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CHINESE PATENTING

REPORT ON THE CURRENT STATE OF INNOVATION IN CHINA



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TABLE OF CONTENTS

INTRODUCTION	3
TRENDS IN CHINESE INNOVATION	4
Total Patent Application Volumes 2006 – 2010	5
Figure 1	5
Projected Total Patent Application Volumes 2006 – 2015	6
Figure 2	6
Figure 3	6
Domestic vs. Total Patent Volumes	7
Figure 4	7
INNOVATION IS HOMEGROWN	8
Figure 5	8
Domestic Patent Applications by Technology	9
Figure 6	9
Figure 7	9
TECHNOLOGY LANDSCAPES	11
Chinese Automotive Sector	11
Figure 8	11
Figure 9	12
Figure 10	13
Figure 11	14
Pharmaceutical Sector	15
Figure 12	15
Figure 13	15
Figure 14	16
CHINA LOOKING OUTWARDS	17
China's Invention Patent Applications Overseas	17
Figure 15	17
Figure 16	17
Figure 17	18
Figure 18	18
THE DRIVING FORCES BEHIND CHINA'S PATENT BOOM	19
Development Plans and Targets	19
Figure 19	20
Conclusions	21

INTRODUCTION

2011 marked the 90th anniversary of the Chinese Communist Party. Since 1949 under their government, a series of five-year plans have been implemented which have guided the development of China from a poor developing nation to become the second-largest global economy behind the United States both in terms of purchasing power parity and, most recently, in terms of GDP.¹

China has just completed the 11th Five-Year plan for National Economic and Social Development. This plan highlighted innovation as a focus along with social harmony, environment, macroeconomic balance and governing the market. The corresponding science and technology plan articulated the goal of China becoming an “innovation-oriented” society by the year 2020. Many of the developments of the last five years have illustrated how far China has moved towards that goal:

- The Thomson Reuters prediction that China will lead the world in published patent applications in 2011 has been realized. China officially outpaced the United States and Japan this year.
- Published applications have increased by 16.7% per year over the period from 171,000 in 2006 to nearly 314,000 in 2010
- China’s global ranking based on citations in international science papers has moved from 13th in 2006 to 8th in 2010²

- China now ranks 29th as measured by the Global Innovation Index³ and is the only developing country among the top 30 innovators
- In 2008, China invested 457 billion yuan (US\$65.8 billion) in R&D, or 1.52% of its increasing GDP
- Significant recent technological achievements include the opening of the world’s longest sea bridge at 26.4 miles long⁴ and the ongoing development of the world’s largest high-speed railway system⁵ with around 10,500 miles completed or under construction

The recently released 12th Five Year plan lays out a number of challenging goals which are aimed at continuing the drive towards moving from “Made in China” to “Designed in China.” In order to achieve this, the government plans to heavily invest in science and technology education and R&D and further develop China’s intellectual property rights system.

This report examines the ways in which China is further transforming from a manufacturing to an innovation economy and the prospects for achieving the targets set out for the next five years. The driving factors for China’s patent boom are analyzed using data drawn from Thomson Reuters. Patent volumes and trends are explored, as well as the underlying causes of increased innovation, including economic and government policy factors and the changing IP climate in China.

1 Full year GDP figures for 2010 were USA \$14.66 trillion, China \$5.88 trillion and Japan \$5.46 trillion.

2 Based on Science Citation Index (SCI) figures. Citation count is an important indicator to measure quality of scientific papers and reflects the impact of scientific papers of a country.

3 GII is a global index measuring the level of innovation of an economy in terms of their innovation capabilities, 2011 results were released on 30 June jointly by INSEAD and its knowledge partners including World Intellectual Property Organization (WIPO).

4 <http://www.telegraph.co.uk/news/worldnews/asia/china/8608279/China-opens-worlds-longest-sea-bridge.htm>

5 <http://www.guardian.co.uk/world/2011/jun/27/china-high-speed-rail-beijing>

TRENDS IN CHINESE INNOVATION

In 2010, the patent offices of Japan, US, Europe, Republic of Korea and China accounted for 77% of all new invention patent applications published worldwide. Japan, Korea and China alone accounted for 54.8% of these. An analysis of patent volumes over the last five years from these five major offices shows that inventions from China have been growing at a faster rate than any other region.

There are several attributes that can be measured to identify and track innovation trends for a particular region:

- **Published patent application total volumes.** This gives a measure of the total patenting activity in a region both by domestic and foreign concerns seeking protection for their inventions in order to manufacture, use or sell the invention or products in the region.

- **Local priority patent applications volumes.**

This gives a picture of homegrown innovation by providing a measure of how many inventions claim priority in the region. In general terms, the priority country is the country from where the invention originated.

- **International patent application volumes.**

This provides information about the extent to which a country is seeking to extend the market for its innovation beyond its domestic borders.

Using data from the Thomson Reuters value-added patent collection Derwent World Patents Index® (DWPISM), the trends in patenting according to the numbers of published patent applications are compared for Japan, US, Europe, Republic of Korea and China.

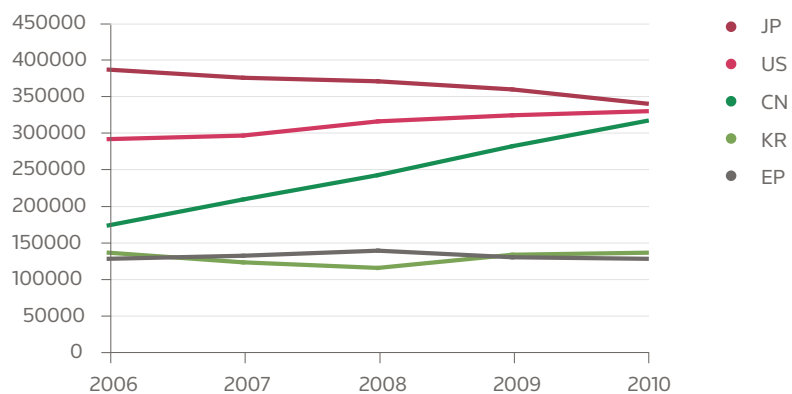


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TOTAL PATENT APPLICATION VOLUMES 2006 – 2010

Figure 1 shows the total volumes of published patent applications from the five patent offices from 2006 to 2010. Japan has the highest volumes year-to-year during the period, but its lead narrows as the US catches up. Europe and Korea have similar volumes and growth trends. The striking difference among these regions is China – it is experiencing the most rapid growth and is poised to lead the pack in the very near future.

