

产业生态学 2.0 (IE 2.0): 中国制造业的发展需要我们探索新的理论前沿 (Industrial Ecology 2.0: Chinese Manufacturing Asking New Integrated Theories)

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Outline:

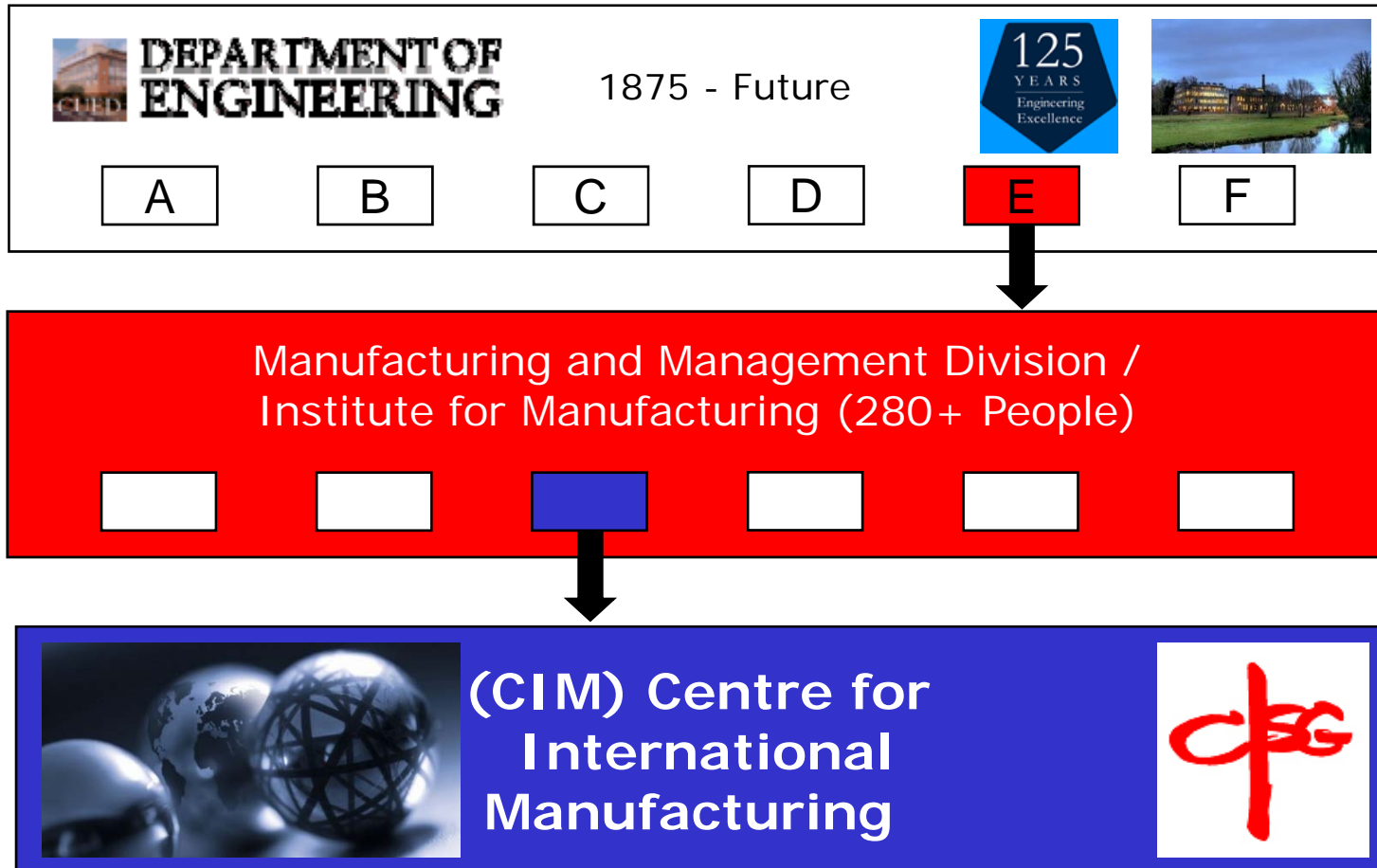
- **Background** 研究背景
- **Chinese Industrialization and Inspirations as well as Challenges**
中国的工业化及其启发和挑战
- **New Framework for Industrial Ecology 2.0 as a Solution**
产业生态学2.0是否可以是新的理论框架
- **Conclusion and Discussions**
结论与讨论



Where we fit within the University:

6 Schools: 150 Department and Institutions, 9000 Staffs and 18000 Students

<http://www.cam.ac.uk/colleges-and-departments>





“Manufacturing is the **full cycle of business process** from understanding markets through product and process design to operations, distribution, and after-sales service, taking into account economic, financial and people issues.”

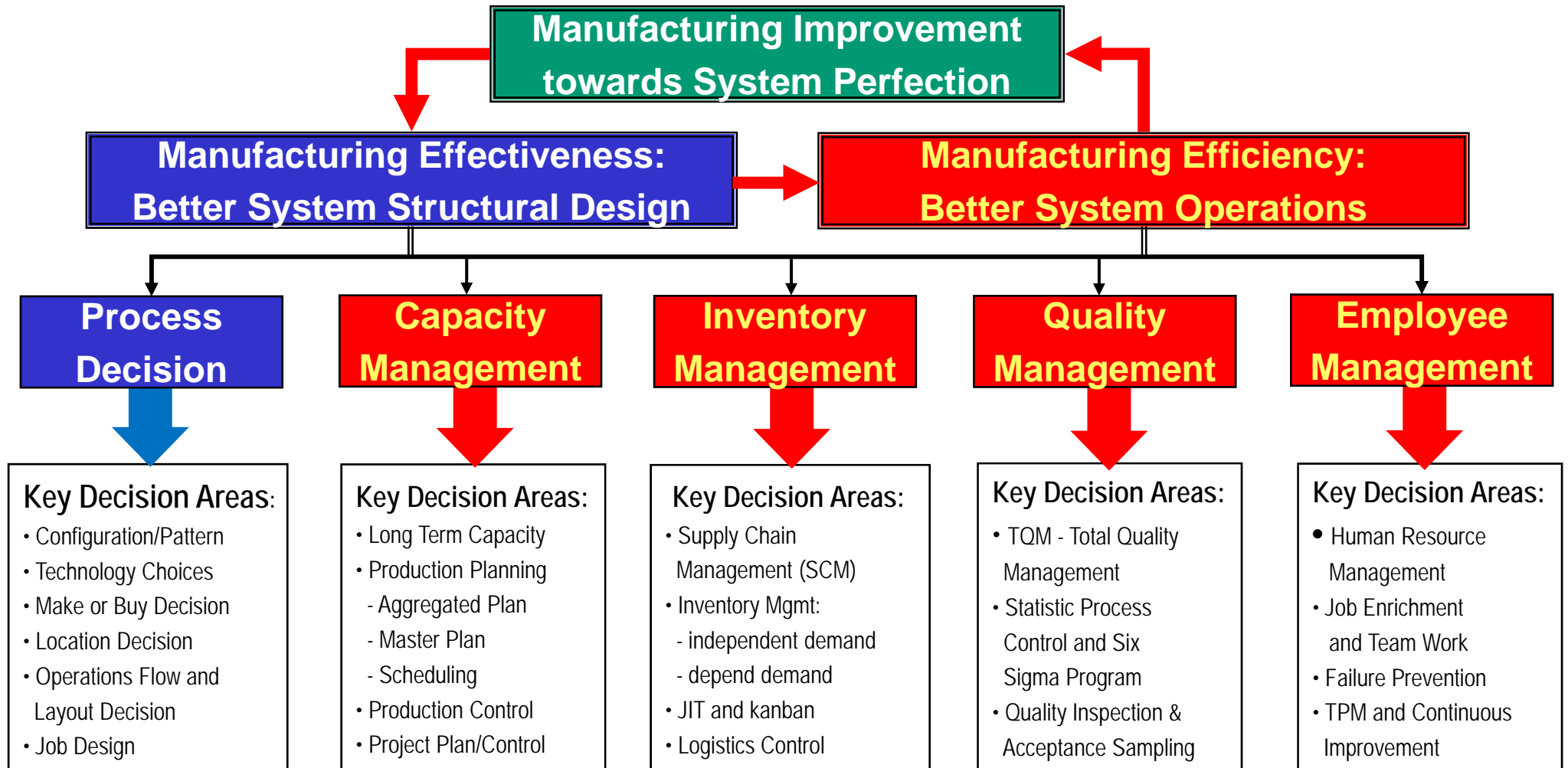
对于“制造”概念的新理解

制造是一个从了解市场开始，通过产品与工艺设计，到生产运作和产品分销的**整体过程**，其中还需要考虑这一过程中的经济,财务, 和人员的问题.



