

## **Focus on the Development of Strategic Emerging Industries in China—Based on SWOT Analysis**

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### **Abstract**

*Strategic emerging industries have become the world's new focal point of economic competition. By using the SWOT analysis method, this article analyzes the internal capability and external environment for the development of strategic emerging industries in China, and explores the development status of strategic emerging industries in China from four dimensions including strengths, weaknesses, opportunities and threats. Finally, according to the combinations of SWOT matrix analysis, the paper formulates four kinds of different development strategies to provide certain references to the development of China's strategic emerging industries.*

**Key Words:** Strategic emerging industries, China, SWOT analysis, Strategies

### ***1. Introduction***

In 2008, because of the financial crisis, the world economy has suffered the most serious challenge since the Great Depression in the last century, the world's economic situation and structure has undergone significant changes. In order to gain advantage in the new round of international competition, various countries in the world have to adjust the industrial structure, develop and foster strategic emerging industries. With the purpose of adapting to the new international economic form, enhancing the comprehensive national strength and international competitiveness, and improving the ability to resist risks, China believes that it is inevitable to foster and develop strategic emerging industries.

In September of 2009, China's then prime minister, Wen Jiabao chaired a meeting of the strategic emerging industry, determined the seven major industries of "strategic emerging industries", emphasized the development of emerging strategic industries was a long-term strategic choice based on the current situation of China, and it would help China to weather the storm. In October 10, 2010, "Decision about accelerating the cultivation and development of strategic emerging industries" was formally promulgated by Chinese State Council, opened the prologue of substantive development of strategic emerging industries in China. It is necessary to provide a comprehensive analysis and evaluation to the industries under the complicated and volatile environment in China. In this article, SWOT analysis was used to evaluate the internal and external environment of China in order to clarify the strengths, weaknesses, opportunities and threats of the strategic emerging industries. This research tries to draw a picture for grasping the current situation and future development of the industries, and provides valuable information for practitioners to improve their development strategies.

### ***2. SWOT analysis method***

The SWOT analysis method was first proposed by Wehrich, a professor of management in the University of San Francisco. He proposed the method when he studying the competitiveness and strategies of enterprises in the early 1980s. SWOT is the abbreviation of four words: Strength, Weakness, Opportunities and Threat, in which "S" and "W" are internal factors, while "O" and "T" are external factors (Wehrich H, Cannice MV, Koontz H 2008).

It is commonly accepted that an industry's strengths and weaknesses demonstrate the industry's internal characteristics and are controllable; and an industry's opportunities and threats are determined by external factors on which the industry has no direct control but can react to its own advantage.

SWOT analysis is a methodology allowing an industry to understand and plan to use their strengths to exploit opportunities, to recognize and repair or avoid their weaknesses, and to defend against or sidestep any known threats. The method has been widely used as a strategic planning tool and found it was effective (Zhao ZY, Shen LY, Zuo J, 2009). In this paper, S, W, O and T factors involved in the strategic emerging industries in China are proposed. These factors will be analyzed with qualitative methods. Data used in the analysis stem from multiple sources including statistical reports, literature review, laws, regulations, policies, and case studies. These findings should provide a valuable reference to assess and evaluate the strategic emerging industries in China.

### ***3. SWOT analysis of strategic emerging industries in China***

#### **3.1. Strengths (S)**

##### **3.1.1. Superior natural conditions (S<sub>1</sub>)**

Natural resources are important material basis to develop strategic emerging industries, which are abundant in China. In the respect of new energy resources, solar, wind, tidal, hydropower, biomass and others in China are very rich, hydropower development capacity and annual power generation volume ranking first respectively in the world. Two-thirds of the country's land rich in solar energy, wind energy that can be developed and utilized approximately one billion kilowatts, existing biomass mainly straw, industrial waste, garbage, etc, and it is estimated that there are 500 million tons of standard coal of these resources potential conversion. In the respect of new materials, China has abundant raw materials. Such as rare earths, tungsten, titanium, lithium, vanadium and other minerals, which are large reserved and central stored. The amount of rare earth reserves in China ranks the world first. In the aspect of biological resources, as shown by the statistics of March 2010, China has about 260,000 kinds of biological species, of which 12,800 kinds are medicinal plants and animals. At present, China established the world's largest crop germplasm holdings as well as Asia's largest repository of microorganisms' repository. These rich material resources provide a unique foundation conditions for China to foster and develop strategic emerging industries.