FIGURE 1



PROJECTED TOTAL PATENT APPLICATION VOLUMES 2006 – 2015

Figure 2 gives the projected growth in published patent applications for these regions and shows that China is set to lead the patent information landscape this year, 2011, which has in fact already happened as Thomson Reuters predicted.

FIGURE 2

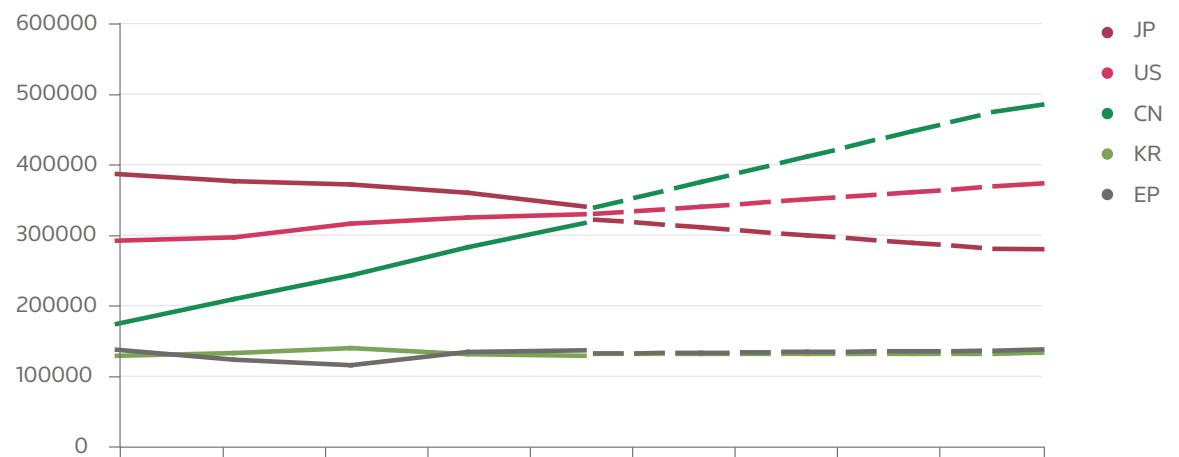
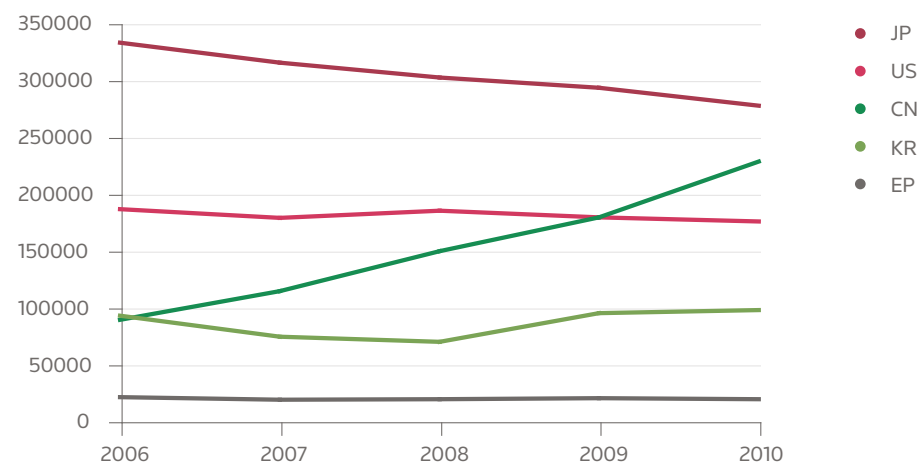


Figure 3 shows the number of patent applications with local priority and indicates the number of domestic applications for each region. China is again the exception with dramatic growth in domestic applications from less than 90,000 in 2006 to nearly 230,000 in 2010.

FIGURE 3



DOMESTIC VS. TOTAL PATENT VOLUMES

The ratio of domestic patent applications (those with local priority) to total patent volume for each region from 2006-2010 is given in Figure 4. This ratio ranges from the lowest of 13.7% in Europe in 2008 to the highest of 86.6% in Japan in 2006.

Japan shows a high proportion of domestic to total patent applications at a relatively steady level over time. The ratio for the US has declined over the period. Domestic applications have remained flat while applications for patents made by foreign concerns have been increasing over time. Europe and Korea both display fluctuating ratios for the period, and the low ratios for Europe reflect the high proportion of applications with priority filings at patent offices other than the European Patent Office.

By contrast, China is the only region in the group where the ratio of domestic to total applications is growing steadily, from less than 52% in 2006 to nearly 73% in 2010. Clearly, applications by domestic concerns are growing at a more rapid pace than foreign entities and are fueling the Chinese patent boom.