Production/Operations Management

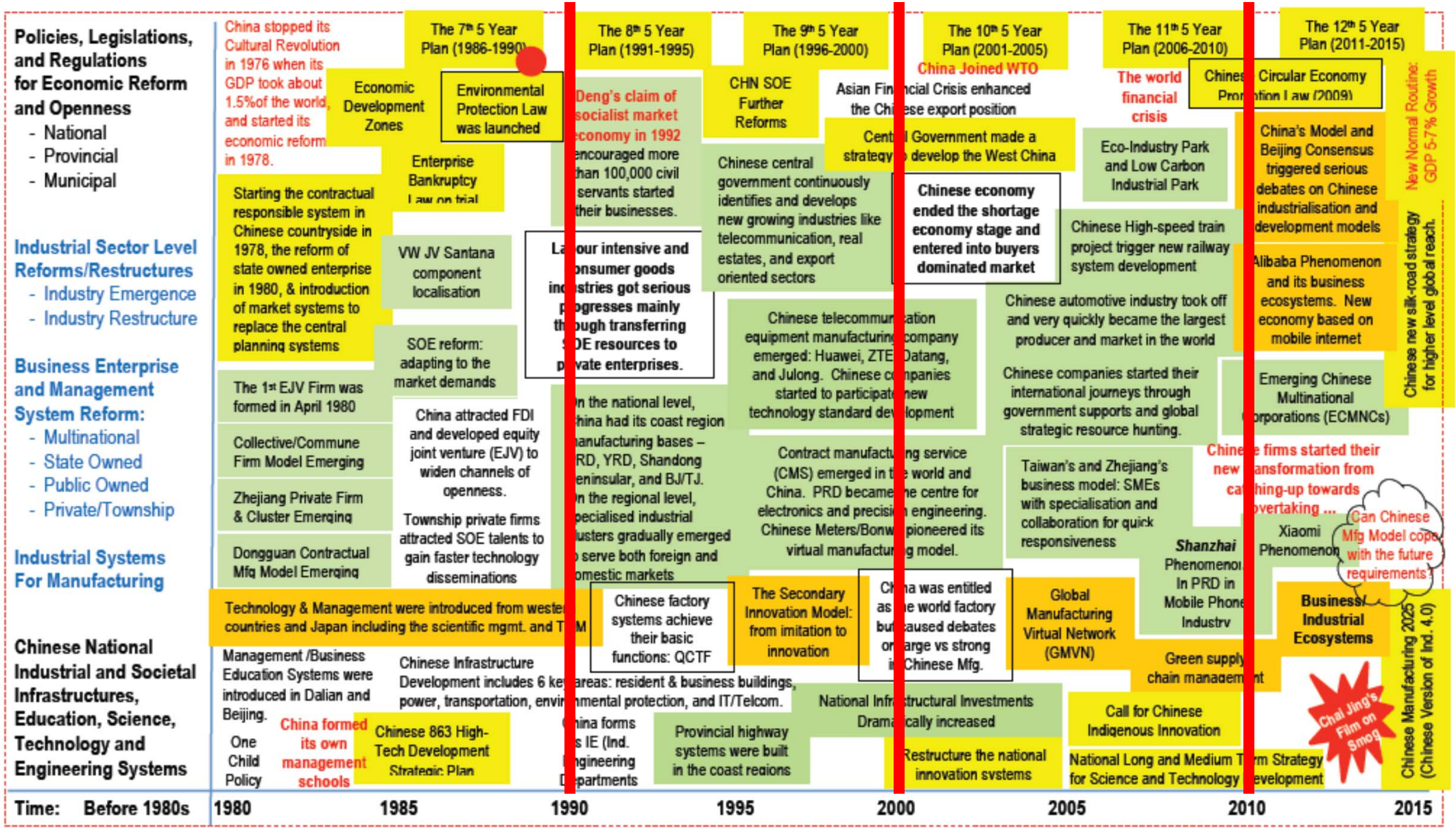
生产运作管理的主要内容体系



China's Painful and Enjoyable Developments: How can we understand it more comprehensively?

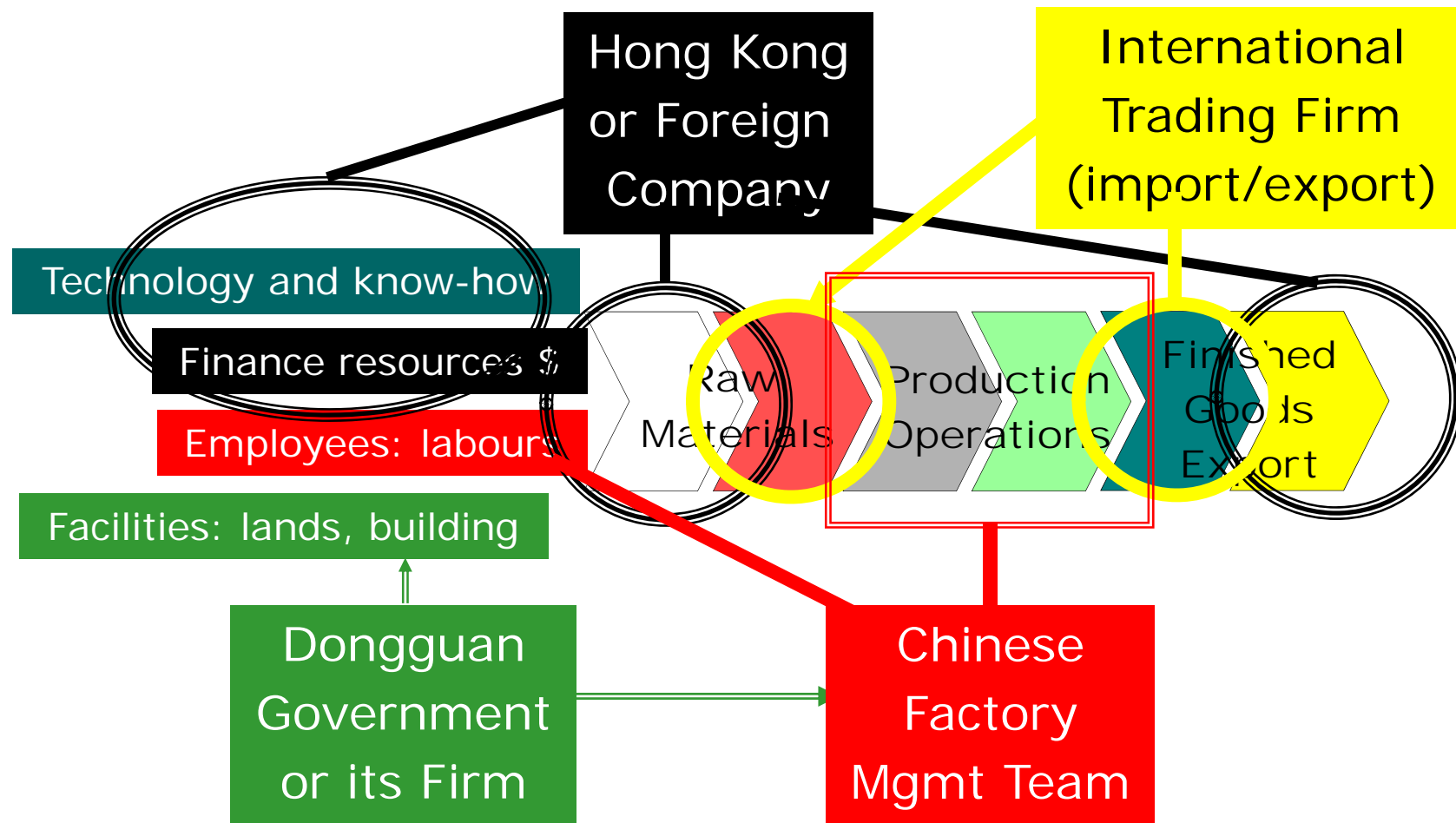


Chinese Manufacturing Evolutions in the last 35 Years: a general picture



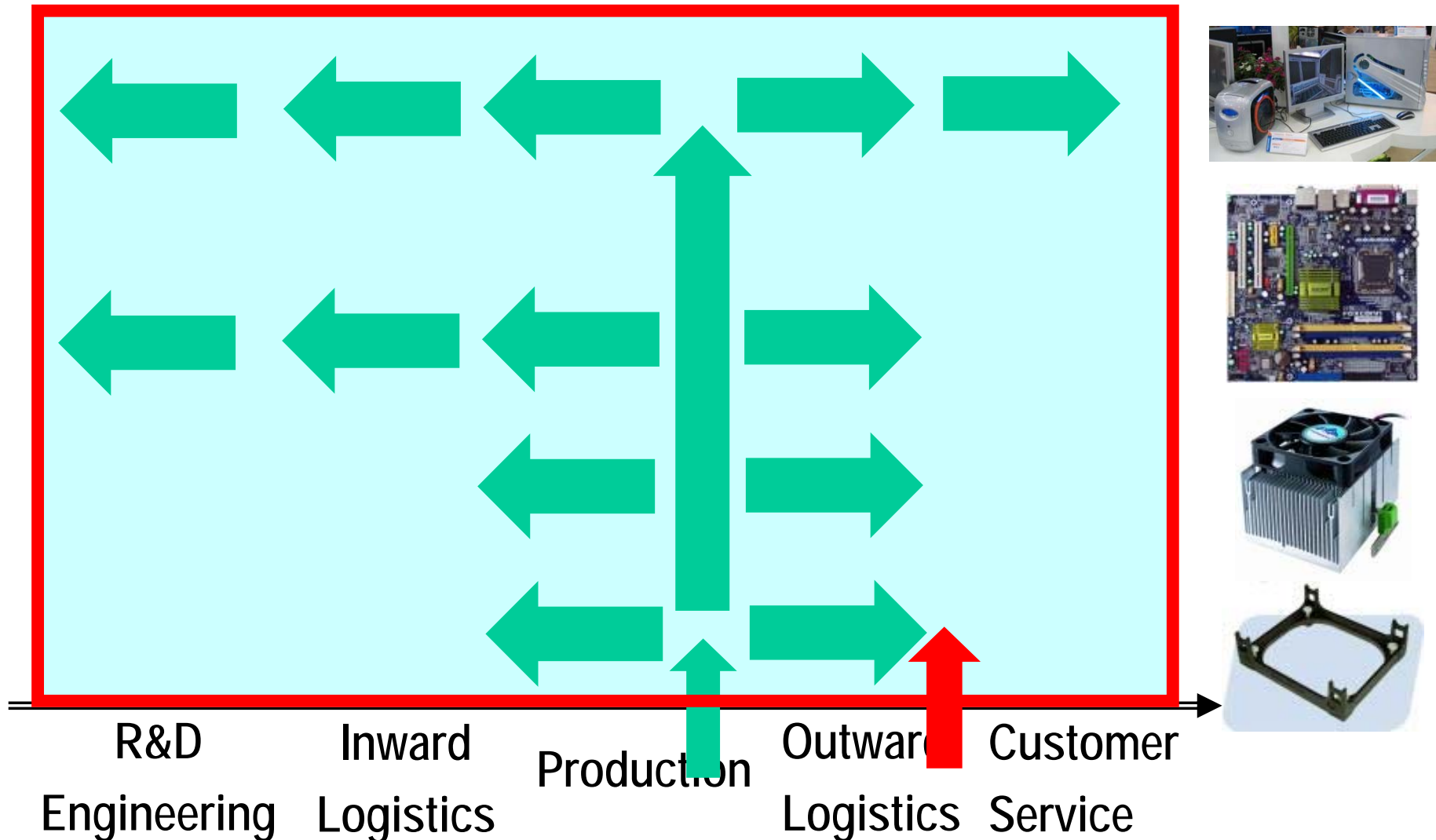
The Business Collaboration: CMS

七十年代末、八十年年代初的“三來一補”



Chinese Industrial System: Firm Level

中国企业如何利用全球化来发展自己.....



