

The Research on Transformation and Upgrading of China's Manufacturing Industry under the Background of Industry 4.0

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Research Background

- Manufacturing related activities among global nations are rapidly evolving. Manufacturing earnings and exports are stimulating economic prosperity causing nations to increase their focus on developing advanced manufacturing capabilities by investing in high-tech infrastructure and education.
- Nations and companies are striving to advance to the next technology frontier and raise their economic well-being. And as the digital and physical worlds of manufacturing converge, advanced technologies have become even more essential to company and country-level competitiveness.
- In the 2016 GMCI, CEO survey respondents were asked to rank nations in terms of current and future manufacturing competitiveness. Top performing nations have each demonstrated strengths across multiple drivers of manufacturing excellence. They also clearly illustrate the close tie that exists between manufacturing competitiveness and innovation. The 2016 study takes a closer look at 5 focus nations: United States, China, Japan, Germany, and South Korea. Collectively, these countries account for greater than 50 percent of world's manufacturing GDP, demonstrating the influence these nations have on global manufacturing trends.
- Source: 2016 Global Manufacturing Competitiveness Index

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In the global manufacturing industry into the era of "industrial 4.0", manufacturing transformation and upgrading is being considered as the key task of industrial revolution by national governments. Intelligent Manufacturing is reshaping a new ecological manufacturing. German Federal Department of Research and Technology and the Federal Ministry of the Economy in 2013 have put "Industry 4.0" project into the German "High-tech strategy 2020". Soon afterwards, German Machinery and Manufacturers Association (VDMA) have jointly established the German "Industry 4.0 platform". American government promote the integration of Information technology and intelligent manufacturing technology, accelerate the platform installation of intelligent manufacturing and impel intelligent manufacturing industry as an engineering project. To make technological innovation and intelligent manufacturing industry support each other. Japanese officials, among others, have issued "Robot New Strategy" and proposed three objectives in January 2015: Innovation bases of World robot; the first country of using robot in the world; the new era of the most advanced robotics industries in the world.

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- South Korea's goal is to enhance the competitiveness of manufacturing industry, to promote the integration manufacturing and other industry, especially the information technology to create new industry. South Korean government have issued 《Manufacturing Innovation Strategy Implementation Plan 3.0》 in March 2015. In this plan the station have launched to three major manufacturing innovation strategy: 1. Promote the intelligent manufacturing. 2. Improve the industry's core strength in key areas. 3. Consolidate the base of manufacturing innovation.
- Chinese government have put forward the plan named 《Made in China 2025》 in May 2015 aim to resolve the present problems of China's manufacturing "big but not strong, and more without fine", clearly stated to focus on the development of the top ten key areas.
- Source of information from national Government confessed Notices

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Research Background

	A	B	C	D	E	F
U.S	12.3%	\$37.96/hour	4019	\$110,049.50GDP/person	\$1,034.2 Billion	63.7%
China	29.9%	\$3.28/hour	1089	\$ 22,407.70 GDP/person	\$2,197.9 Billion	93.8%
Germany	22.2%	\$40.54/hour	4472	\$ 87,208.30 GDP/person	\$1,248.6 Billion	82.6%
Japan	18.8%	\$23.95/hour	5201	\$ 71,433.80 GDP/person	\$ 597.8 Billion	87.4%
S.Korea	31.1%	\$20.71/hour	6457	\$67,564.40 GDP/person	\$ 495.8 Billion	86.2%

A represents Manufacturing GDP of total GDP in 2013
B represents Manufacturing Labor Cost in 2015
C represents Researchers per Million in 2013
D represents Labor Productivity in 2014
E represents Manufacturing Exports in 2014
F represents Manufacturing Exports of total Exports in 2014

Date resource: 2016 Global Manufacturing Competitiveness Index

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Advantage

- US :Design Develop Capacity(cutting-edge technology+business models closely integrated)
- Japan:Workshop scene(know how and who to integrate the architecture of products)
- Germany:Cutting-edge technology development and fuse with emerging technology+CPS
- Korea:modular architecture of Capital-intensive product+ invest ability(high-duty tech learning)
- China:The modular architecture of products and some part of large complex equipment

Resource:Huang Qunhui He Jing, The Core Competence and Function Orientation and Development Strategy of China's Manufacturing Industry[J].China Industrial Economic 2015(06)

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The theory of Transformation and Upgrading on (manufacturing) industry