FIGURE 4

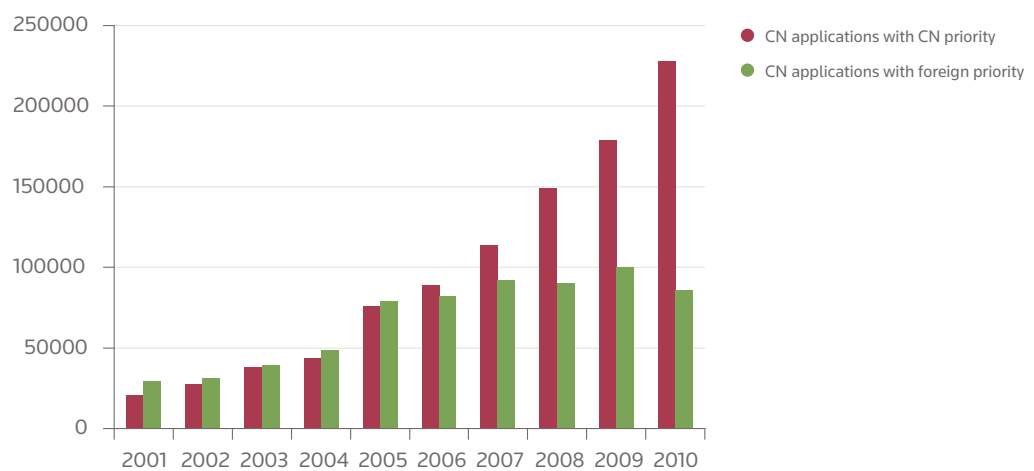
Ratio of domestic to total applications	2006	2007	2008	2009	2010	Average
Japan	86.6%	84.4%	81.9%	81.9%	82.1%	83.4%
US	64.4%	60.7%	58.9%	55.6%	53.6%	58.6%
Europe	16.5%	14.2%	13.7%	15.4%	15.1%	15.0%
Korea	69.0%	61.1%	61.7%	72.0%	72.8%	67.3%
China	51.9%	55.2%	62.2%	64.1%	72.7%	61.2%

INNOVATION IS HOMEGROWN

Figure 5 shows the number of domestic patent applications compared to those from foreign sources. By 2010, the number of homegrown patent applications outstripped foreign ones by a factor of nearly three to one.

DOMESTIC VS. FOREIGN PATENT APPLICATIONS

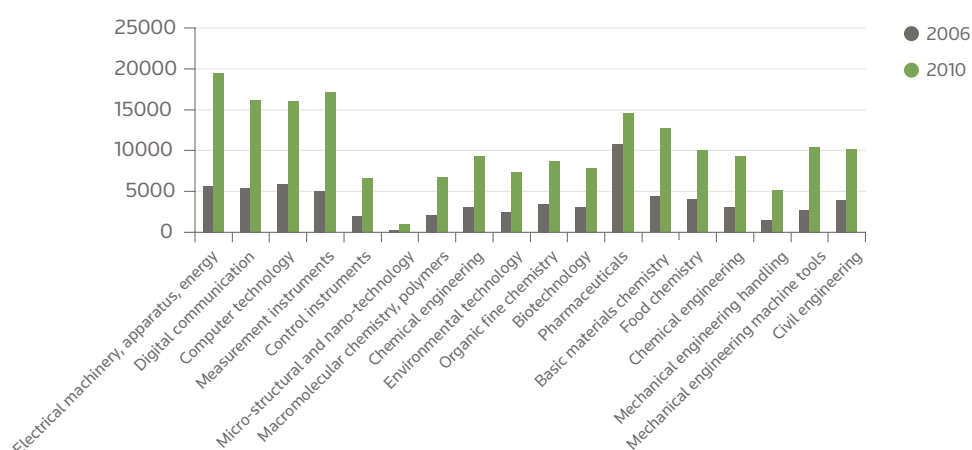
FIGURE 5



DOMESTIC PATENT APPLICATIONS BY TECHNOLOGY

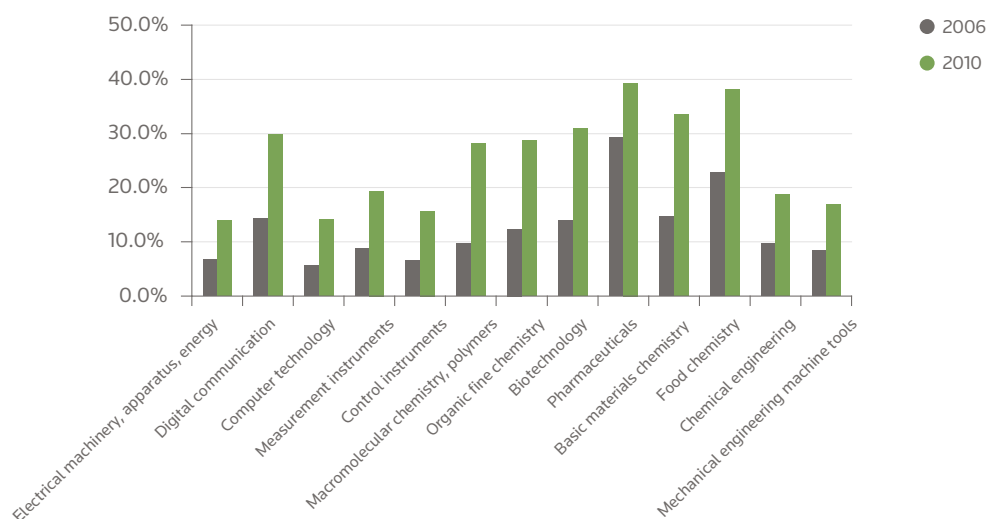
The results of an analysis conducted on Chinese domestic patent application volumes for 2006-2010 in selected technology fields are shown in Figure 6. All sectors show growth with electrical machinery, digital communication, computer technology, measurement instruments and pharmaceuticals taking the top five slots in 2010.

FIGURE 6



The global share of Chinese domestic applications (ratio of Chinese domestic applications compared to global applications) by technology for 2006-2010 was also analyzed and results summarized in Figure 7. The dominant industries by global share in 2010 were pharmaceuticals, food chemistry and basic materials chemistry closely followed by biotechnology and digital communication.