Chinese Industrial System: Network Level – Shenzhen mobile phone cluster

山寨 现象

Outbreak
stage (2005-
present)

Evolutionary
stage (mid 1990s -
2005)

Embryonic
stage: (early 1980s-
mid 1990s)

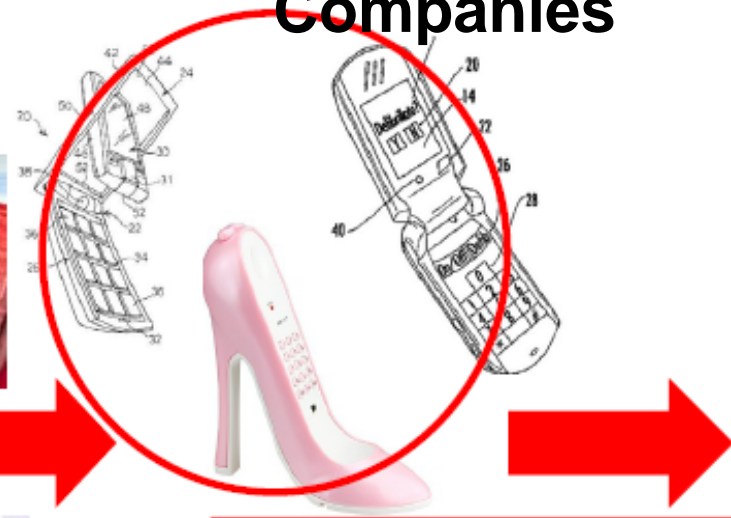
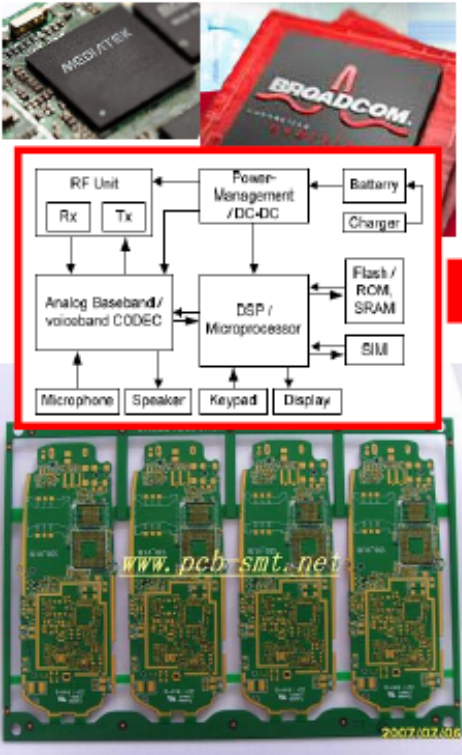
Digital watch,
personal mini-game
machine, early telecom
switch

Mobias,
Net-books

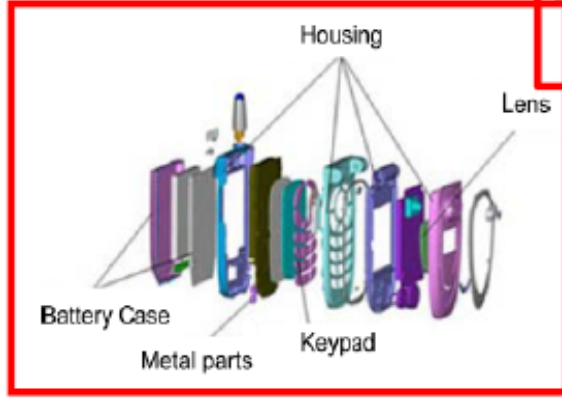
Learning Machine,
VCD/DVD, mp3, mp4

400+ IC
Design
Companies

2000+ Solution
Companies



2000+
Distribution
Companies
and
200+ Million
Mobile Phones



99% Local
Sourcing;
200,000 People
Involvement

最近6-7年的发展：

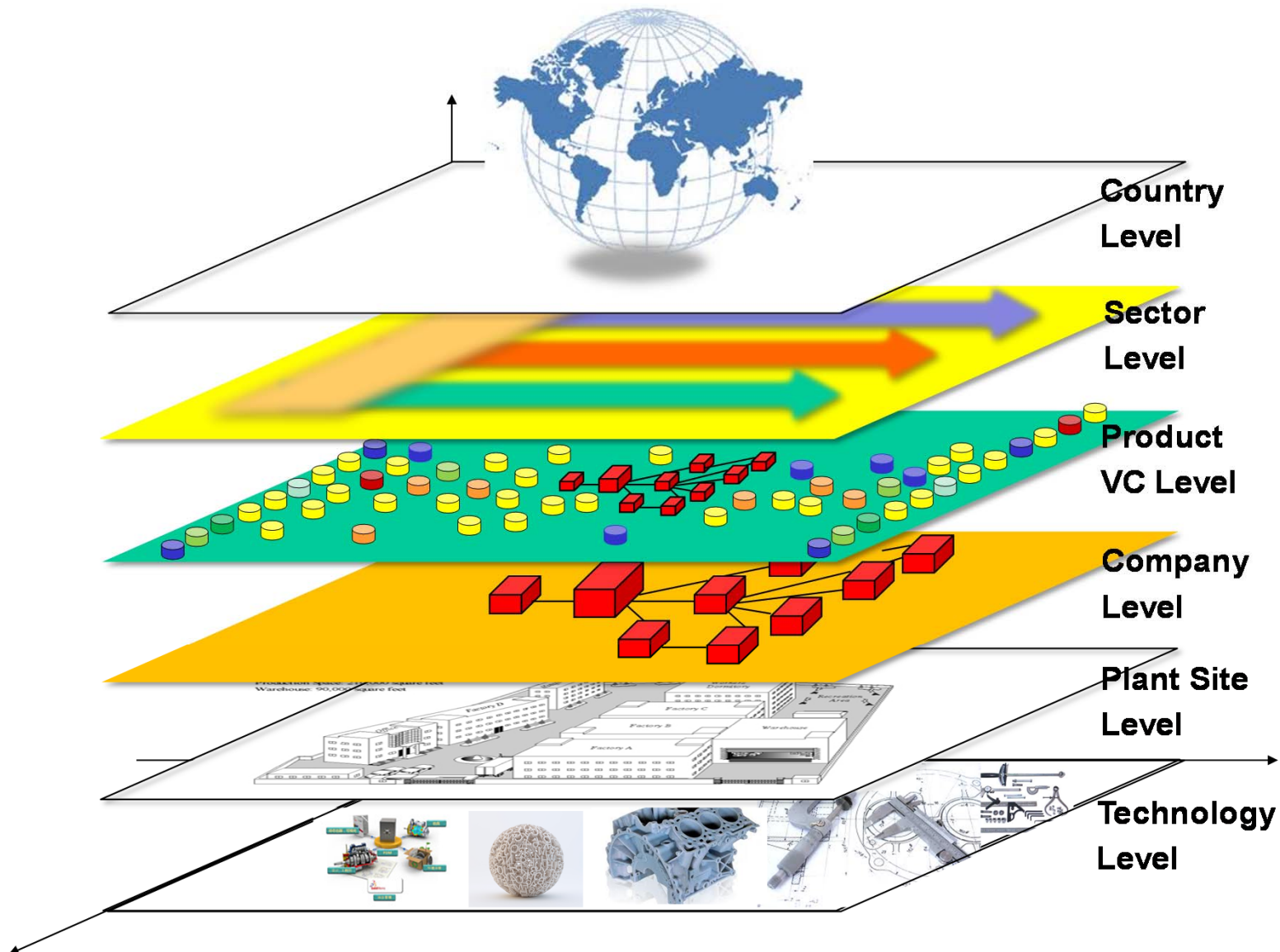


中国制造的启示：

Inspirations: Why so fast?

- Pursuing prosperity through hardworking and dedication are deep-rooted Chinese cultural traits.
- Well balanced between market and planed economy
ambidexterity skills and incremental transformations
- Take advantage of globalised manufacturing
 - developed countries' manufacturing systems
 - robust knowledge for transferability
 - Chinese absorbing capacity
- Good understanding about industrial systems from all levels – not only factory, but supply and value networks, regions / clusters ... business ecosystem

Six Levels of Industrial Systems: from factory to national and international industrial systems forming an industrial ecosystem



A Big-M Perspective on Manufacturing



Technology Enterprise



Business Model Innovation



International Manufacturing



Industrial Sustainability



Babbage Industrial Policy Network



Science, Technology & Innovation Policy

Business ecosystems

(industrial economy, globalisation, sustainability)



Design Management



Technology Management

Organisational systems

(innovation management, strategy, organisational structures)



Strategy and Performance



Cambridge Service Alliance



Distributed Information & Automation Laboratory

Manufacturing systems

(Quality, lean, ops management, data and simulation)



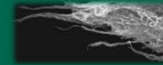
Asset Management



Inkjet Research



Industrial Photonics



NanoTechnology



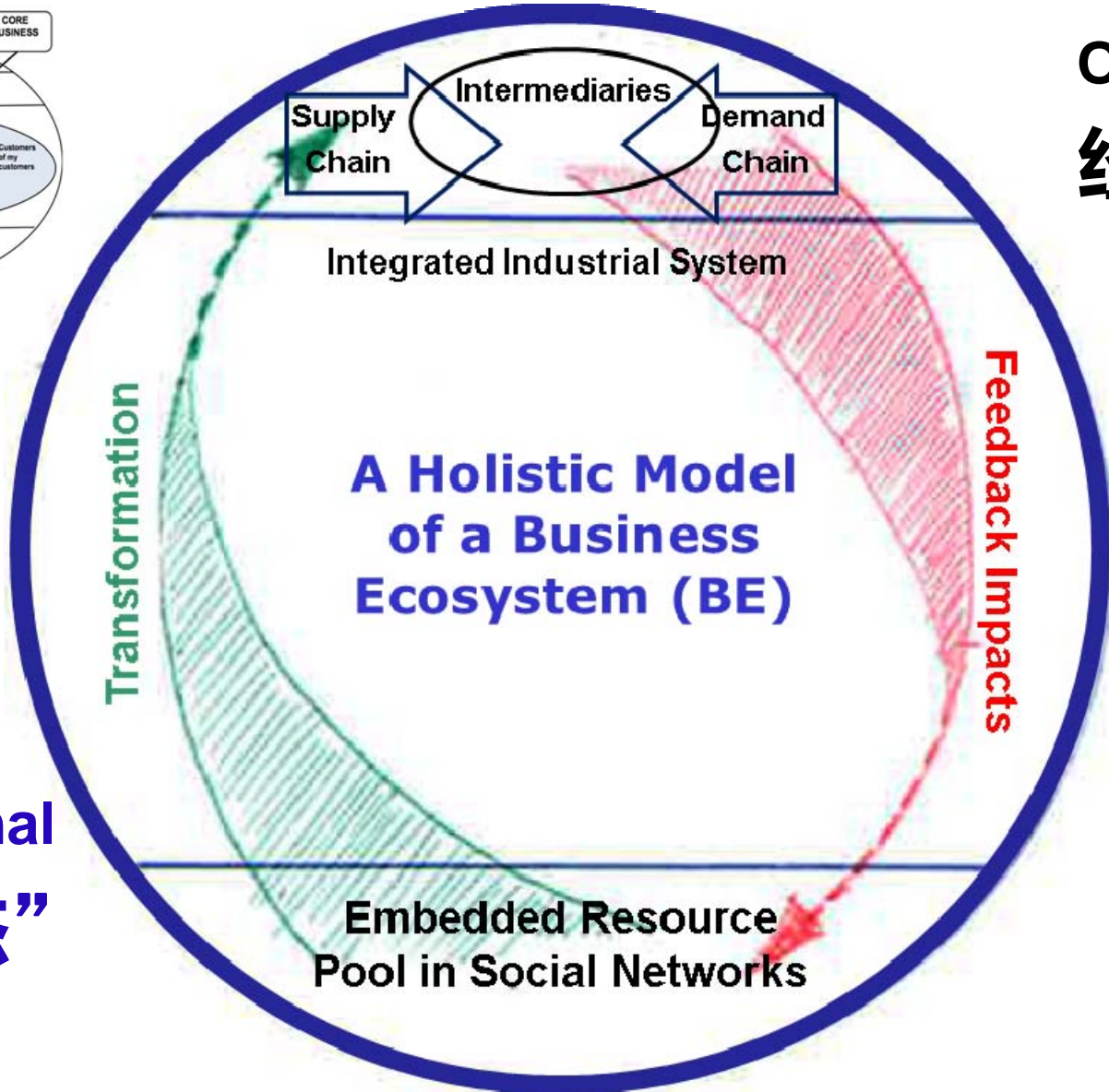
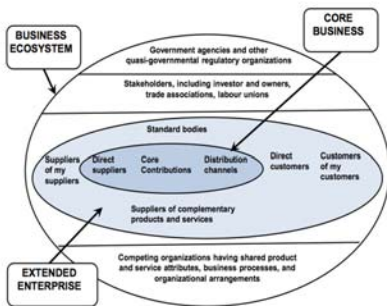
Fluids in Advanced Manufacturing