##### **3.1.2. Powerful technology strength (S<sub>2</sub>)**

Science and technology are primary productive forces, science and technology have profound impact on the industry structure, growth mode and competitiveness in the international competition, and countries have been committed to seize the commanding heights of international science and technology. China already has 221 national key laboratories, 19 national laboratories, 334 national engineering (technology) research centers, 91 national engineering laboratories, 729 state-certified enterprise technology Center. In 2010, the Chinese government S&T appropriation was 490.3 billion RMB (\$80.4 billion), the National Research and Development (R & D) funding amounted to 868.7 billion RMB (\$134.5 billion), more than Germany, routed to third in the world, which was shown in Figure1. National Research and Development (R & D) personnel equivalent reached the volume of 255.4 million and has become the country that has the largest scientific and technological human resources (Department of Development Planning Ministry of Science and Technology, PRC 2012). In respect of the output of science and technology, in 2010, China received 1.084 million domestic patent applications, 281,000 invention patent applications, over 12,000 patents passed the "Patent Cooperation Treaty" Application of international applications, China ranked to fourth in the world. In 2008, "Science Citation Index (SCI)", "Engineering Index (EI)", "Science and Technology Conference Index (ISTP)", the three most influential search tools, included 117000, 89000, 65000 papers from China respectively, which ranked in the first, second and first place of the world (National Bureau of Statistics, Social and Technology Statistics Division, PRC 2012 ). S&T papers indexed by SCI, EI and CPCI-S in selected countries are shown in Table1.

##### **3.1.3. Favorable Policy environment (S<sub>3</sub>)**

Chinese State Council and governments at all levels have formulated plans and policies to support the strategic emerging industries, in September 2010, the Chinese State Council executive meeting examined and adopted the "Decision about speeding up the cultivation and development of strategic emerging industries" and seven special plans (Cui Wei 2011).

In 2012, the State Council issued "National development plan for strategic emerging industries during the 12th Five-Year period". The 12th Five-Year Plan outline projects stated the development of emerging industries in a separate chapter, identified macro-development ideas, made it clear that strategic emerging industries should be fostered and developed to become the leader and pillar industries.

Currently, there are more than 30 provinces and cities in China have laid down the plans and policies to develop strategic emerging industries.

#### **3.1.4. Solid industrial foundation (S<sub>4</sub>)**

Since the reform and opening, China has made considerable progress in high-tech field, industries of aerospace, nuclear energy, electronic information, new materials and other fields have already had a considerable competitive in the world, some of which have reached the world advanced level, meanwhile a number of high-tech enterprises which have early internationally competitive have come out. China's high-tech industry output value was from 500 million RMB (\$82 million) in 2007 to 8.8 trillion RMB (\$1.4 trillion) in 2010 with an average annual growth rate of 15.2%. Main economic indicators of high-tech industry are shown in Table2. Total number of import and export of high-tech products is from \$528.75 billion in 2006 to \$1.01 trillion in 2011, with an average annual growth rate of 13.87%. The amount of balance of trade is from \$-117 billion in 2001 to \$85.6 billion in 2011[4]. High-tech industry in the national economy has been increasing. As high-tech industry and strategic emerging industries have some industries overlap, the development of high-tech industry reflects the strategic development of emerging industries to some extent. At present, development of Chinese strategic emerging industries has shown a good momentum.

### **3.2. Weaknesses (W)**

#### **3.2.1. Lack of independent innovation capability (W<sub>1</sub>)**

In current situation, independent research and technological innovation capability of strategic emerging industries in China is relatively weak. Investment for R & D is inadequate, products are lack of high technological content, and corporate status and the high-tech industry structure are mismatch. Production processes and technology are primary imitative and conventional, patents and products are lack of independent property rights, and most of the key technologies and core equipment are imported. Take high-end equipment manufacturing industry for an example, 80% of the integrated circuit chip manufacturing equipment, 40% of the large-scale petrochemical equipment and 70% of car manufacture core equipment and advanced intensive agricultural equipment in China are imported. Most export products are OEM, Chinese own brands are less than 20% (Chen Liuqin 2011). The shortage of independent innovation capability and corporate R & D capabilities, turned out to be technical barriers to the development of strategic emerging industries in China.