FIGURE 7





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A summary of the significant findings of these analyses is given here by technology area:

- **Electrical engineering**

- Dramatic growth rates over the period were observed for **Electrical machinery, apparatus, energy** (rising from 5,671 applications to 19,511 applications at a compound annual growth rate [CAGR] of 36.2%), **Digital communication** (from 5,481 to 16,168, CAGR of 31.1%) and **Computer technology** (5,872 to 16,066, CAGR of 28.6%)
- Domestic patent applications for **Digital communication** grew 20% faster over the period than global applications in this technology
- Global share of domestic Chinese patent applications for **Digital communication** more than doubled from 14.4% to 29.8% over the period
- **Computer technology** domestic applications grew 25.9% per annum faster than global applications

- **Instruments**

- Growth rates for the technology fields of **Measurement** and **Control** grew at CAGR of 35.6% (from 5,071 applications in 2006 to 17,126 in 2010) and 34.6% (from 2,007 applications in 2006 to 6,587 applications 2010) respectively
- **Control** domestic applications grew 24.5% p.a. faster than global applications

- **Chemistry**

- **Micro-structural & nano-technology, Macromolecular chemistry & polymers, Chemical engineering** and **Environmental technology** grew at CAGR of 36.8%, 32.8%, 32.0% and 31.2% respectively
- Global share of **Pharmaceutical** domestic Chinese patent applications grew from 29.2% to 39.3% from 2006-2010
- Global share of **Food chemistry** patents grew from 22.8% to 38.1% over this period
- **Organic fine chemistry** domestic applications grew 23.3% per annum faster than global applications

- **Mechanical engineering**

- **Handling** and **Machine** tools grew 35.9% and 40.4% CAGR respectively for the period

- **Other fields**

- **Civil Engineering** domestic applications grew at CAGR 26.7% from 3,696 applications in 2006 to 10,213 in 2010

TECHNOLOGY LANDSCAPES

Further in-depth analysis was conducted for two specific technology sectors (automotive and pharmaceutical) to help identify significant trends for these areas.

CHINESE AUTOMOTIVE SECTOR

A search to retrieve all basic patents (i.e., the first instance of an invention) published in China in 2010 within the automotive sector was conducted using DWPI on Thomson Innovation®. This data set was then analyzed in two ways:

- Those basics with a Chinese application in the patent family. This analysis is called “Domestic and Foreign filings” and gives an indication of all companies, both domestic and foreign, that are filing automotive patents in China in 2010.

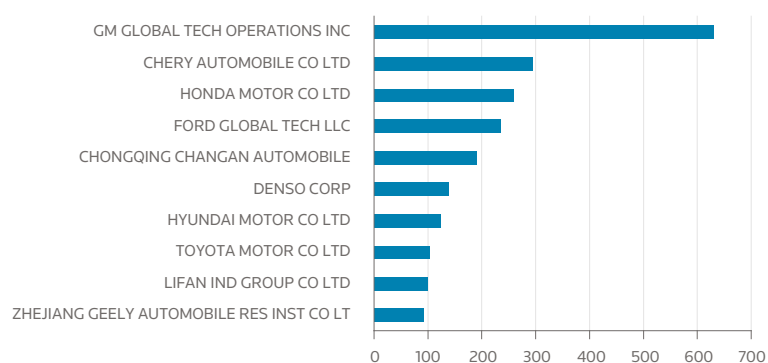
- Those basics with Chinese priority. This analysis is called “Domestic filings” and gives an indication of domestic companies filing automotive patents in China in 2010.

DOMESTIC AND FOREIGN FILINGS

The top 10 companies in China in 2010 based on basic patent publications are given in Figure 8. Of these, four are Chinese, three are Japanese, two are US, and one South Korean. GM Global Tech Operations Inc tops the list with over 600 basics in 2010.