- Utterback (1974) proposed the upgrading of products to promote the industry upgrading
- Abernathy, Utterback (1975) put forward "AU industrial upgrading model" says that the company's technology innovation is a collection of product innovation and process innovation
- Nelson, Winter (1982) brought out "NV Model" which have described path-dependent, self-dependent innovation and imitative innovation play important roles in industry upgrading
- Paul (1990) used "technological change cycle model" to explain the interaction between technological innovation and industry upgrading
- Gereffi (2001) considered industry upgrading in developing countries because of the weak foundation generally follow the upgrade path OEM (original equipment manufacturer) → OBM (own brand manufacturing) → GLC (global circulation rules) or ODM (independently design and manufacture) model to achieve self-dependent innovation and industry upgrading
- Gereffi (2005) thought industrial upgrading is divided into four different levels,including the level of enterprise products, enterprise-level economic activity, within the inter-industry level and upgrade the industrial level
- Piorebelli (2011) and Yohanes (2012) regarded global value chains as an important trend in the development of the domestic manufacturing industry to upgrade
- Sadayuki (2011) and Anwar (2012) showed that foreign direct investment(FDI) have significant positive effect in the country to promote manufacturing industry upgrades

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The theory of Transformation and Upgrading on (manufacturing) industry-In China

- Zhang QiZai(2008) showed that the national industry upgrade path is determined by the path of comparative advantage industries.
- Liu Peng (2009) used empirical methods to stress importance of growth and industry upgrading to China's economic growth
- Guo Yuan Xi (2010) shown that under technical constraints on economic growth and external environment , internal factors limit, The way of industry upgrading and development is innovation
- Tao Feng (2008) and Chenai Zhen (2008) said that the global value chain of China's manufacturing industry to upgrade make a significant effects of spilling knowledge. In order to better integrate into global value chain, we need to follow the path of absorption → deepen → innovation model
- Wu Qiang (2012) believed that our industry promotion is to build national value chain to improve the absolute advantage in the value chain
- Dexu (2010) and Shen Kun rong (2011)said that the absorption of foreign direct investment (FDI) paly an important role to upgrade a Chinese manufacturing industry

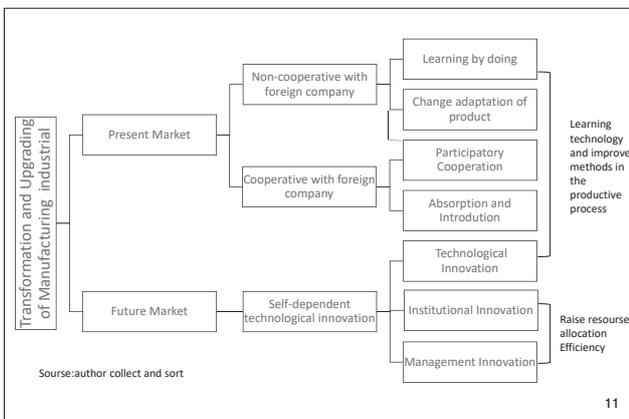
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The theory of Transformation and Upgrading on (manufacturing) industry

Summarize the theories of industrial upgrading mentioned above I will divide these into three levels: micro, meso and macro

Micro-level (company)	Meso-level (sector)	Macro-level (government)
The process of individual enterprises to increase investment in research, develop new products and technology, optimize the allocation of resources, cultivate their core competitiveness, gain a competitive advantage in the pursuit of maximum profit	Different production factors and resource keep flowing to achieve the optimum assignment in the process of a nation. The trend looks roughly the same in all direction-from labor- intensive to technology(capital)-intensive; production capacity from low-productivity to high-productivity; technological content of products from low to high value-added products Evolution	The government use national-level technology strategy and amount of capital to guide the resource flow from high-pot but low-output industries to low-input and high-output industries.

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- Current Situation of China's manufacturing industry

Cost advantage is gradually weaken

Export growth is slowing

Internet and manufacturing are closely combined

The low location of the global value chain

Environmental pollution and resources cut-down

Changes in consumer demand

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• Current Situation of China's manufacturing industry

Development of major sectors (manufacturing industry) in recent years

	2015				2014				2013				2012				2011			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Steel crude	2.30	%			6.90	%			7.50	%			3.10	%			7.3	%		
Steel rolled	6.60	%			4.50	%			11.4	%			7.70	%			9.9	%		
Engineering industry			3.32	5.5	%			9.40	%			13.8	10.9	%		9.80	6.4	%		15.1
Automobile	3.25	4.68	%		7.30	6.90	%		14.7	13.87	%		4.69	4.3	%		6.8	2.5	%	
Household Appliances			0.80	%				10.0	%			14.2	%		8.40	%				
Food		4.60	5.7	%			8.00	7.8	%			14.3	9.10	%		19.0	12	%		31.150
Medicine			9.10	%			12.9	%				18.0	%		19.7	9%				2%