Manufacturing processes

(additive, subtractive, forming, continuous, fabricating)

Business Ecosystem (2.0): a holistic & dynamic view

商业生态系统

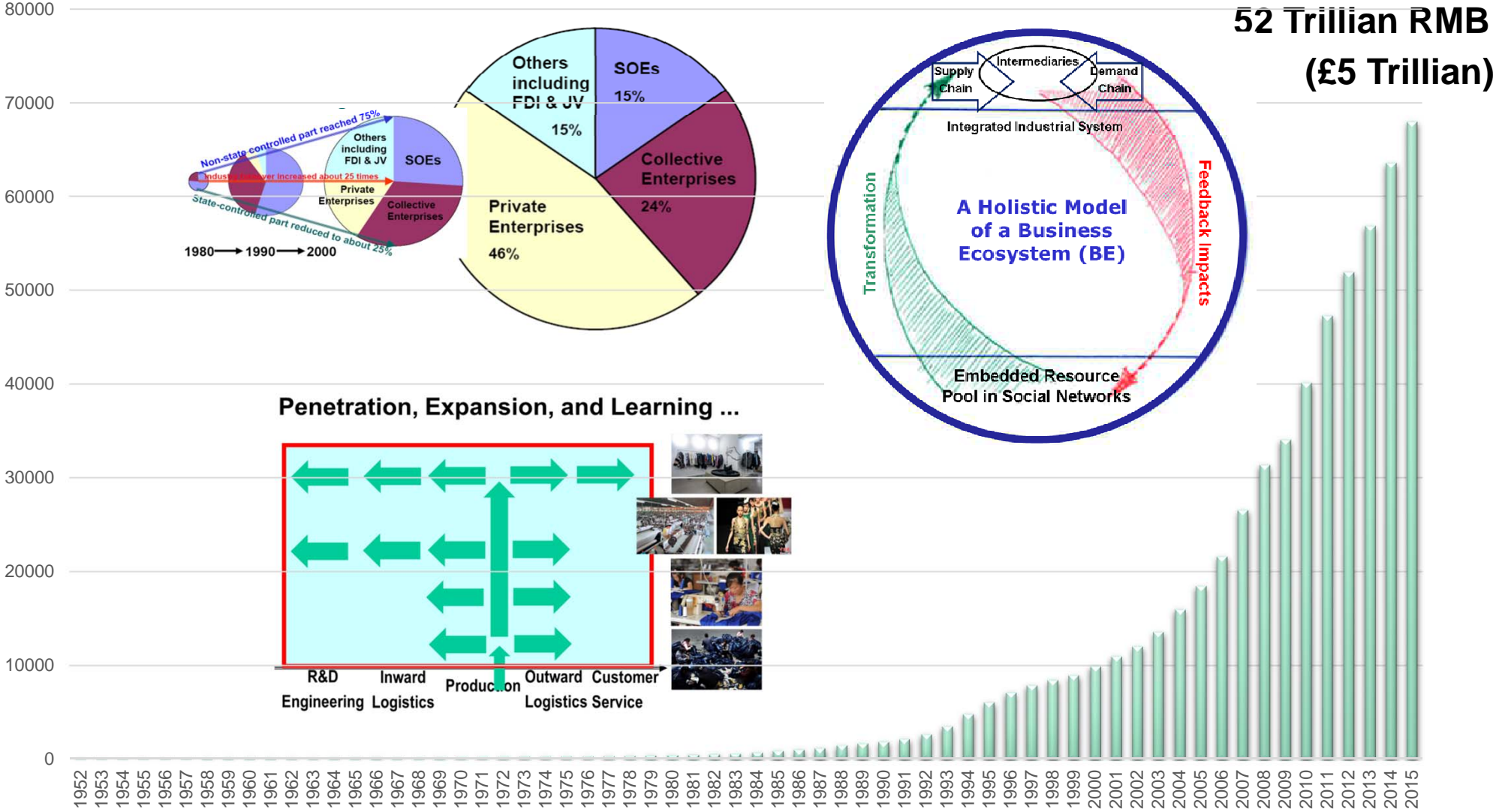


Old Normal
经典业态

NEW Normal
“新常态”

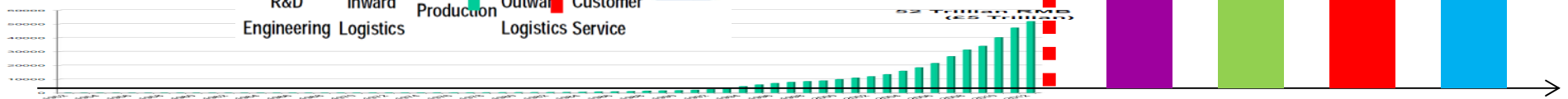
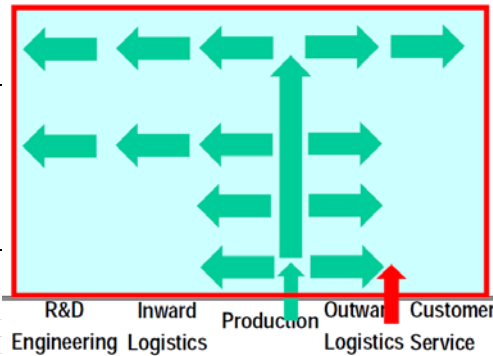
小结:

China's Development during the Globalisation



未来 场景？

Chinese Manufacturing Evolutions: Towards Crises and Transformations





国在山河破...



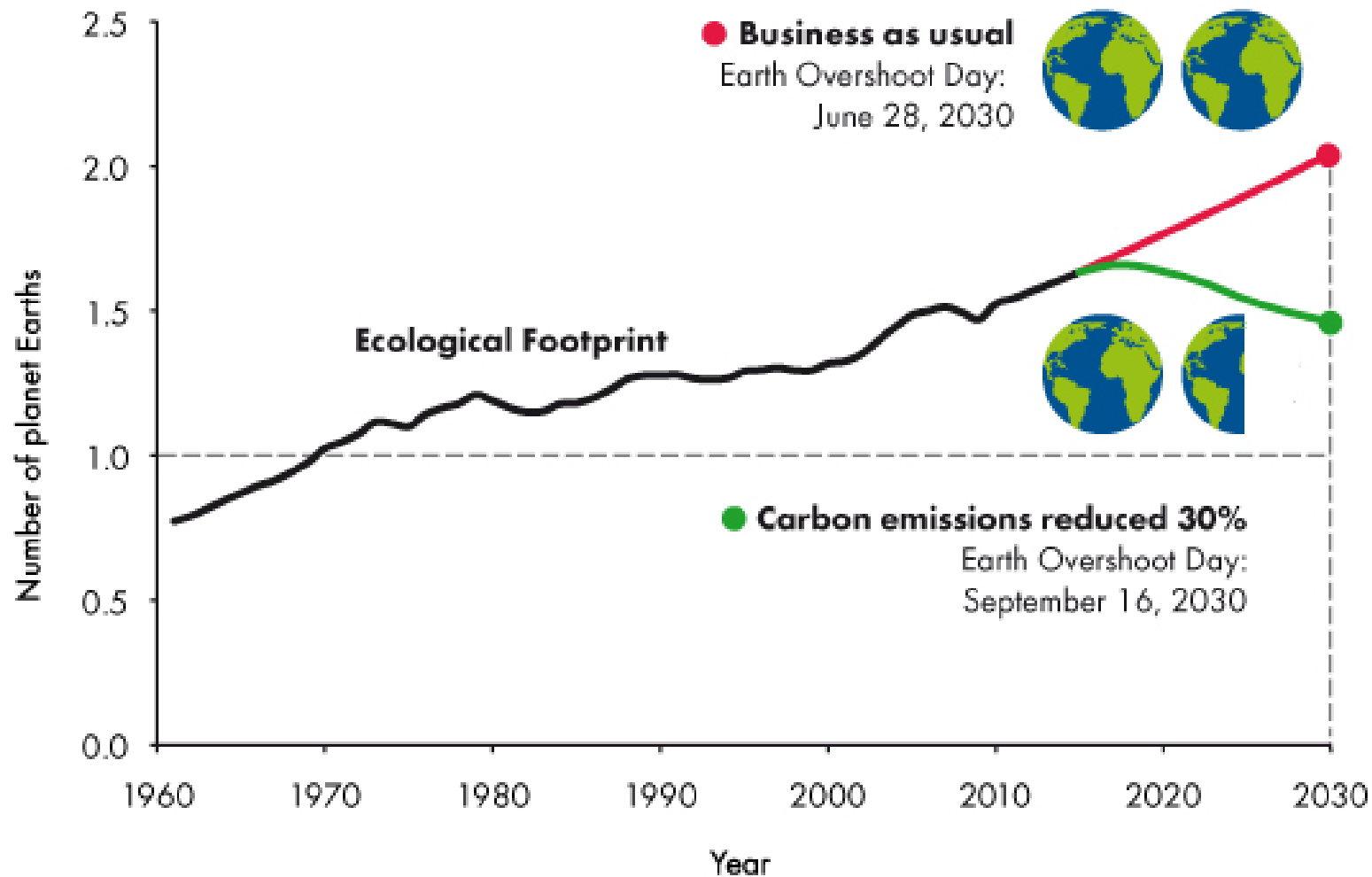
IF THE WORLD'S POPULATION LIVED LIKE...

How much land would we need if all 7 billion of us lived like the people of these countries?

PER SQUARE MILE



How many Earths does it take to support humanity?