AUTOMOTIVE COMPANIES WITH PATENT APPLICATIONS IN CHINA 2010

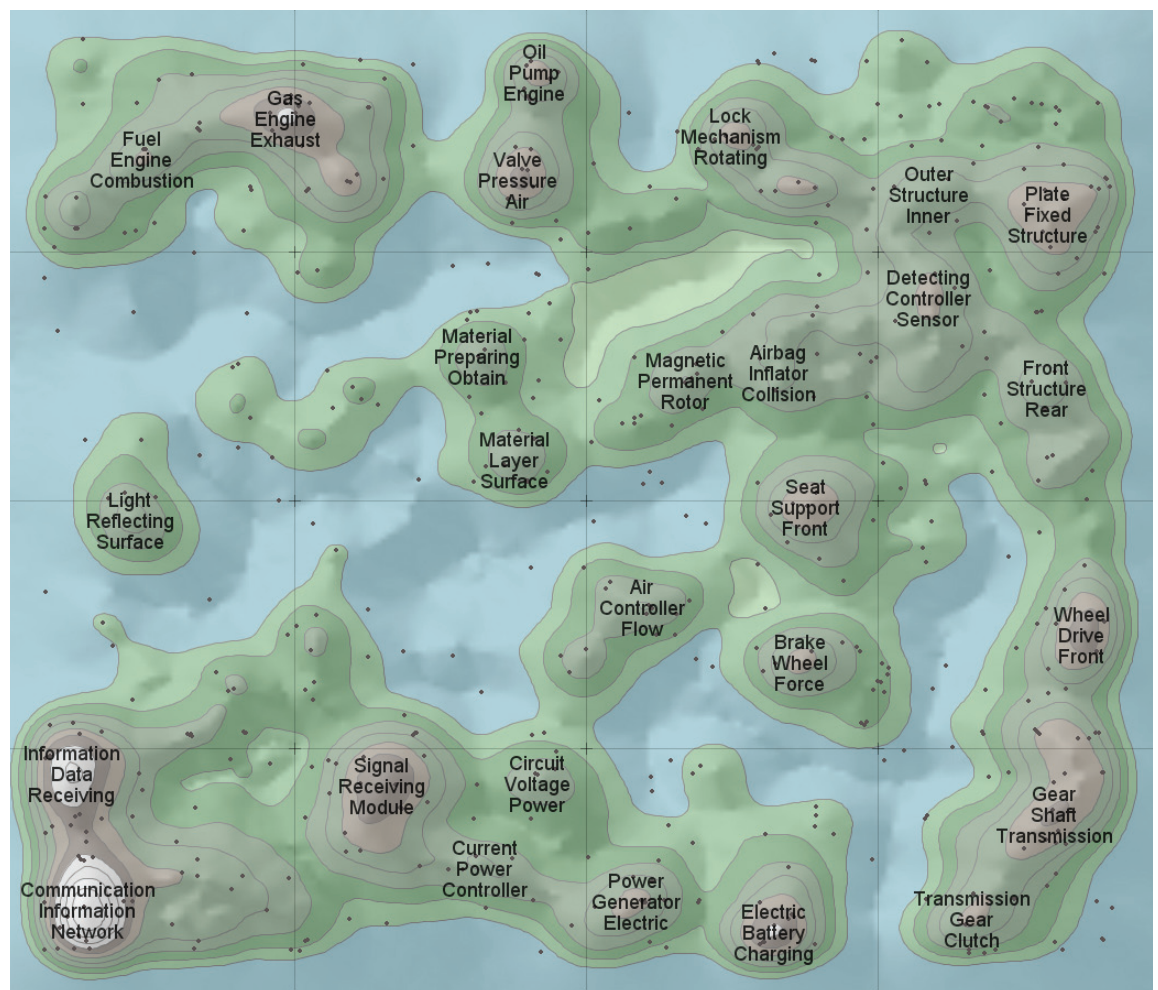
FIGURE 8



The Chinese automotive companies in this list are notable for their rapid rise in prominence. The other companies are long-standing concerns, but the Chinese companies all have their foundations from the late 1990's. Chery Automobile was founded in 1997, ChongQing Changan Automobile has roots back to 1862 but the modern incarnation was formed in 1997, and Lifan Ind Group was founded in 1997 as a motorcycle manufacturer with car production beginning only in 2006. Similarly, Zhejiang Geely Automobile began with motorcycle manufacture in 1994 and started making cars in 2001.

The Chinese automotive landscape based on basics published in 2010 is mapped out in Figure 9.

FIGURE 9



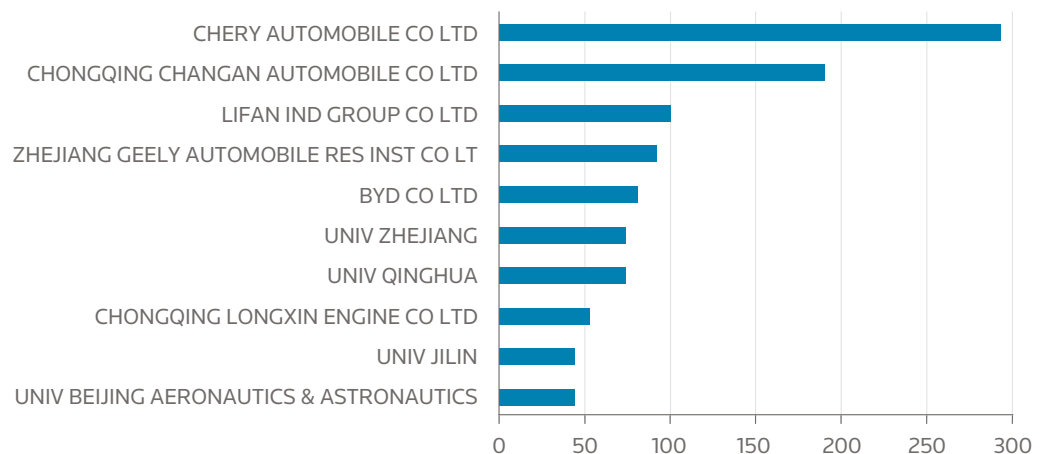
There are significant clusters for fuel, engine combustion and exhaust technology, for transmission and for electric vehicle technology, but the most densely populated areas are around innovation in automotive information and communication technology. On closer inspection, a significant part of patenting in this area is for navigable map technology with real-time updating of traffic information with Chinese company Beijing CenNavi Technologies Co. Ltd. featuring a number of patent applications in this field.

DOMESTIC FILINGS

In terms of analysis of domestic activity (based on basics with Chinese priority published in 2010) the top assignees are given in Figure 10.

