

## Innovation trends in China

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*2006 marks the first year of the 11<sup>th</sup> Chinese five-year plan. The focus of this plan is to foster independent innovation and build an innovation-oriented country. Intellectual property (IP) rights form a central plank in this transition from a manufacturing to innovation-based economy.*

### Introduction

Tian LiPu, the Chinese Patent Office commissioner recently stated:

*"We are standing in front of the new scratch line full of responsibility. We will devote ourselves to following the route of the new industrialization and building up an innovative country, to fulfilling our nation's revival and to creating a more splendid future of IP course."*

In fact, China is already more than just a manufacturing economy. Recent figures show substantial R&D investment in high technology, electronic and telecoms, medical and pharmaceutical, and aerospace sectors. To what extent is this transition already being driven by research and innovation, both by Chinese nationals and by inward research and innovation from outside? This article examines this question by comparing recent scientific & technical research and patenting activity in China to that of former times.

### Research and innovation trends

By any measure, the rise of innovation in China in recent times is impressive:

- From 1981 to 2005, there has been a 3,500% increase in papers authored by Chinese residents indexed within *Web of Science*<sup>®</sup>.<sup>1</sup>
- There has been a 29% increase from 2004 to 2005 alone, to over 65,000 papers last year.
- Similarly, the number of patents has grown consistently between 15 to 25% in the last five years, with record growth of 36.4% from 2004 to 2005.<sup>2</sup>

This dramatic rise in scientific and technical information output is matched by the growth in R&D spending within China which, at adjusted rates, has grown fivefold from 20 billion yuan to 100 billion yuan over the last 10 years<sup>3</sup>. Although less than other major regions, the R&D spend as a proportion of GDP has grown fastest in China in the last 5 years from 1% to just over 1.4%<sup>4</sup>. Patenting growth rates have also far outstripped other major regions in the same time period<sup>5</sup>.

In terms of the areas where this increased activity is concentrated, the top 5 scientific fields in China with the largest world shares of papers (last 5 years) shows an emphasis on the physical sciences<sup>1</sup>:

Rank	Field	Years	World share	China papers
1	Materials Science	01-05	12.72%	19,684
2	Physics	01-05	10.26%	51,032
3	Chemistry	01-05	9.64%	53,851
4	Mathematics	01-05	9.58%	7,732
5	Engineering	01-05	7.62%	24,463

### Patenting trends

Overall, there has been substantial increase in applications for patent protection of innovation in China over the last five years<sup>2</sup>:

Year	Invention	Utility	Design	Total	% increase
2001	63204	79722	60647	203573	19.3%
2002	80232	93139	79260	252631	24.1%
2003	105318	109115	94054	308347	22.1%
2004	130133	112825	110849	353807	14.7%
2005	141590	n/a	n/a	476264	36.4%

Analysis<sup>6</sup> of Chinese invention patent applications for 2005 from both Chinese national and foreign inventors reveals that the top five sectors of technical innovation (as defined by Derwent class) are (see figure 1 for details):

- Computers
- telephone and data transmission systems
- natural products
- fermentation technology
- computer peripherals:

**Figure 1. Top 5 patented technologies, 2005, all applicants**

RANK No.	Items	Term	Definition
1	18649	T01	Digital Computers
2	12997	W01	Telephone and Data Transmission Systems
3	9146	B04	Natural products and polymers
4	5334	D16	Fermentation industry
5	4838	T04	Computer Peripheral Equipment

Splitting this out to compare applications from Chinese nationals with those from foreign applicants shows distinct differences. In 2005, Chinese inventors filed most applications in natural products closely followed by digital computers, whilst foreign applicants focused on digital computers and telecoms patents:

**Figure 2. Top five patented technologies, 2005 (Chinese applicants)**

RANK No.	Items	Term	Definition
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1	8195	B04	Natural products and polymers
2	6355	T01	Digital Computers
3	4718	W01	Telephone and Data Transmission Systems
4	3497	D16	Fermentation industry
5	2976	D13	Other foods, food treatment including additives

**Figure 3. Top five patented technologies, 2005 (foreign applicants)**

RANK No.	Items	Term	Definition
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1	12985	T01	Digital Computers
2	8655	W01	Telephone and Data Transmission Systems
3	7207	L03	Electro-(in)org.features of conductor,etc
4	6629	W02	Broadcast, Radio&Line Transmission Systems
5	6336	U11	Semiconductors, Materials and Processes

Comparing this to the picture ten years ago in 1995, applications overall for digital computers have risen dramatically by over 3,000%:

**Figure 4. Top 5 patented technologies, 1995 (all applicants)**

RANK No.	Items	Term	Definition
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1	1854	B04	Natural products and polymers
2	1209	D13	Other foods, food treatment incl additives
3	625	D16	Fermentation industry
4	584	T01	Digital Computers
5	520	L02	Refractories, ceramics, cement incl. mfg.

Ten years ago Chinese inventors were filing predominantly in natural products, but also in foods, fermentation and refractories (see figure 5). Applications for Digital computers appear outside the top five list with 269 applications only in 1995:

**Figure 5. Top 5 patented technologies, 1995 (Chinese applicants)**

RANK No.	Items	Term	Definition
1	1700	B04	Natural products and polymers
2	1096	D13	Other foods, food treatment incl additives
3	461	D16	Fermentation industry
4	403	L02	Refractories, ceramics, cement incl. mfg.
5	378	P34	Sterilising - syringes, electrotherapy

Patent applications by foreign inventors in 1995 reflected the manufacturing bias of the Chinese economy and the prevailing consumer technology of the time being focussed on audio/video recording, semiconductor materials and broadcast/radio technology:

**Figure 6. Top 5 patented technologies, 1995 (foreign applicants)**

RANK No.	Items	Term	Definition
1	404	W04	Audio video Recording and Systems
2	399	L03	Electro-(in)org.features of conductor,etc
3	350	W02	Broadcast, Radio&Line Transmission Systems
4	315	T01	Digital Computers
5	312	X25	Industrial Electric Equipment

**Conclusion**

These figures demonstrate the dramatic increase in R&D and patenting activity in China over the course of the last ten years. There is ample evidence to support the idea that R&D acts as a stimulus for economic progress. Thus China should begin to reap the benefits of this investment in innovation through substantially enhanced economic growth in those sectors of heaviest investment.

**References**

1. Thomson Scientific original research from Web of Science
2. [http://www.sipo.gov.cn/sipo\\_English/ndbg/nb/ndbg2004/t20050902\\_53480.htm](http://www.sipo.gov.cn/sipo_English/ndbg/nb/ndbg2004/t20050902_53480.htm) - Patent statistics from Chinese Patent Office 2004 Annual Report available in English at SIPO website; 2005 figure from 2005 Annual Report available only in Chinese on SIPO web-site
3. [http://www.most.gov.cn/eng/statistics/2005/t20060317\\_29724.htm](http://www.most.gov.cn/eng/statistics/2005/t20060317_29724.htm) - Chart showing growth of R&D spending within China 1991-2004
4. AAAS/OECD chart showing R&D spend as a proportion of GDP 1991 – 2004 for China, JP, US, KR, DE and EU (sourced by Thomson Scientific Market Intelligence group)

5. Chart showing China's patent applications from 2000 to 2004 compared with WIPO, EPO, KIPO, USPTO and JPO (provided by Thomson Scientific Market Intelligence group)
6. Thomson Scientific original research from *Derwent World Patents Index*