#### **3.2.2. Deficient financing system (W<sub>2</sub>)**

In recent years, China's science and technology expenditures have had significant growth, but the percentage of GDP is low compared with developed countries. China accounted for 1.84% of the percentage in 2011, while the United States had reached 2.90% in 2009, Japan had reached to 3.26% in 2010 (Department of Development Planning Ministry of Science and Technology, PRC 2012). The shortage of research capital in China is mainly due to the narrow channels of financing. Although the business investment accounts for more than 70%, most of that are large state-owned enterprises and military enterprises, which occupy a considerable proportion. The venture capital is not perfect and the private investment is not active. Essentially, the government is the major source of funding to develop strategic emerging industries. While in other countries, venture capital is a major source of high-tech industries, private investment is developed very well.

#### **3.2.3. Low technological achievements conversion rate (W<sub>3</sub>)**

Technological achievements conversion rate is a direct indicator to reflect the status of scientific and technological achievements. According to statistics, Chinese current technological achievements conversion rate is about 20%, patent rate is less than 10%, which are far behind the developed countries and some newly industrialized countries such as South Korea, Singapore (Liu Erzhong 2010).

The reason is mainly the lack of socialize, networked technology service system based on the science and technology intermediary agencies, the result is that large numbers of enterprises are difficult to obtain the necessary scientific and technological achievements, and many universities, research institutes and technological achievements cannot find a suitable diffusion channels. This leads to the difficulty to play social benefits of advanced scientific and technological achievements, and it is not conducive to the development of strategic emerging industries.

#### **3.2.4. Lack of professionals (W<sub>4</sub>)**

The Chinese government has always attached great importance to the training of personnel, in 2010, China R & D personnel totaled 288.3 million. But China has a serious lack of high-tech talents, the number of labor in R & D is only 34 in ten thousand in 2010, and the same year, South Korea reached 135, Japan reached 133 and Canada 132. China also faces phenomenon of brain drain, a lot of talent pour into the United States, Europe, Canada and other developed countries every year. In 2011, 34 million people went abroad, but only 18.6 million returned (Department of Development Planning Ministry of Science and Technology, PRC 2012). In recent years, Microsoft, Hewlett-Packard, Motorola and a number of foreign companies, have set up research and development institutions in China. They attract more and more senior people to join. Brain drain seriously weaken Chinese scientific and technological strength, China has to attract talent from other countries. It can be said, the lack of scientific and technological personnel further restrict the development of strategic emerging industries in China.

### **3.3. Opportunities (O)**

#### **3.3.1. New industrial revolution caused by the international financial crisis (O<sub>1</sub>)**

The scientific and technological revolution is the engine of economic growth, the development of new industries serves as an important method to respond to the economic crisis, to narrow the economic cycle and to cultivate long-term economic growth point. After the economic crisis, most of the developed countries choose to stimulate and promote economic development rely on the development of emerging industry. China also lists seven key support industries include energy conservation and environmental protection, new generation of information technology, biotechnology, high-end equipment manufacturing, new energy, new materials, new energy automobile, which are known as the strategic emerging industries. In order to generate new economic growth and technological development, cities in China follow the national policy guidance, seize the opportunity of adjustment of world economic structure, and focus on the development of strategic emerging industries.

#### **3.3.2. Huge potential market (O<sub>2</sub>)**

By the constraints of resources conditions, China has an urgent need to develop and nurture emerging industries that have high scientific, technological content, good economic returns, low resources consumption and little environmental pollution. In addition, most countries have the new energy and low carbon economy as the engine of the new round of industrial revolution. The reason is that the rise of new energy industry will cause the revolution and fission of power industry, IT industry, construction industry, automotive industry, new materials industry, communications industry, and other industries, and gave rise to a series of new industry market.

#### **3.3.3. Mature technical condition (O<sub>3</sub>)**

The global rise of the emerging industries is based on the evolvement and industrialization of the emerging field. Next-generation information network, mobile communications, networking, cloud computing, large-scale integrated circuits, electronic components and flat panel display and other emerging field of information has become the new economic growth point of global information industry. Biotechnology in functional genomics, proteomics, stem cell, bio-chips, genetically modified organisms breeding, animal and plant bioreactor medicine, agriculture and energy sectors have made a major breakthrough and gone into large-scale industrialization phase. Wind power, solar photovoltaic, solar thermal, biomass energy and other industries showed a rapid development momentum, the industrialization of new energy automotive industry developed steadily. New materials industry has shown a trends of specialized, complex, detailed, such as the field of application of rare earth materials has penetrated into the new energy, environmental protection, national defense and other aspects, and have more than ten thousand kinds of varieties and specifications (Jiang Jiang 2010). Increasingly sophisticated technology provides a good opportunity to develop strategic emerging industries in China.