AUTOMOTIVE BASICS 2010 WITH CHINESE PRIORITY

FIGURE 10

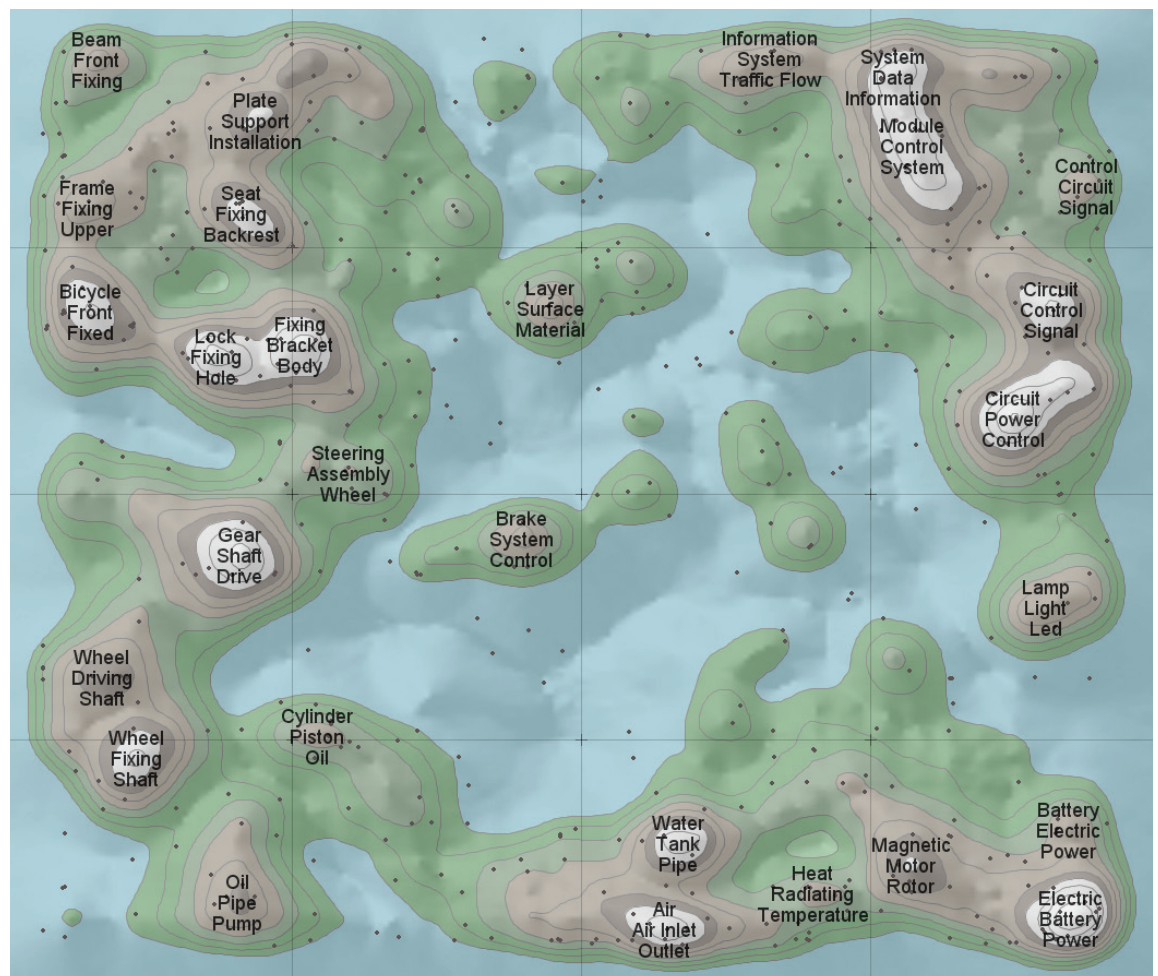


In addition to the prominent Chinese automobile companies described before, a couple of other notable organizations appear here. BYD Co Ltd. is the largest global supplier of rechargeable batteries and has the largest market share for nickel-cadmium batteries. The auto division, BYD Auto, leads the field of electric vehicles with unique technologies.

An academic institution, University of Zhejiang, also puts in an appearance in 6th place. Patent applications from this organization cover a wide and diverse range of innovations across the automotive spectrum from electric vehicle technology and design to inventions relating to air conditioning, clutch, braking, exhaust and flywheel energy storage systems.

Domestic automotive innovation is mapped out in Figure 11.

FIGURE 11

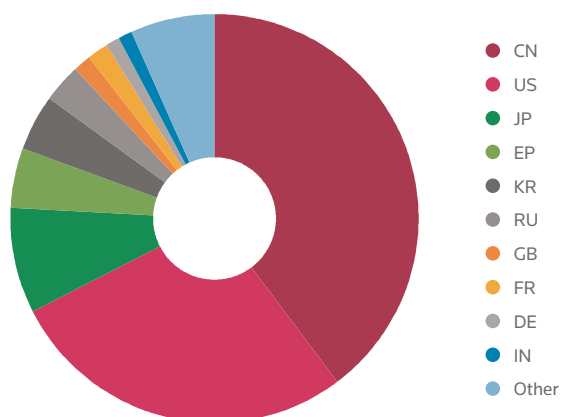


Note the prominent clusters around electric vehicle technology and circuit power control as well as more traditional engineering technology in the area of frames, plates and seat fixings as well as gear and wheel driving shafts.

PHARMACEUTICAL SECTOR

The global distribution of pharmaceutical patent applications in 2010 was analyzed and the results shown in Figure 12.

FIGURE 12



China is responsible for around 40% of all pharmaceutical patent applications published worldwide in 2010. However, a large proportion of these are traditional medicine patent applications.

To determine the relationship between traditional medicine and “Western type” pharmaceutical patenting, patenting trends for Chinese

domestic pharmaceutical inventions were analyzed for 2006-2010 both with and without the traditional medicine inventions. All domestic Chinese patent applications for the period 2006-2010 within the pharmaceutical sector were retrieved using DWPI on Thomson Innovation and the results given in Figure 13.

FIGURE 13

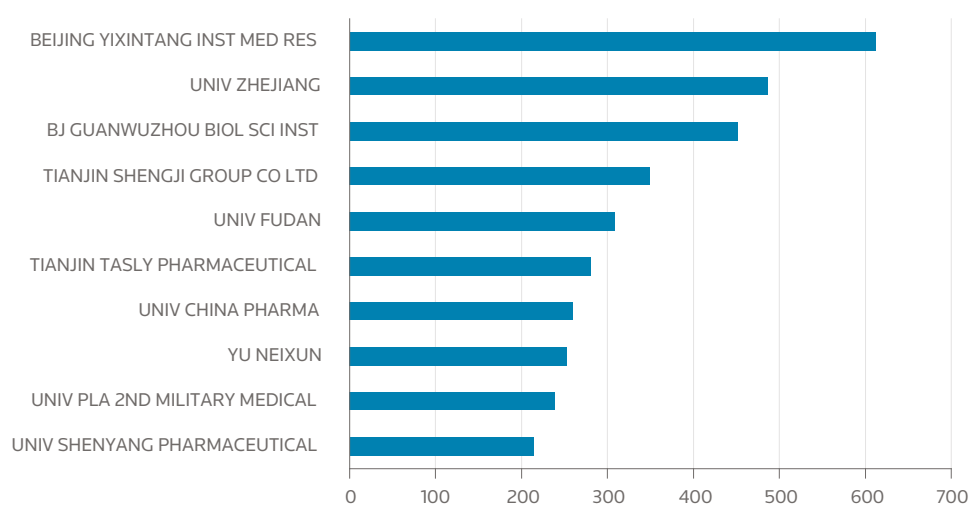
Year	All Pharma	Traditional Medicine	Non-Traditional
2006	10,799	6,967	3,832
2007	12,658	8,513	4,145
2008	12,246	7,820	4,426
2009	12,833	7,798	5,035
2010	14,005	8,111	5,894

China accounts for around 70-75% of all the world's patents in traditional medicine. However, the contribution to "Western type" medicine is increasing at an average annual growth rate of nearly 13% from 14.3% in 2006 to 23.3% in 2010.

Analysis of the top assignees in the pharmaceutical sector is given in Figure 14.

TOP 10 CHINESE ASSIGNEES IN PHARMA 2006-2010

FIGURE 14



It is notable that seven of the top 10 organizations are academic institutions.