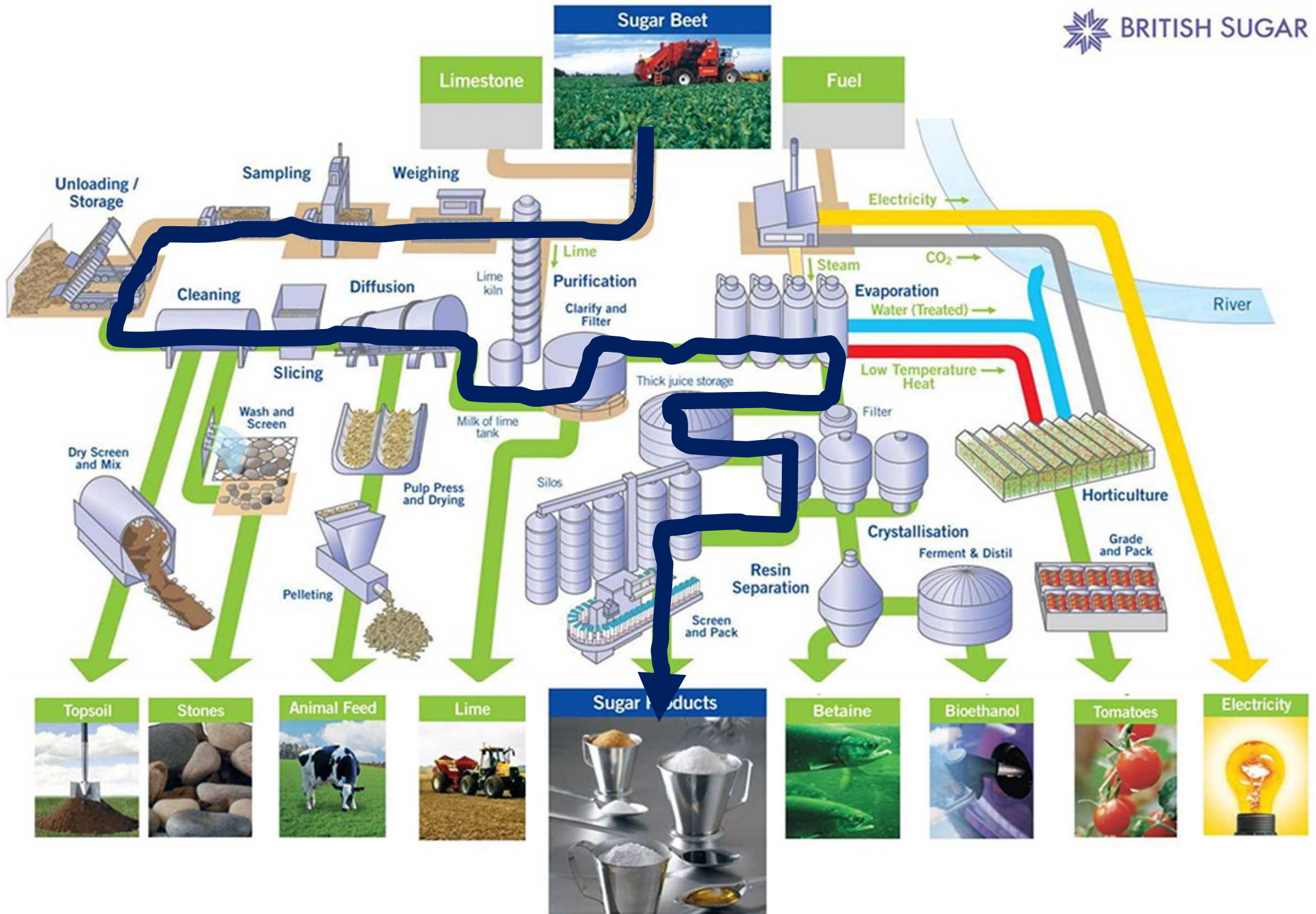
Source: <http://www.footprintnetwork.org/>

Future industrial systems must -

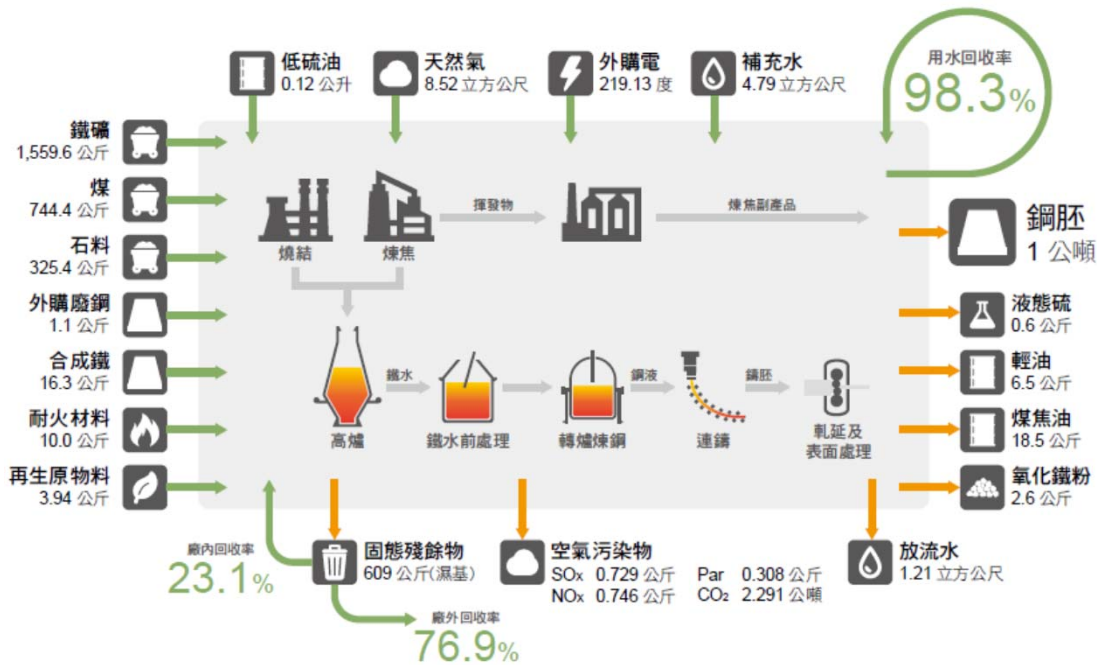
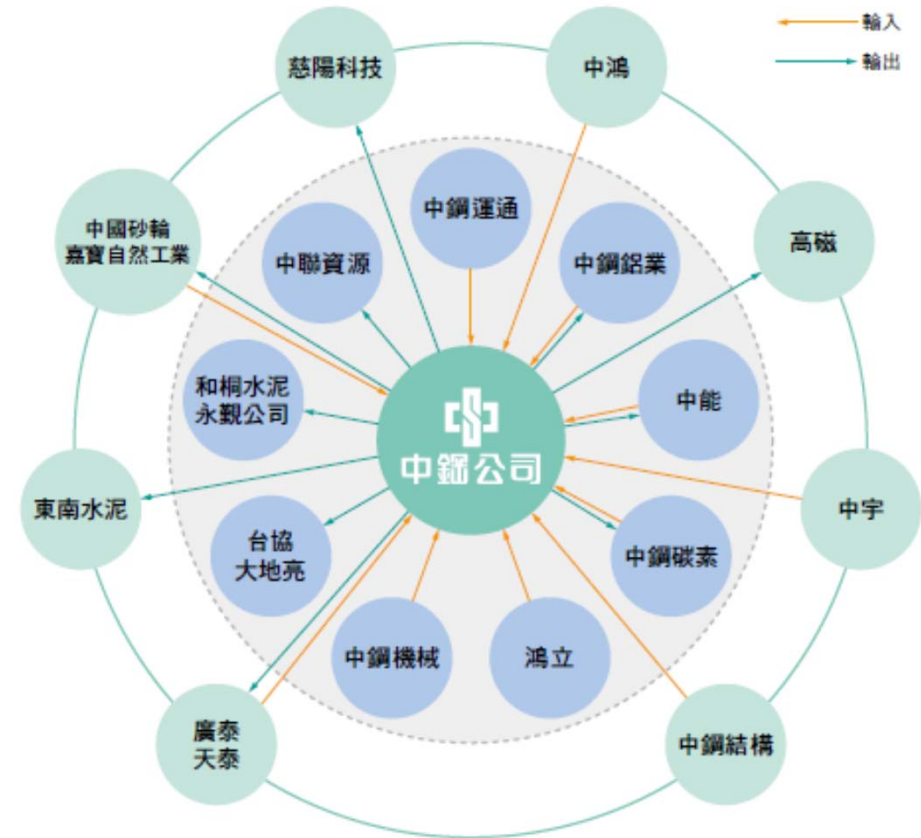
中国制造
告诉我们

- Cope with radical changes 应对不确定需求
- Be environmentally benign 环境友善和贡献
- Maximise value from resources 资源高效率



