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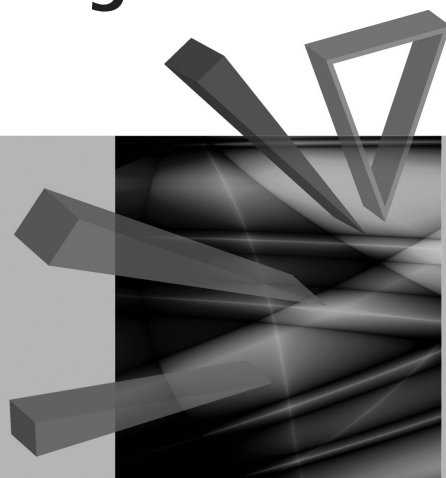
Uniwersytetu Ekonomicznego we Wrocławiu

**RESEARCH PAPERS**

of Wrocław University of Economics

**257**

# **Innovation as a Factor of the Development of the Asia-Pacific Region**



edited by

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Publishing House of Wrocław University of Economics  
Wrocław 2012

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**ISSN 1899-3192**

**ISBN 978-83-7695-214-7**

The original version: printed

Printing: Printing House TOTEM

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## **TRANSFORMATION OF CHINA'S INNOVATION POLICY. SELECTED ISSUES**

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**Summary:** China during last decades has become a global player in terms of research, science and technology development. The paper tries to answer the question of the way China has become one of the most important actors in this field. The paper makes an attempt to analyse the process of creating the Chinese innovation system. The progress of this phenomenon as well as the aim of China's innovation policy and conditions associated with this strategy are analysed. The main determinant of these changes is the eagerness to transform the economy, based on the export of low value added products into a highly innovative economy, which is based on the export of advanced technologies. As a result of this strategy, Chinese enterprises can obtain greater benefits from the process of international capital transfers and they may enter more and more widely into global markets.

**Keywords:** innovation policy, science and technology, research and innovation, China.

### **1. Introduction**

Innovations are one of the main factors that enhance the international competitiveness of enterprises. Currently the pace and scope of the creation and implementation of innovation determines the supremacy and competitive advantages of a single enterprise as well as whole economies. They determine not only the speed and directions of economic growth and development, but also, to a considerable extent, they appoint the form, structure and configurations of international business cooperation.

The overarching goal of the paper is to present the process of the transformation of the Chinese innovation system. The objective is to portray reasons why China has become one of the most important players in this field. The paper is to present a supporting and leading role of creating – in an administrative way – the innovation policy in the process of transforming Chinese economy by 2020 and over a longer period of time. The analysis indicates that the best method to accelerate economic changes to achieve the most favourable economic transformation in China is to create bases that would influence building up its own endogenous innovations.

## 2. National R&D strategies

“This is our generation’s Sputnik moment”, said Barack Obama to relate to an increased competition of China and other Asian nations in the fields of science and technology. He refers it to “space race” to shoot the first Soviet satellite. The global race is heating up, with aggressive spending on science and technology, creating “the next generation of miracle drugs, the technology that will put electric cars in every garage and ultra-fast computers to tackle complex problems such as climate change”.<sup>1</sup>

Not only the US, but almost every country perceives knowledge as one of the most important factors of production alongside labour and capital resources. Innovation as well as science and technology have become more important than ever.<sup>2</sup> Most countries want first to transform themselves into innovation nations by setting “aggressive national science and technology agendas, establishing world-class research centers and nurturing local entrepreneurs”.<sup>3</sup> Education systems and graduates in science and engineering, doctoral candidates and a number of professional researchers have received a priority for the process of building workforce. It is noticed that “productivity is an important long-term driver of growth, and because it influences innovation, expenditures on R&D is one of its main determinants in advanced economies. Lifting R&D spending can improve the absorptive capacity for adopting new technologies”.<sup>4</sup>

According to the research analysis, one can distinguish five distinctive national science and technology strategies: “stay ahead”, “get ahead”, “exploit existing R&D strengths”, “alleviate points of national pain” or “maintain the current level of prosperity” (see Figure 1).<sup>5</sup>