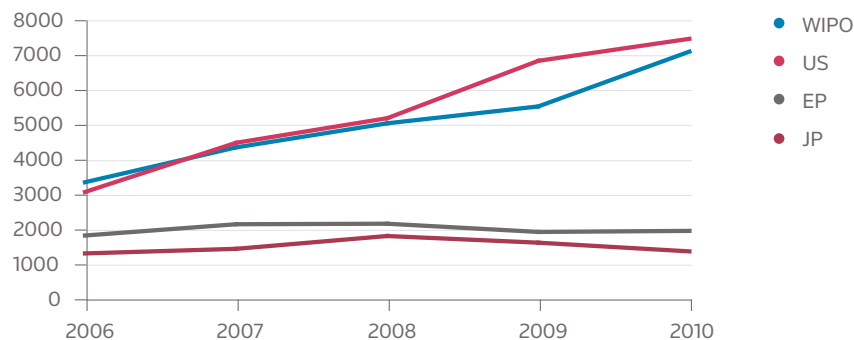
CHINA LOOKING OUTWARDS

CHINA'S INVENTION PATENT APPLICATIONS OVERSEAS

Chinese patent applications abroad are still at low levels, but growing steadily (Figure 15).

CHINESE PATENT APPLICATIONS ABROAD

FIGURE 15



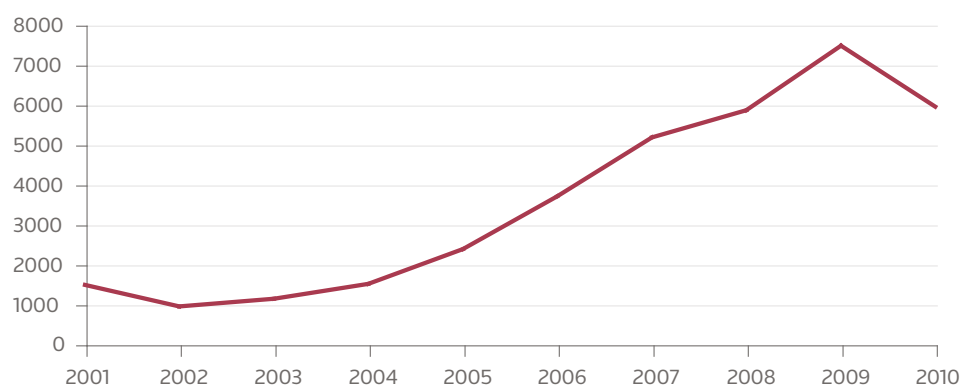
For the first time, a Chinese company (Huawei Technologies) topped the list of applicants to the World Intellectual Property Office (WIPO) in 2008. However, they slipped to second position behind Panasonic in 2009. For 2010, Huawei

was placed in fourth position in 2010 behind Qualcomm (US, 3rd), ZTE Corp (China, 2nd) and Panasonic (Japan, 1st).

Patent Cooperation Treaty (PCT) filings originating from China are growing steadily (Figure 16).

PCT FILINGS FROM CHINA

FIGURE 16



They are experiencing the fastest growth rate of applications from any region in the world according to WIPO official stats from the 2010 report (Figure 17).

PCT APPLICATIONS BY COUNTRY OF ORIGIN

FIGURE 17

Country of Origin	2005	2009	Growth Rate (%): 2005-09
United States of America	46,858	46,079	-0.4
Japan	24,870	29,807	4.6
Germany	15,987	16,732	1.1
Republic of Korea	4,689	8,049	14.5
China	2,512	7,906	33.2

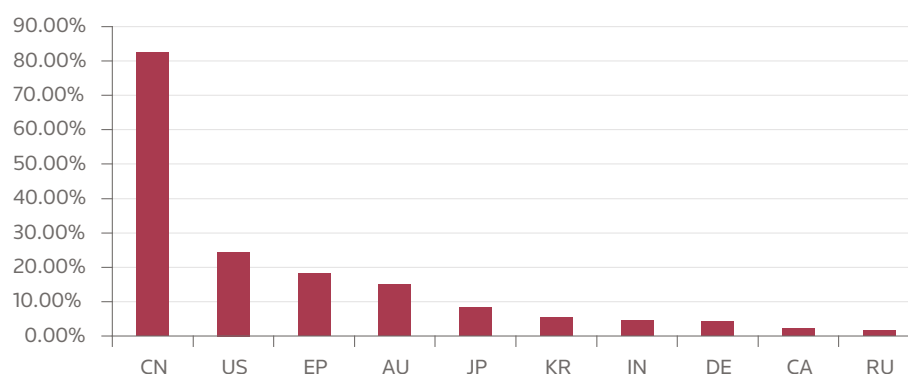
Looking more closely at the patent applications published from WIPO (PCT applications) gives us a view on how Chinese organizations intend to protect their innovation more broadly into international markets.

Where do these Chinese PCT filings end up?

Figure 18 shows that the majority of WIPO filings pass on to the Chinese patent office to be processed as Chinese national patent applications, but significant numbers pass through to the US, European, Australian, Japanese and Korean patent offices to be processed as national patents in these regions also. Therefore we see that China is beginning to look outwards into the broader international arena for protection of its indigenous innovation.

DESTINATION OF CHINESE PCT APPLICATIONS 1994-2010 PASSING INTO NATIONAL PHASE

FIGURE 18



THE DRIVING FORCES BEHIND CHINA'S PATENT BOOM

DEVELOPMENT PLANS AND TARGETS



The 12th Five-Year Plan for National Economic and Social Development was released earlier this year. In this plan, the Chinese government lays out its strategic vision and direction for the development of China over the next five years up to 2016.

A key strategic priority laid out in the plan is for China to transition from "Made in China" to "Designed in China." This is part of a long-term strategy to transform China from a manufacturing to an innovation economy.

To support this goal, there are plans to further develop China's intellectual property rights system and for heavy investment in science and technology education and R&D through development in seven "Strategic Emerging Industries" (SEIs). These are:

- New Energy – Nuclear, hydro, wind and solar power
- Energy conservation and environmental protection – Energy reduction targets
- Biotechnology – Drugs and medical devices
- New materials – Rare earths and high-end semiconductors

- Next-generation IT – Broadband networks, Internet security infrastructure, network convergence, "Internet of things"
- High-end equipment manufacturing – Aerospace and telecomm equipment
- Clean energy vehicles – Battery cell technology; target to produce one million electric vehicles per annum by 2015

There are plans to spend more than RMB four trillion on these industries during the next five years, with a view to increasing the SEI's share of GDP from around 5% today to 8% by 2015.