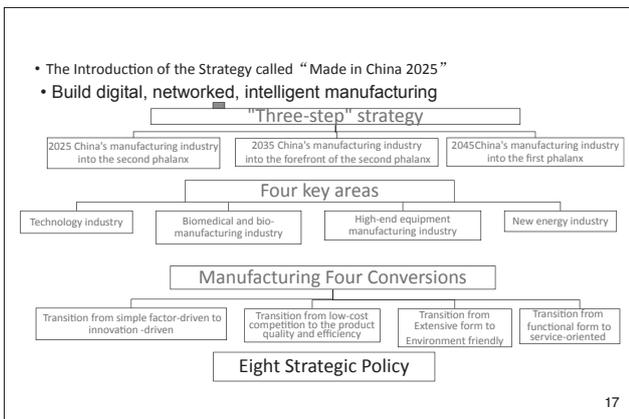
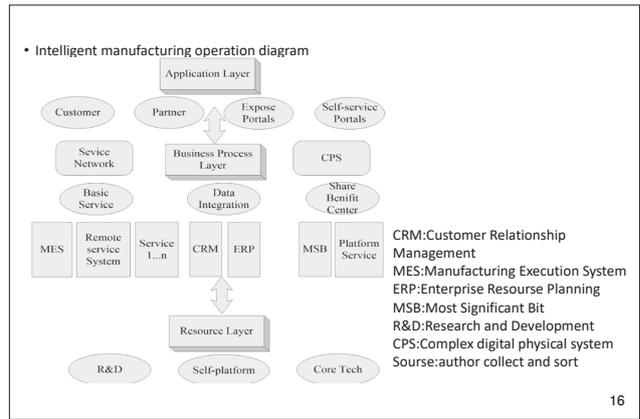
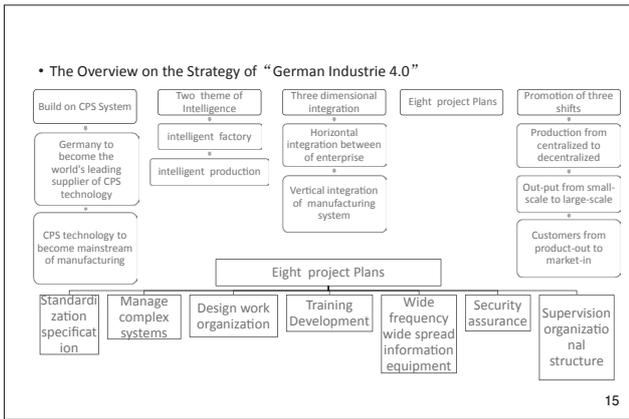
A:Production increased on year-on-year basis
 B:Sales volume increased on year-on-year basis
 C:Main business income increased on year-on-year basis
 D:Value added

Date Source:author collect and sort

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- The Overview on the Strategy of "German Industrie 4.0"
- Build the information of a physical system :CPS- the network combine the virtual online world and the real physical system based on information with communication technologies on the rapid development of he manufacturing resources, such as all kinds of information, goods, people and so on
- To put traditional manufacturing plant into a " intelligent factory" and "intelligent production"
- With the large-scale application of network technology, the production efficiency is raised through scientific method ,complete process and past experience, especially the connection between production equipment, products and users. It has formed an intelligent manufacturing network including the whole industry chain's factors
- The process of Intelligent Manufacturing is built on the Internet and net-working. It does not mean intelligent manufacturing should must be based on fully developed of Internet, networking, networking services .We do not need to wait until All of these networks mature enough and perfect then to start develop Intelligent Manufacturing. The correct approach is based on current technology, the use of existing scientific and technical intelligence to build a manufacturing platform. The development of intelligent manufacturing may promote the integration of three networks in turn

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• In summary, There are two ways to transform and upgrade China's Manufacturing Industry

- One is to promote the overall manufacturing technology industry through connecting institutional innovation and market innovation, make it from existing production manufacturing to service-oriented manufacturing, just like developed countries.
- Second is direct way to upgrade by breaking through the technical constraints in different manufacturing industries to promote industries to develop. This path we can learn from the successful experience of other Asian countries such as South Korea and Singapore. China can move along the path of "Manufacturing process upgrade" – "Manufacturing Product upgrade" – "Manufacturing capability upgrade". As a result, it will upgrade in Global Value Chain

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Conclusions and recommendations

To Transform And Upgrade China's Manufacturing Industrial	To be led by the Government to promote the intelligent manufacturing planning and construction of technical standards and implementation
	To optimize the manufacturing industry structure in-hand, then pay attention to cultivate new development areas in manufacturing industry
	To cooperate the effects among Government, enterprises and scientific research institutions to promote the development of the core manufacturing industry technology innovation

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Thank you for your listening

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