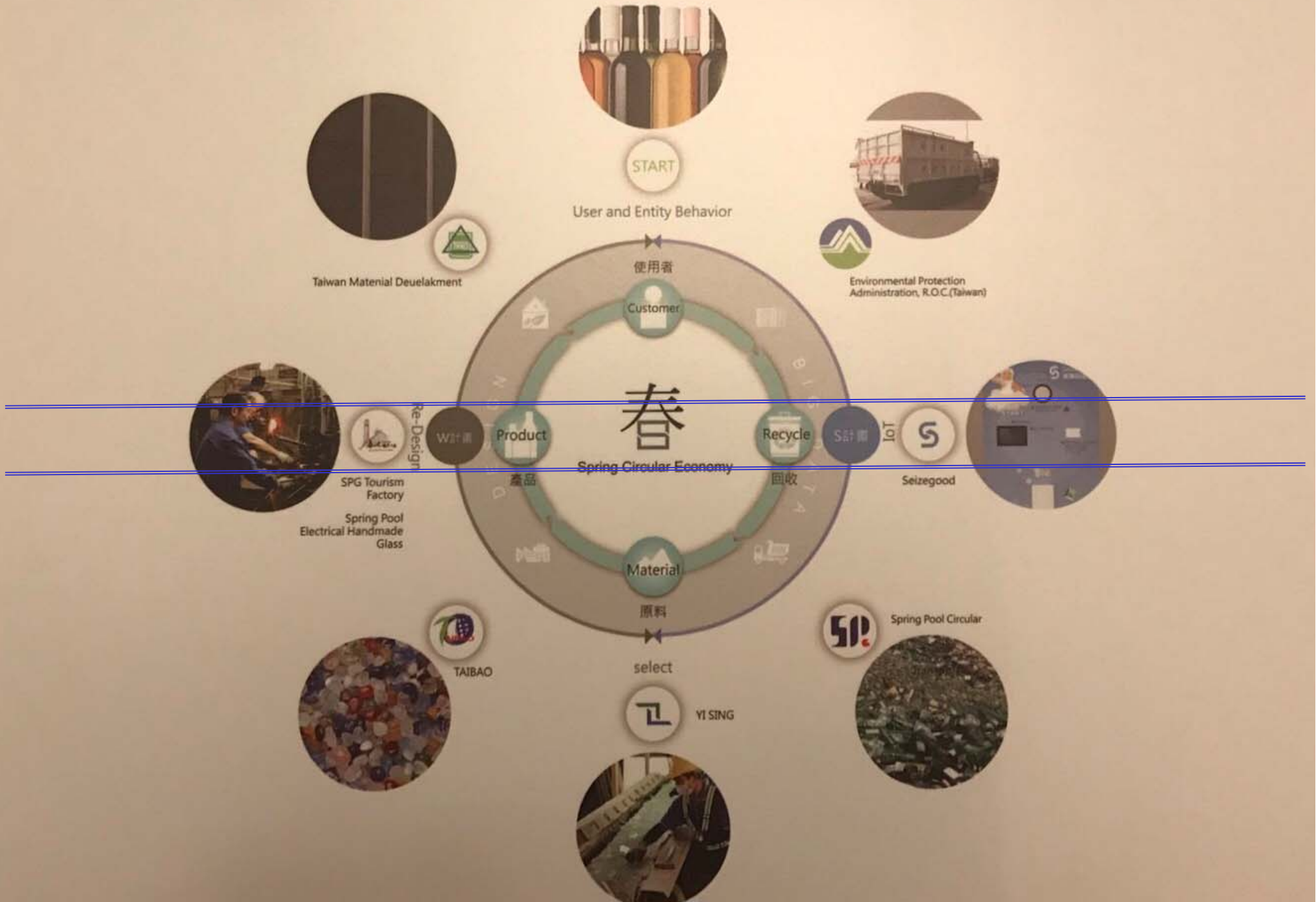


China Steel Corporation: from internal towards external/regional integration



台灣中鋼公司

Spring Pool Circular Economy Ecosystem



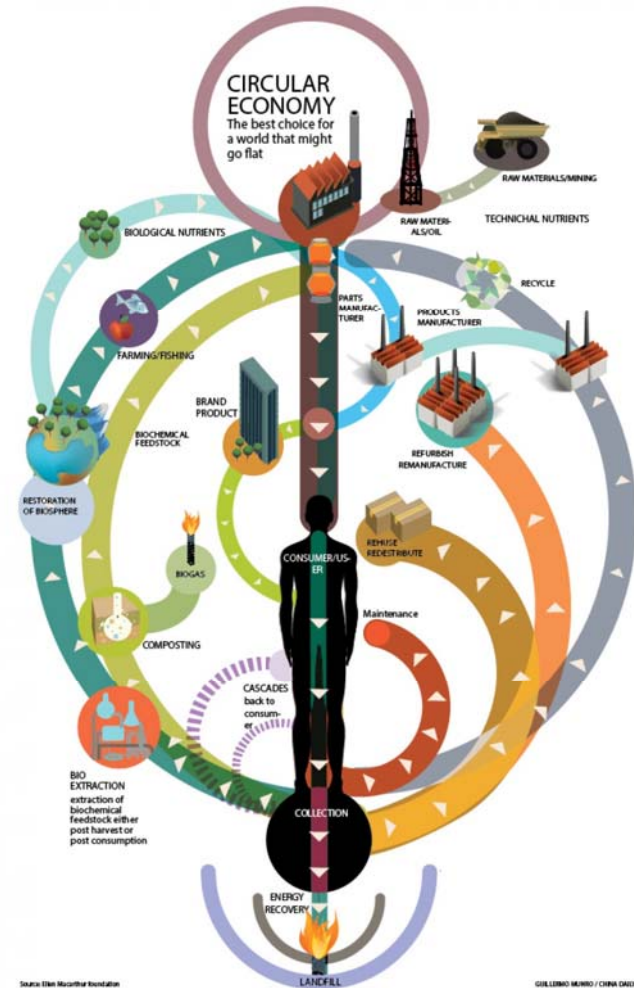
Resource Value Cascading Strategy - for the Value Potentials: **RbV 3.0**

- A tree → furniture → paper → fuel → energy → fertiliser → new trees
- Different orientations: not only the demands but also resources
- RbV: Competitiveness
- NRbV (RbV 2.0): Benefit from and to the Natural Environment



Contributions from different disciplines:

- **Economist** – Circular Economy
- **Management School** – Circular Economy and Innovation
- **Industrial Engineering** – saving cost and energy and improve efficiency
- **Energy and Resource Management/Optimisation**
- **Environmental Engineering**



Source: www.bfi.org

Ind. Ecology
(IE 1.0): ↑
↓ Env. Damage

Resource-based
Value
Creation
(RBV 3.0)

New Ind.
Ecosystem
(IE 2.0)

Bus. Ecosystem
- Uncertainty
- Reconfiguration

Outcomes:

1. Ind. Systems
2. Ind. Ecosystems for Longer Term Sustainability
3. Ind Ecosystem Mgmt
4. Tool Box for IE^{2.0}

Future industrial systems must -

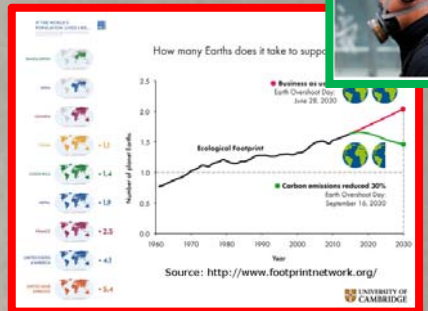
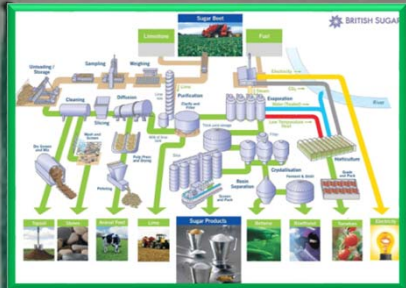
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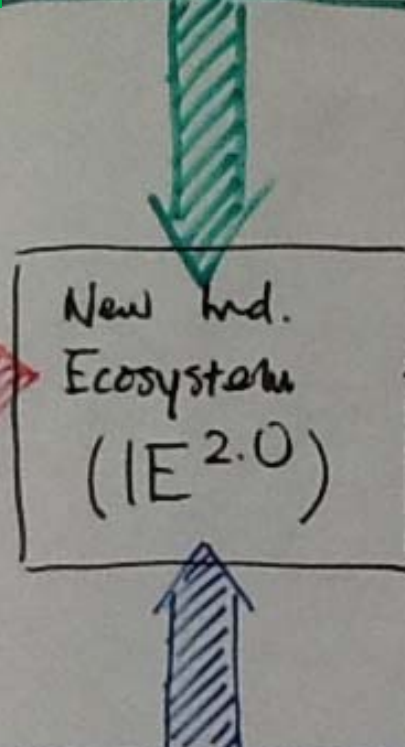




Ind. Ecology
(IE 1.0): ↑
↓ Env. Damages

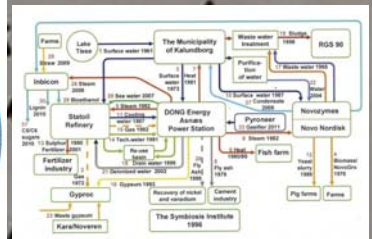
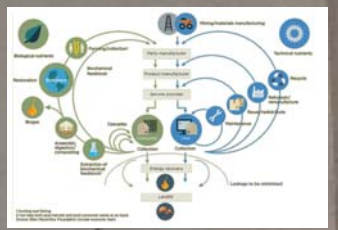


Resource-based
Value
Creation
(RbV 3.0)

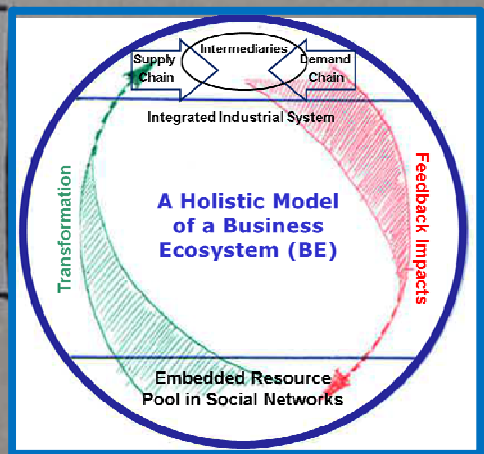
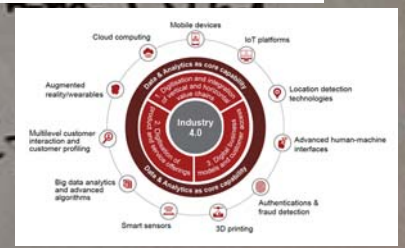


Buis. Ecosystem
- Uncertainty
- Reconfiguration

Outcomes:
1. Ind. Systems

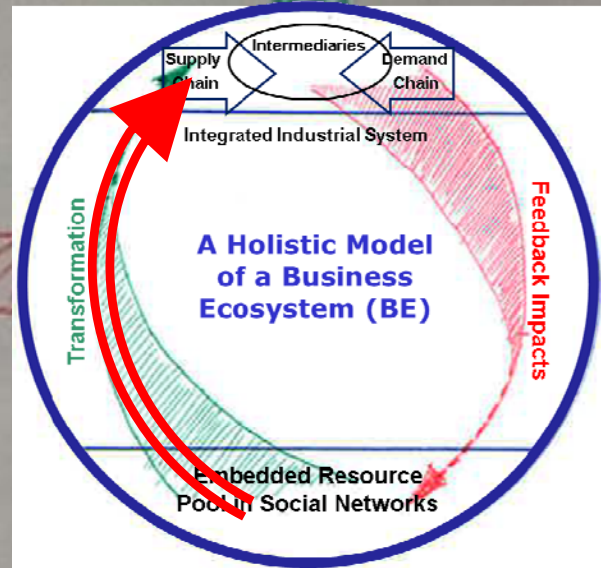


4. Tool Box



Ind. Ecology
(IE 1.0): ↑
↓ Env. Damages

Resource-based
Value
Creation
(RBV 3.0)