The drive for domestic innovation continues with the implementation this year of the 12th National Five-Year Plan on Science & Technology Development which also lays out a number of ambitious goals for the further development of China as a technologically advanced nation:

- Increase in R&D expenditure as a proportion of GDP from 1.75% in 2010 to 2.2% in 2015;
- Improvement in ranking of citations in international science papers from 8th to 5th;
- Increase in invention patent ownership per 10,000 head of population from 1.7 to 3.3

Measures to support this growth in indigenous innovation include:

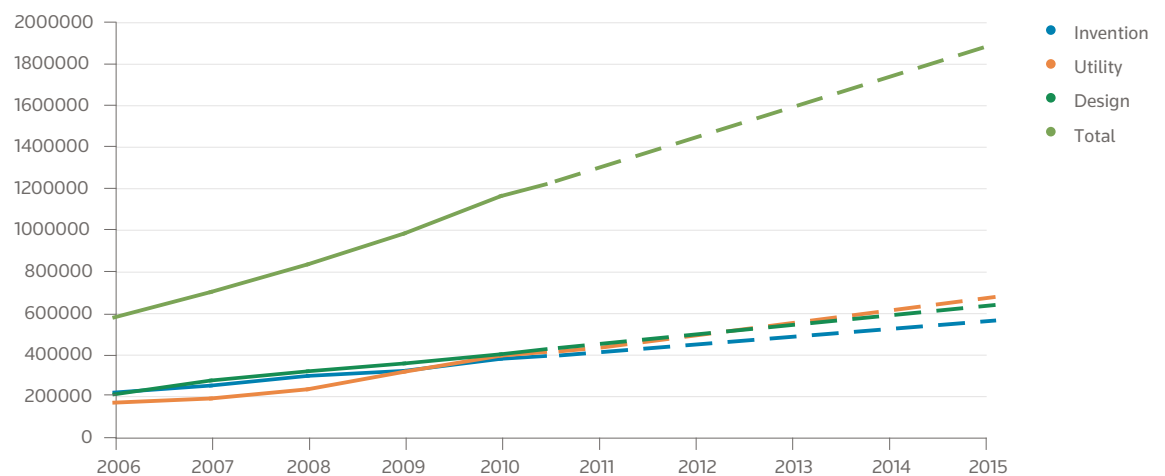
- **Research & development** investment in science and technology aimed at achieving key breakthroughs in targeted technology subsectors, such as core electronic devices, integrated circuits, life sciences, space, marine, earth sciences and nanotechnology
- **Intellectual property** improvements through efforts to strengthen creation, use, protection and management of IP rights

- **Incentives** through fiscal and financial policies that support high-tech industry, including updating management of research funding and systems for venture capital investment

The recently published Chinese National Patent Development Strategy (2011-2020) also sets out some additional specific patent targets including the goal that “by 2015 the annual quantity of applications for patents for inventions, utility models and designs will reach two million.” At current run rates, China is set to reach 1.86 million total publications by 2015, so that seems like a realistic although challenging target (Figure 19).

CHINA INVENTION, UTILITY MODEL AND DESIGN PATENT APPLICATION PROJECTIONS TO 2015

FIGURE 19



Other specific targets for achievement by 2015 are laid out in this patent development strategy:

- Annual invention patents granted to domestic entities shall rank within the top two in the world
- The number of invention patents owned and external patents applied in every million people will be doubled

- The ratio of the patent application by industry enterprises above a designated size is to reach 8%, and the number of patents owned shall be increased considerably
- Driven by national strategic demand, a group of essential technology patents will be pre-deployed in critical areas to support emerging industry development and the industry structure adjustment

CONCLUSIONS

Our original report “Patented in China” published in 2008 projected that China would become the global number one publisher of invention patent applications by 2012. From the revised projections in this report, that milestone was already realized in 2011.

This has occurred not by accident, but very much by design. The continuing series of Chinese five-year plans are focused on driving change in the economy to ensure that prosperity going forward is built increasingly on innovation as well as continuing to generate wealth through being the world’s major goods manufacturer. Increasingly, that innovation is being fueled by homegrown research and development with nearly 73% of published Chinese invention patent applications originating from China in 2010. The latest five-year plan specifically sets a target for 2015 of a combined total of two million invention, utility model and design patents (which

projecting from current figures looks like a challenging although achievable target) and a target to double patent ownership per 10,000 head of population from 1.7 in 2010 to 3.3. in 2015.

The major growth areas over the last five years have been in the areas of electrical machinery apparatus and energy, digital communication and computer technology. We may expect to see continued growth in these areas as well as in the seven strategic emerging industry areas as laid out in the latest five-year plan.

Whatever the future holds, it is clear from the plans and targets laid out in the Chinese five-year plans that innovation in general, and patents in particular, form a central plank of China’s plans for prosperity going forward.



REUTERS/NIR ELIAS

ABOUT THE AUTHOR

Bob Stembridge graduated from the University of Sussex, UK with an Honors degree in Chemistry. He joined Derwent (one of the founding components of the IP Solutions business of Thomson Reuters) in 1980 and has held various roles in editorial, marketing, sales and product development over the years. Leaving in 1988 for interludes working as Senior Information Analyst specializing in patent analytics at British Petroleum and European Sales Liaison with Dialog, he returned to Thomson Reuters in 1996 and most recently became Customer Relations Manager with responsibility for liaising with customer user groups for the organization.

He is a member of the American Chemical Society (ACS), the Chartered Institute of Library Information Professionals (CILIP) and the Patent Information User Group (PIUG), and is Secretary of the Confederacy of European Patent Information User Group (CEPIUG) and current Chair of the Patent and Trademark Group (PATMG). He currently serves on the Chemical Structure Association (CSA) Trust Board of Trustees to which he was elected in February 2007.

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