	7.01	10.63	20.06	26.88	36.00	116.10	174.40	170.38	177.50



positioning on the value chain

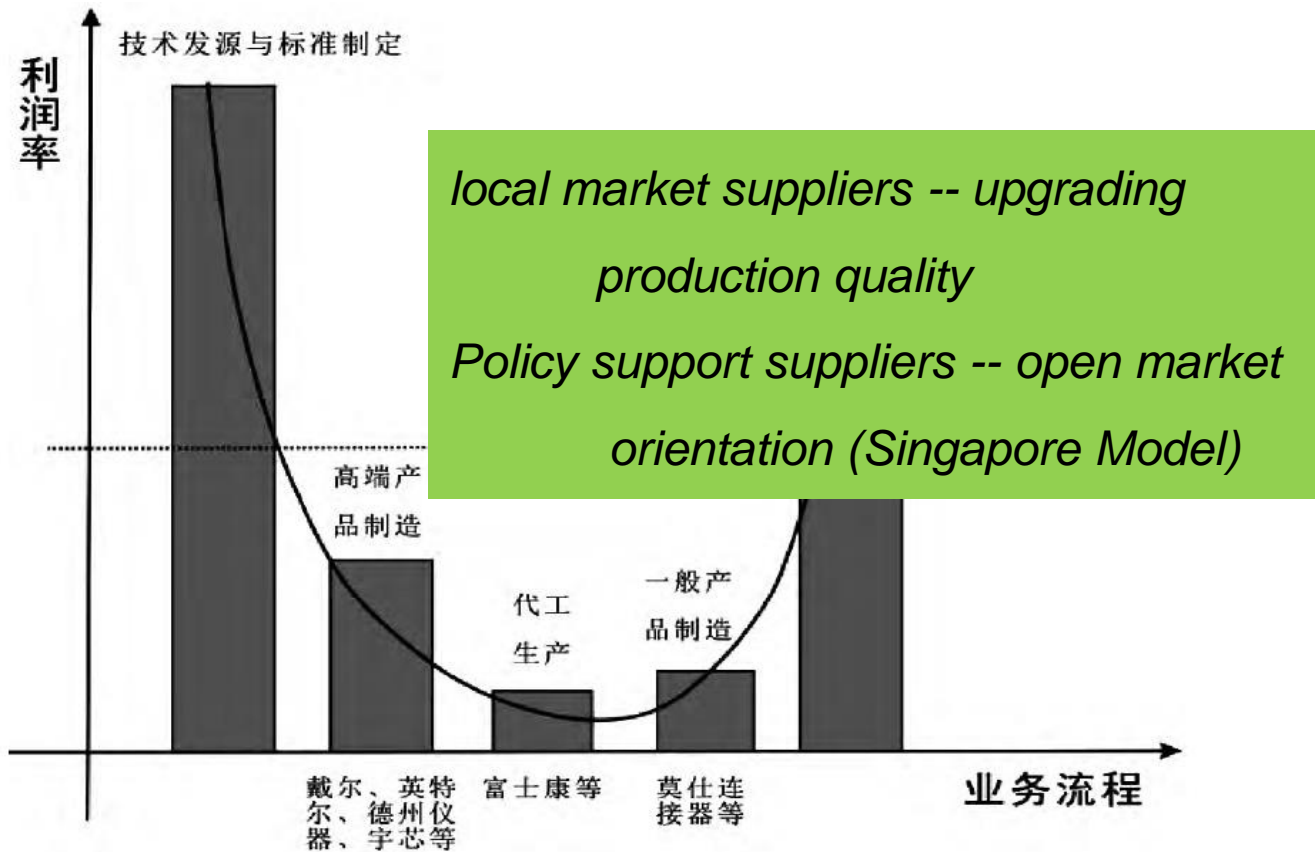


图2 成都高新区主要跨国企业的价值链特征
亡化而吞



Cheng Du case: Entrapreneurial actions in manaderail level - phase IV

- **“Local innovation”**

- *backgrc*

- *finan*
- *earth*

- **“Eleme**

- *major cl*

- *indus*
- *MNE*

- **“Third Tim**