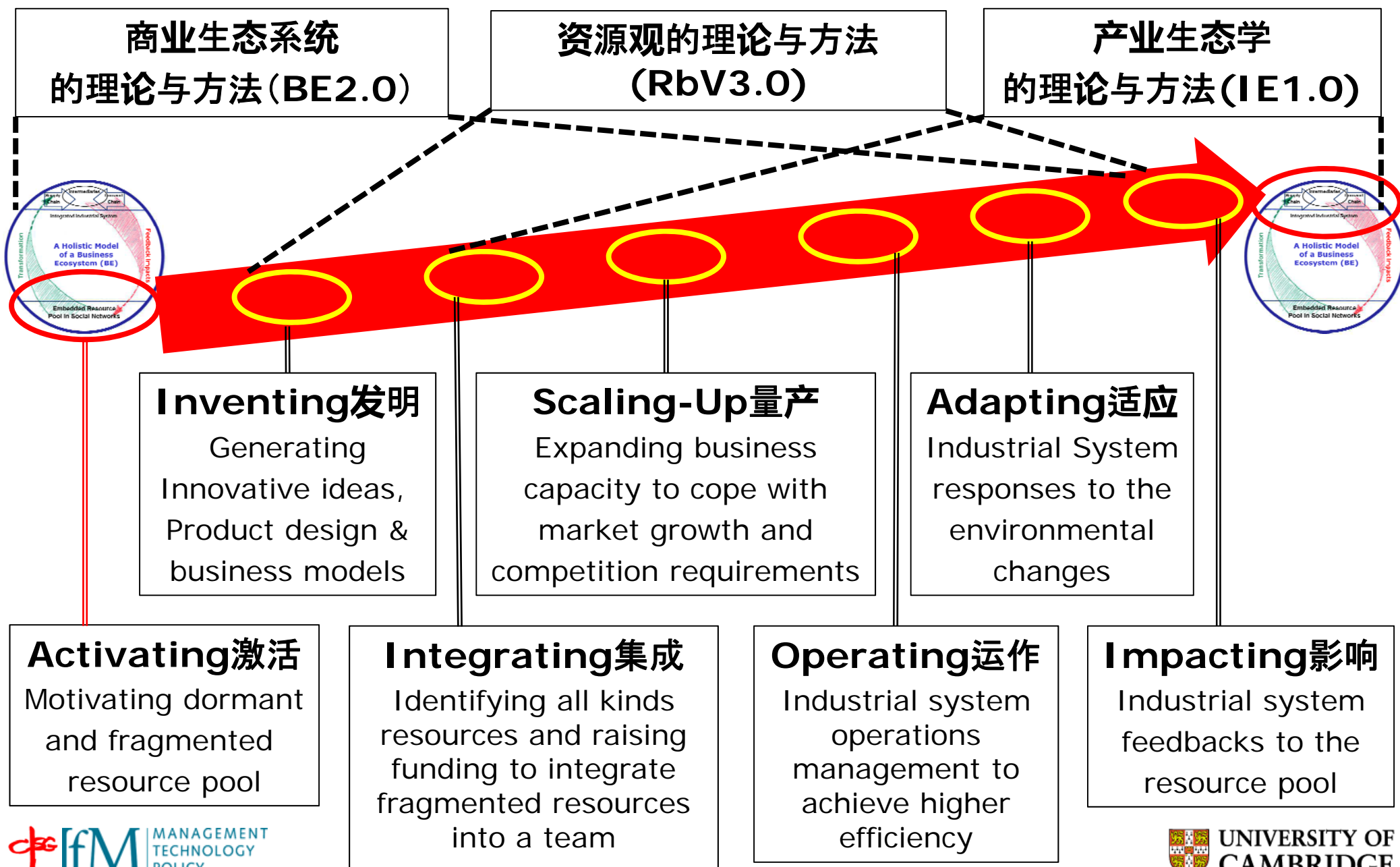


Bus. Ecosystem
- Uncertainty
- Reconfiguration

Outcomes:

1. Ind. Systems
2. Ind. Ecosystems for Longer Term Sustainability
3. Ind Ecosystem Mgmt
4. Tool Box for IE^{2.0}

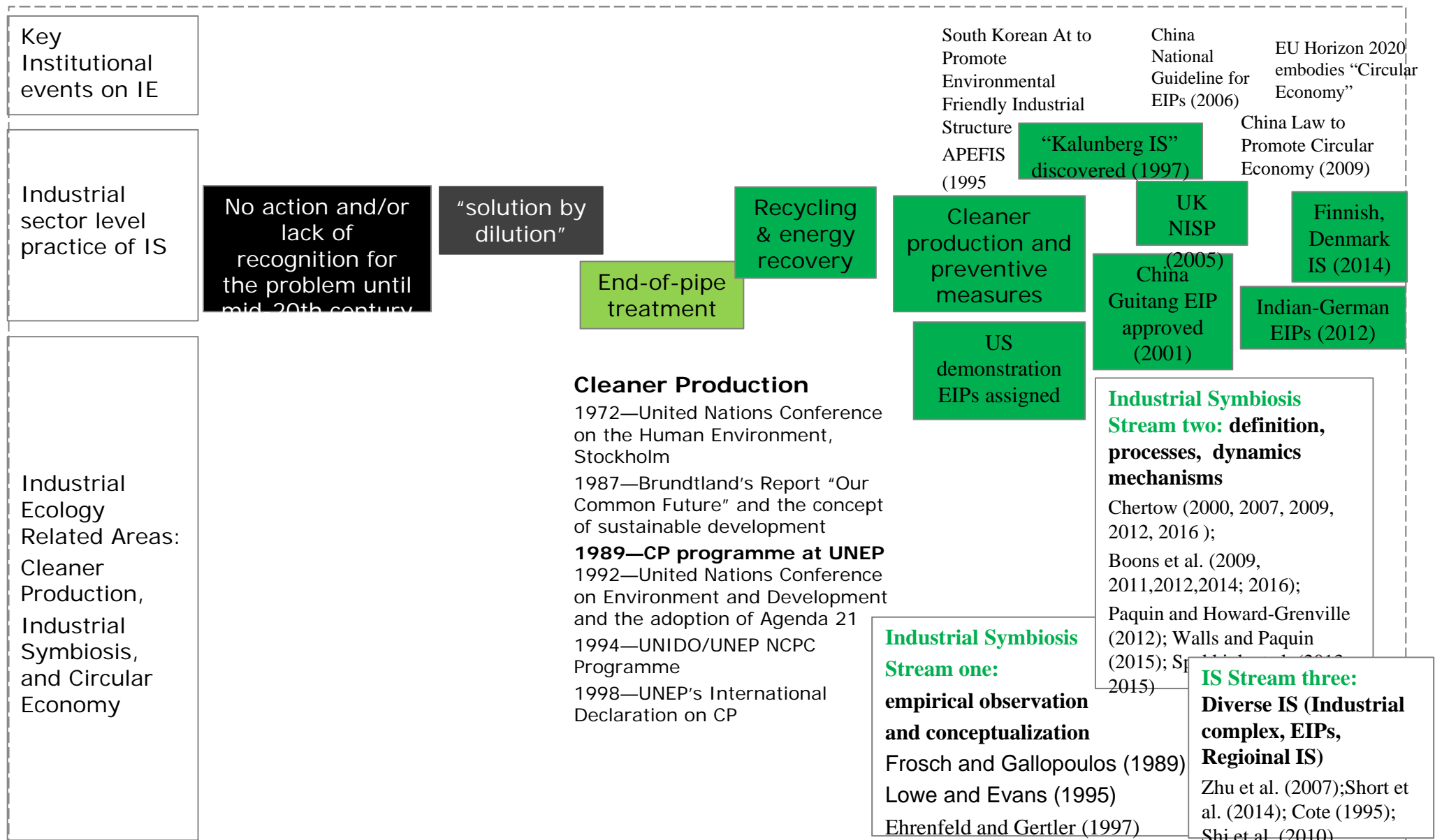
产业生态系统的设计、构建及其培育的概念模型



Key Building Blocks of IE 2.0: (IE 2.0 = IE 1.0 + BE 2.0 + RbV 3.0)

- 1. Classical Industrial Ecology (IE) 1.0 (page 3-4):**
 - Cleaner Production Technology
 - Industrial Symbiosis
 - Circular Economy
- 2. Business Ecosystem (BE) 2.0 (page 5-6):**
 - Classical Business Ecosystems
 - Dynamic and Holistic Model of Business Ecosystems
- 3. Resource based View (RbV) 3.0 (page 7-8):**
 - Resource based View focusing on organisational resources
 - Natural Resource based View focusing on the interactions between natural and organisational resources
 - Resource cascading strategy for its potential values

A Simplified Mapping about Industrial Ecology (IE 1.0)



A Simplified Mapping for Business Ecosystems

Cambridge CIM Research Work

How:

- Design/nurture process
- Strategy process
- Evaluation process
- Health assessment

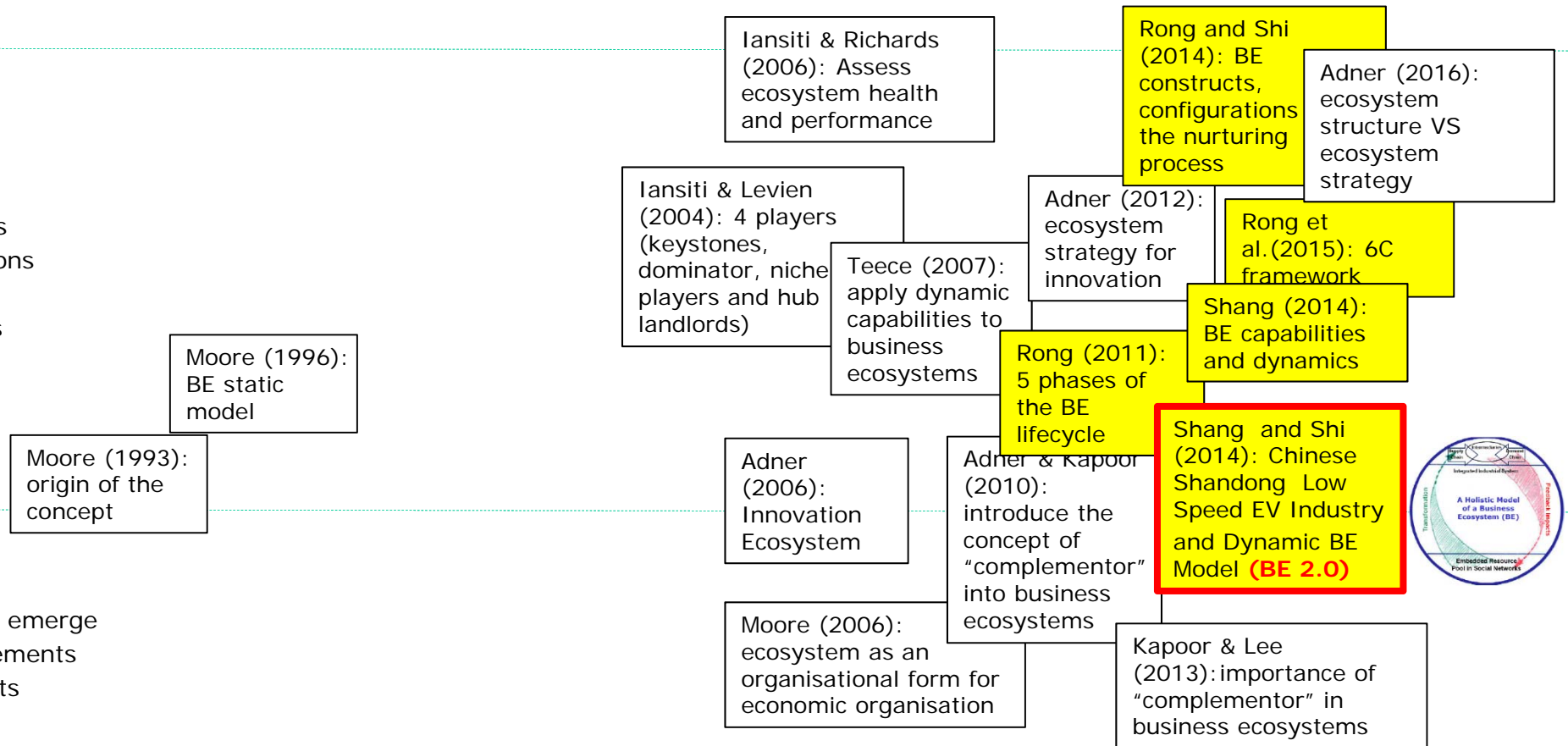
What:

- Constructs
- Mechanisms
- Configurations
- Capabilities
- Adaptations
- Evolutions