### **3.4 Threats (T)**

#### **3.4.1. Restriction of resources, environmental and demographic (T<sub>1</sub>)**

China has formed an extensive mode of economic growth relying on a huge waste of resources, environmental pollution and cheap labor. Such an economic growth mode with high investment, high consumption, high pollution, to some extent, has promoted the development of industry. But it is unable to meet the industrialization process under the constraints of resources, environment and labor.

The shortages of resource, deterioration of ecological and the gradual disappearance of the demographic dividend, is increasingly becoming an important factor which restricting the development of strategic emerging industries.

#### **3.4.2. Domestic factors (T<sub>2</sub>)**

The experience of developed countries shows that emerging industry is based on technology deepening and the original high-tech industrial. But in actually, since the Chinese State Council has decided to develop strategic emerging industries vigorously, various provinces and regions have invested heavily in the development of new industries, which caused a certain degree of similarity, and led to overcapacity and a waste of resources. In addition, there will be conflicts between strategic emerging industries and traditional industries, business interests, ideas and the government-oriented, and the conflicts between the various local governments on strategic emerging industries.

#### **3.4.3. International factors (T<sub>3</sub>)**

Energy crisis spawned new scientific and technological revolution, many countries of the world are proceeding vigorously to develop new energy, new materials, bio-engineering, new generation of information technology and other emerging industries, which has brought tremendous competition and pressure to China. Although China has cooperated with foreign countries, but China does not have the core technology, parts of the core equipment are imported. If other countries stop the export or give technical blockade to China, that will be a lethal threat. The development of strategic emerging industries requires a lot of young scientists, engineering, technology, management talent with innovative entrepreneurial spirit, specialized knowledge and skills, global competition for talent between various countries has become a no smoke war.

### **3.5. SWOT analysis matrix of strategic emerging industries in China.**

According to the analysis above, the SWOT analysis matrix for Chinese strategic emerging industries can be got, as shown by Table3.

## ***4. Strategies for promoting strategic emerging industries in China***

### **4.1. SO strategy**

China has already had a good foundation for the development of strategic emerging industries. The existing industrial base, superior geographical advantages, talents resources, and policy advantages should be made full use of, to strengthen the capability of independent innovation, to grasp the good opportunity that governance at all levels – national, and local – supports the development of strategic emerging industries vigorously, to make strategic emerging industries bigger and stronger, and to enhance the core competitiveness in the domestic and overseas markets.

### **4.2. ST strategy**

China should change the extensive industrial development, and take a new way of industrialization with the characteristic of high technology content, good economic returns, low resource consumption and little environmental pollution. The market should be cultivated and predicted scientifically. Strategic emerging enterprises should strengthen communication with users, concern about the production that meet the market demand, organize a demonstration project of strategic emerging industries, enhance the credibility of the produce, expand its influence, increase domestic and foreign demand, and tap the potential market by quality services (Hou Liyu 2011).

### 4.3. WO strategy

China should expand financing channels, establish diversified financing mechanisms to support the development of strategic emerging industries, give favorable fiscal and tax policy to support the implementation of strategic emerging industries, encourage enterprises to increase the technological transformation efforts, establish industry-university-research cooperation, research institutes and other alliances, train innovative engineers, scarce professionals and highly skilled personnel.

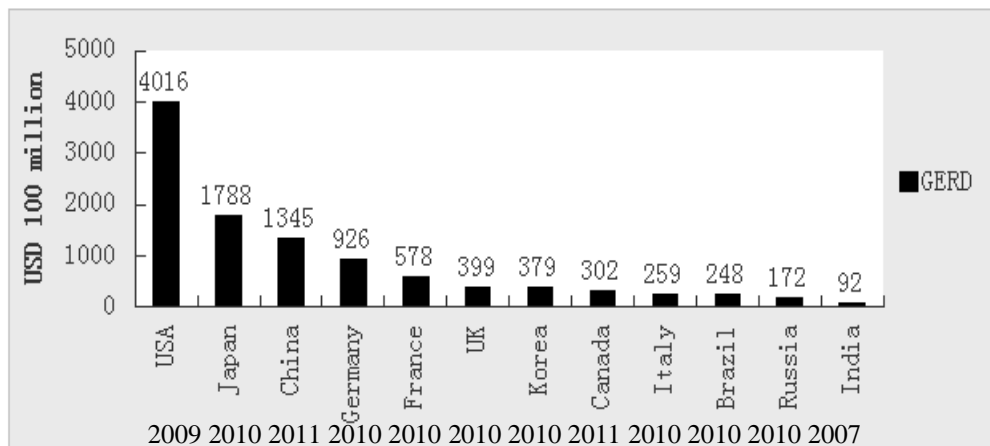
### 4.4. WT strategy

China should promote the shift of strategic emerging industries from energy-based mode to conservation-oriented mode, establish manufacturing sector with high quality, high efficiency, low power consumption, import core technology from foreign country to master the core technology of strategic emerging industries, increase the ability to yield strategic emerging products, enhance the ability of independent R & D and innovation to research and develop its own brand products (Li Yan, Men Guibin, Liu Yixiu 2012).