Stay ahead	Get ahead	Exploit existing strengths	Address points of pain	Maintain level of prosperity
<ul style="list-style-type: none"> <li>• United States</li> <li>• United Kingdom</li> </ul>	<ul style="list-style-type: none"> <li>• China</li> <li>• South Korea</li> </ul>	<ul style="list-style-type: none"> <li>• Israel</li> <li>• Netherlands</li> </ul>	<ul style="list-style-type: none"> <li>• India</li> <li>• Africa</li> </ul>	<ul style="list-style-type: none"> <li>• Germany</li> <li>• Finland</li> </ul>

**Figure 1.** National R&D strategies at a glance

Source: *The Race for Global Leadership in Innovation. An Analysis of National R&D Strategies*, Toronto Region Research Alliance, Toronto 2011, p. 4.

<sup>1</sup> Global race for innovative technology is heating up, *The Denver Post*, <http://www.denverpost.com> (accessed: 27.04.2012).

<sup>2</sup> *The Race for Global Leadership in Innovation. An Analysis of National R&D Strategies*, Toronto Region Research Alliance, Toronto 2011, p. 3.

<sup>3</sup> *Ibidem*.

<sup>4</sup> S. Dougherty, China and India: Making sense of innovation and growth, *OECD Observer*, No. 264/265, December 2007–January 2008, [http://www.oecdobserver.org/news/fullstory.php/aid/2423/China\\_and\\_India:\\_Making\\_sense\\_of\\_innovation\\_and\\_growth.html](http://www.oecdobserver.org/news/fullstory.php/aid/2423/China_and_India:_Making_sense_of_innovation_and_growth.html) (accessed: 27.04.2012).

<sup>5</sup> *The Race for...*, *op. cit.*, p. 2.

For developed countries the main strategy is to stay ahead and maintain top positions in science and technology. For nations in the emerging world (i.e., Asian's countries), what is very important is to catch up with innovation leaders in the future. Aggressive strategies taken by such countries, especially by China, have pressed the world leaders to continue spending on science.

The strategy of exploiting country's existing strengths relies on identified industrial advantages of a country and an attempt to make these industries and related research more innovative and more competitive. On the other hand, some countries are moving ahead with science and technology because socioeconomic problems need to be solved. In turn, some countries emphasise the use of science and technology in maintaining the state of wealth. Innovation is viewed as a key contributor to increasing productivity and economic growth.

### 3. World's R&D overview towards China

The US, the European Union and Asia are still remaining the strongest regions in terms of R&D (92% of all global spending). In fact, most of the global funding comes from Asian economies. What is interesting is that, in comparison with other countries, China became the world's second largest R&D investor in 2011. This tendency is presented in Table 1.

Although China is still ranked relatively low in global competitiveness reports<sup>6</sup> and its percentage of high-value global patents and scientific publications is not enough, this country has become a significant player at the global level. Chinese share of R&D spending in global R&D spending increased from 12% in 2010 to 13.1% in 2011, while the US share has decreased from 31.8% to 31%. At the same time, the share of Chinese spending in 2011 exceeded the Japanese ones. While China's economy has steadily grown by 9% to 10% over the past several years, its R&D investments have increased annually by about 12% – by about seven times comparing to the annual percent of the increase in the US.<sup>7</sup>

According to “2012 Global R&D Funding Forecast”, global research spending will grow in 2012 to 1.4 trillion dollars (increase about 5.2%). According to this report, it is slightly less than 6.5% in 2011. China's spending on R&D in the period between 1995 and 2011 increased from about 0.6% of GDP to about 1.6%. The forecast is that driven by China GDP growth, the rate of spending will remain strong in 2012.<sup>8</sup>

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<sup>6</sup> For more see: *The Global Competitiveness Report 2010–2011*, World Economic Forum, Geneva 2010.