Why &

What For:

- Why does it emerge
- New requirements
- New contexts
- Triggers



A Simplified Mapping for RbV Theories

How:

- Design/nurture process
- Strategy process
- Evaluation process
- Health assessment

What:

- Constructs
- Mechanisms
- Configurations
- Capabilities
- Adaptations
- Evolutions

RBV was first raised by Wernerfelt in 1984. The roots of RBV trace back to Ricardo's insights (1817) into land rents and Penrose's theory (1959) of the firm growth

e.g. Rumelt, 1984; Barney, 1986 & 1991; Montgomery & Wernerfelt, 1988; Peteraf, 1993; Amit & Schoemaker, 1993; Dierickx & Cool, 1989; Grant, 1991; Kogut & Zander, 1992; Mahoney & Pandian, 1992; Wernerfelt, 1995

RbV 2.0 - Natural Resource-Based View (NRBV)

Hart, 1995; Grant, 1996; Oliver, 1997; Teece, 1997; Coff, 1999

e.g. Aragón-Correa & Sharma, 2003; Barney et al. 2001; Bharadwaj, 2000; Chan, 2005; Das & Teng, 2000; Lavie, 2006; Peng, 2001; Richard, 2000; Wade, 2004; Wang & Barney, 2006; Barney & Clark, 2007; Hoopes & Walker, 2003; Kraaijenbrink et al. 2010; Priem & Butler, 2001; Sirmon et al., 2007

Emergence of RbV 3.0 – Transforming and optimising resources into value

e.g. Sirmon et al., 2011; Schmidt & Keil, 2013; Jensen et al., 2015; Biggs, 2016; Bromiley & Rau, 2016

Why &

What For:

- Why does it emerge
- New requirements
- New contexts
- Triggers

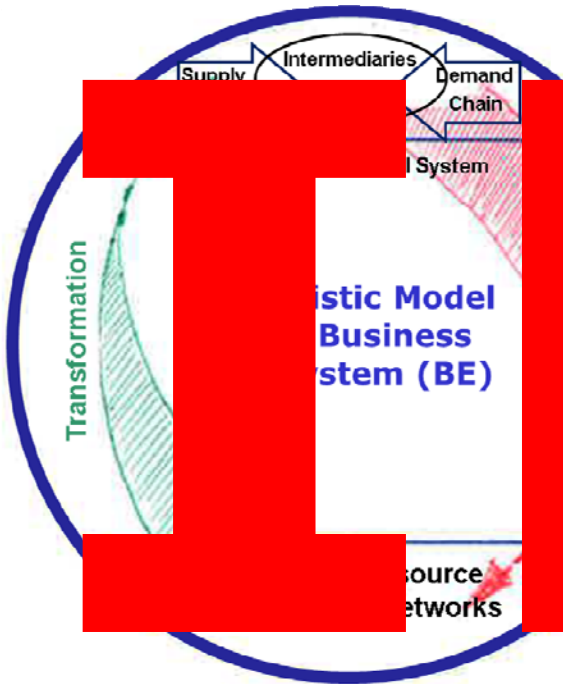
RbV 1.0 – Classical RbV

Phase 1: Introduction and definition; historical theoretical comparisons; preliminary strategy models. Focus: **competitive advantage, resource attributes.**

Phase 2: started from the middle of the 1990s, dynamic capabilities, and resource appropriation by different stakeholders, etc. Focus: **spin-offs of RBV**

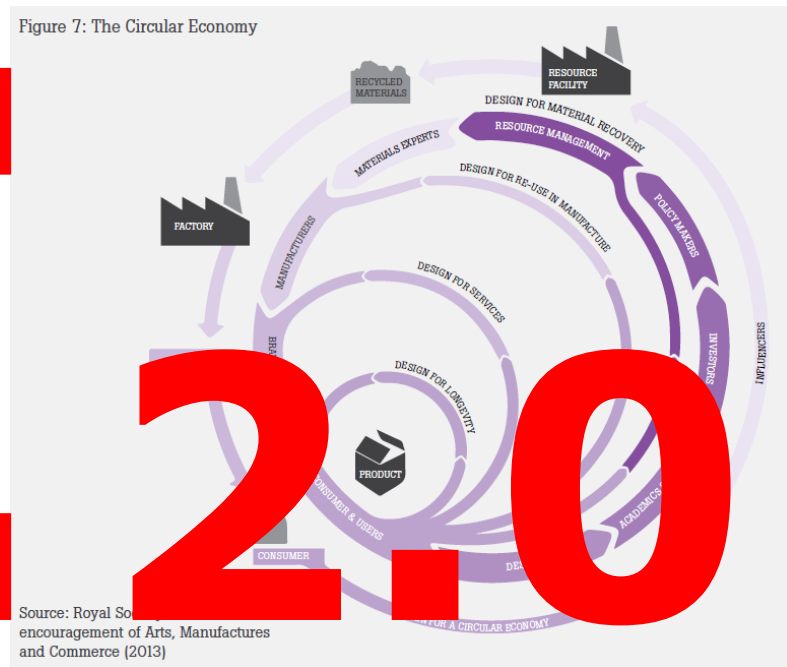
Phase 3: RBV has been widely applied and enriched through empirical studies since 2000. Focus: **Building micro-foundations of resources and capabilities in a dynamic environment.**

Phase 4: Inter-linkage and synthesis with other theories; relations between RBV and sustainability. Focus on **resources and its Impacts**



IE

Figure 7: The Circular Economy



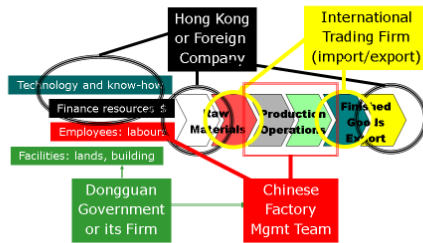
Source: Royal Society for the Encouragement of Arts, Manufactures and Commerce (2013)

2.0

**IE2.0的意义所在：它不仅仅可以是新的学科
 宗和创新体系；而且更重要的应该是中国给世界的一个交代：第二大的经济体不再指望天塌下来有高个子顶着啦，工业化的中国能够解决人类可持续工业化和健康发展的问题！**

Chinese Manufacturing Evolutions and Inspirations: IE 2.0 for the Future

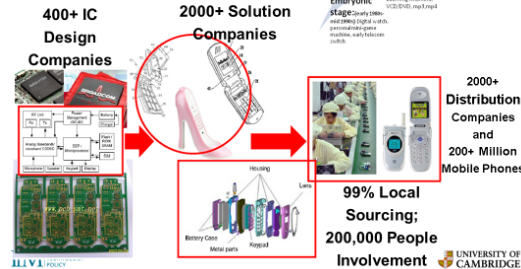
The Business Collaboration: CMS 七十年代末、八十年代的“三來一補”



IEM MANAGEMENT TECHNOLOGY POLICY

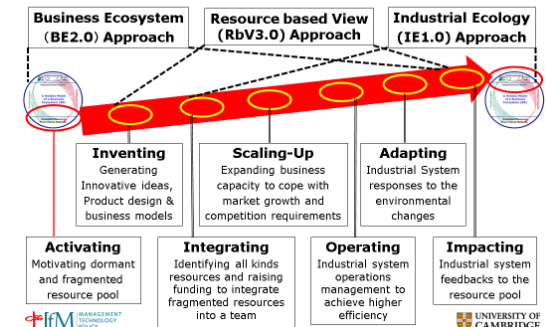
UNIVERSITY OF CAMBRIDGE

Chinese Industrial System: Network Level – Shenzhen mobile phone cluster



IEM MANAGEMENT TECHNOLOGY POLICY

A Process based Model for Industrial Ecosystem

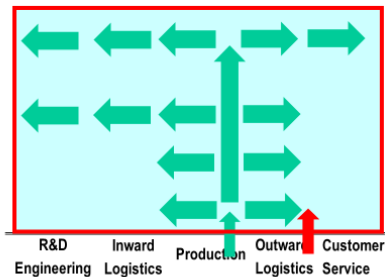


IEM MANAGEMENT TECHNOLOGY POLICY

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Chinese industrial System: Firm Level Penetration, Expansion, and Learning ...



IEM MANAGEMENT TECHNOLOGY POLICY

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Time: Before 1980s

1980

1985

1990

1995

2000

2005

2010

2020

Take-away

希望你们带走些什么呢



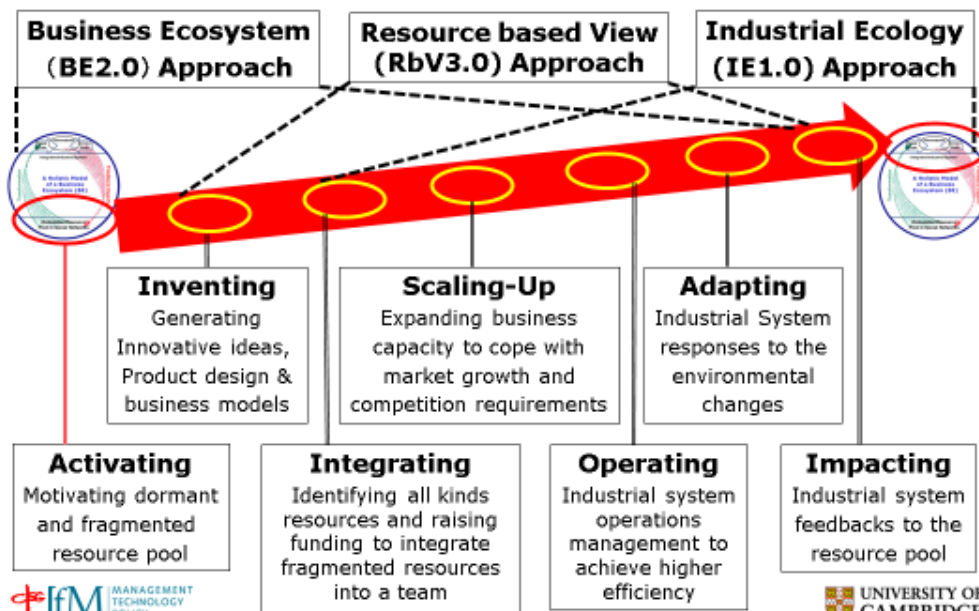
$$IE2.0 = IE1.0 + BE2.0 + RbV3.0$$

- IE = Industrial ecology
- BE = Business ecosystem
- RbV = Resource based View

产业生态学2.0(IE2.0)是在经典的产业生态理论基础上,结合动态的商业生态系统理论(BE 2.0),以及基于资源价值创造的梯度开发过程的第三代资源观理论(RbV 3.0),试图以产业系统及其生态系统为研究与管理对象,探讨它们之间的相互依存关系和动态演化机制,为产业发展和环境友善提供基础理论和实践方法的一个综合性新兴学科。



A Process based Model for Industrial Ecosystem



产业生态学2.0作为一个跨学科的理论框架,能够给予不同的工业发展相关学科一个共同的知识积累的理论平台。



Thank you very much!

Questions and Discussions

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