### 5. Conclusions

China is vigorously foster and develop strategic emerging industries, however, the industries are still immature and having numerous challenges and problems. It is necessary to explore the internal and external factors that affect the present situation and future development of them. Using SWOT analysis approach, the strengths, weaknesses, opportunities, and threats factors in Chinese strategic emerging industries are assessed. This study found that major strengths of the industry include: superior natural conditions, powerful technology strength, favorable policy environment, solid industrial foundation. Whereas the major weaknesses are: lack of independent innovation capability, deficient financing system, low technological achievements conversion rate, lack of professionals. On the other hand, the opportunities for the industry include: new industrial revolution caused by the international financial crisis, huge potential market, and mature technical condition. Meanwhile, the external threats for the industry are: restriction of resources, environmental and demographic, domestic factors, international factors. According to the consequences of SWOT matrix analysis, this paper concluded series of strategies for the development of Chinese strategic emerging industries: strength-opportunity (SO) strategy, strength-threat (ST) strategy, weakness-opportunity (WO) strategy, and weakness-threat (WT) strategy.

These findings provide valuable information for the future development of Chinese strategic emerging industries. However, these SWOT factors will vary with the changing environment. Therefore, continuous assessment should be made to explore the comprehensive situation of strategic emerging industries in China.



Source: (MOST, Main Science & Technology Indicators 2012/1 (OECD), Ministry of S&T of Brazil, UNESCO)

Figure 1. Gross Expenditure on R&D (GERD) in Selected Countries

**Table 1. S&T papers indexed by SCI, EI and CPCI-S in selected countries**

Country	SCI		EI		CPCI-S	
	10,000 papers	Rank	10,000 papers	Rank	10,000 papers	Rank
Total	151.6		47.9		30.1	
China	14.4	2	12.7	1	5.2	2
USA	41.9	1	9.3	2	8.2	1
Japan	8.8	5	3.2	3	1.7	5
UK	11.8	3	2.5	5	1.7	4
Germany	10.9	4	2.9	4	1.8	3
France	7.6	6	2.2	6	1.2	6
Italy	6.5	7	1.5	11	1	7
Canada	6.4	8	1.7	9	0.9	8
Korea	4.9	11	2.0	8	0.8	9
Russia	3.0	15	1.3	13	0.3	17
India	5.0	10	2.1	7	0.5	12
Brazil	3.8	13	0.7	17	0.4	15

Source: (WIPO, Industrial Property Statistics , 2012)

**Table 2. Main economic indicators of high-tech industry in total of China 100 million yuan**

	2007	2008	2009	2010	2011
Gross industrial output	50461	57087	60430	74709	88434
Revenue from principal business	49714	55729	59567	74483	87527
Profit	2396	2725	3279	4880	5245
Taxes and profits	3353	4024	4660	6753	7814
Export	28423	31504	29500	37002	40600

Source: (Department of Development Planning Ministry of Science and Technology, PRC.)

**Table 3. SWOT analysis matrix of Chinese strategic emerging industries**

Strength ( S )		Weakness ( W )	
<b>Internal</b>	Superior natural conditions ( S <sub>1</sub> )	Lack of independent innovation capability ( W <sub>1</sub> )	
	Powerful technology strength ( S <sub>2</sub> )	Deficient financing system ( W <sub>2</sub> )	
	Favorable Policy environment ( S <sub>3</sub> )	Low technological achievements conversion rate ( W <sub>3</sub> )	
	Solid industrial foundation ( S <sub>4</sub> )	Lack of professionals ( W <sub>4</sub> )	
Opportunity ( O )		Threat ( T )	
<b>External</b>	New industrial revolution caused by the international financial crisis ( O <sub>1</sub> )	Restriction of resources, environmental and demographic ( T <sub>1</sub> )	
	Huge potential market ( O <sub>2</sub> )	Domestic factors ( T <sub>2</sub> )	
	Solid industrial foundation ( O <sub>3</sub> )	International factors ( T <sub>3</sub> )	

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