- *High Te*

- **“4+1 inc**

- *ICT, I*
Prodi

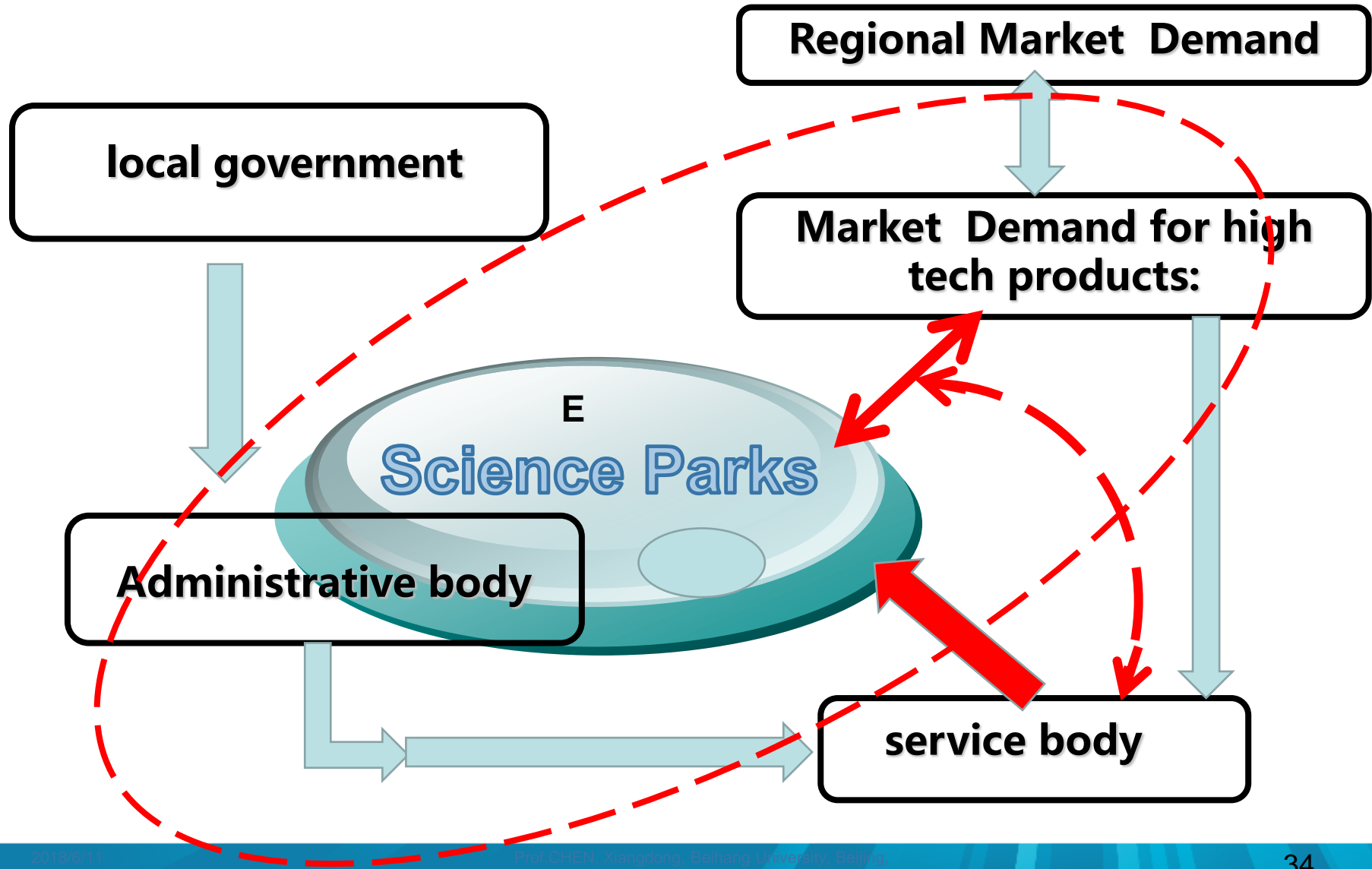


图4 成都高新区新产业空间规划图

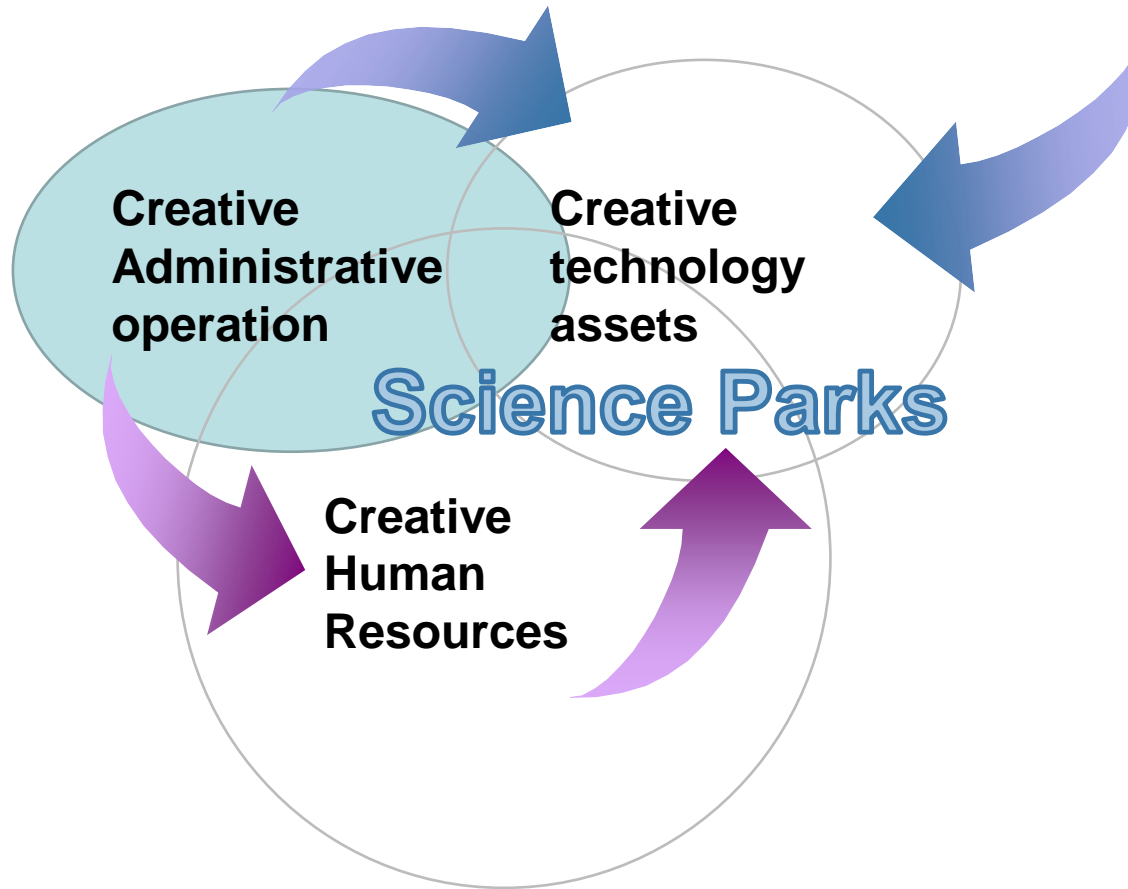
来源:根据成都高新区规划建设局提供资料绘制。



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3 in 1 with various kinds of models



Conclusion

- *Technology assets / Patent resources / IP resources need to be found and supported with market value.*
- *entrepreneurs on technology business as well as on operating models.*
- *Regional market can be highly differentiated in terms of entrepreneurial operation and local government policies.*





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Many Thanks for Your Comments !

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