<sup>7</sup> 2012 Global R&D funding forecast, *Battelle and R&D Magazine* 2011, December, p. 28.

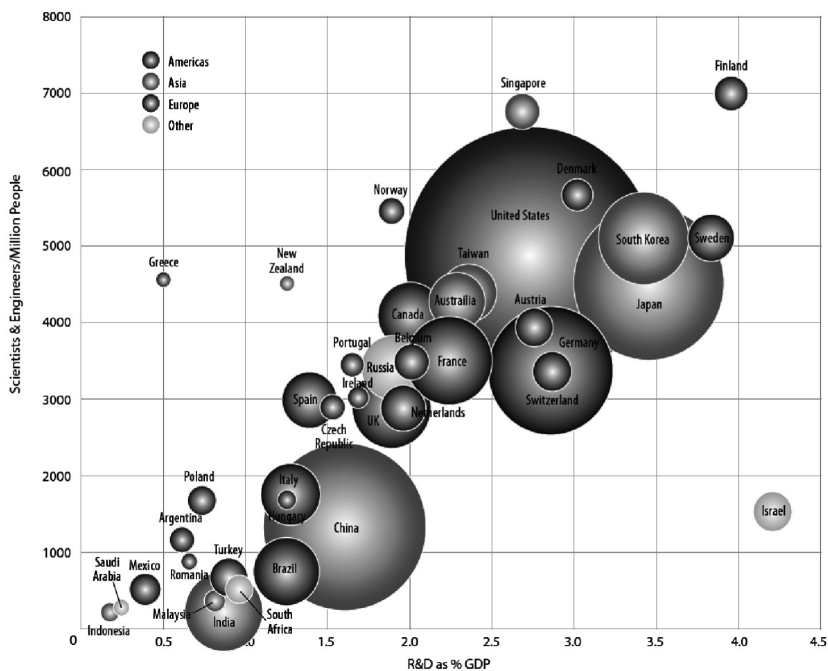
<sup>8</sup> *Ibidem*, pp. 3–28.

**Table 1.** Global R&D spending, R&D spending as a percent of GDP and share of total global R&D spending

	2010 GERD PPP Billion USD	2010 R&D as % of GDP	2010 Share of Total Global R&D Spending (%)	2011 GERD PPP Billion USD	2011 R&D as % of GDP	2011 Share of Total Global R&D Spending (%)	2012* GERD PPP Billion USD	2012* R&D as % of GDP	2012* Share of Total Global R&D Spending (%)
Americas	473.7	2.3	37.8	491.8	2.3	36.9	505.6	2.3	36.0
U.S.	415.1	2.8	31.8	427.2	2.8	31.0	436.0	2.8	31.1
Asia	429.9	1.8	34.3	473.5	1.9	35	514.4	1.9	36.7
Japan	148.3	3.4	11.8	152.1	3.5	11.4	157.6	3.5	11.2
China	149.3	1.5	12.0	174.9	1.6	13.1	198.9	1.6	14.2
India	32.5	0.8	2.6	38.0	0.8	2.8	41.3	0.8	2.9
Europe	310.5	1.9	24.8	326.7	1.9	24.5	338.1	2.0	24.1
Rest of the world	37.8	1.0	3.0	41.4	1.1	3.1	44.5	1.1	3.2
Total	1251.9	2.0	–	1333.4	2.0	–	1402.6	2.0	–

GERD – Gross Expenditures on R&D; PPP – Purchasing Power Parity; \* – Forecast.

Source: 2012 Global R&D funding forecast, *Battelle and R&D Magazine* 2011, December, p. 3.



**Figure 2.** Annual R&D as a percent of GDP and scientists and engineers per million people in 2011

Source: 2012 Global R&D funding forecast, *Battelle and R&D Magazine* 2011, December, p. 4.



Furthermore, a two-digit growth of China in R&D spending by about 2023 will match and surpass the US one. This forecast is based on the assumption that the Chinese R&D growth will still average at the level of 11.5% per year and the US R&D growth average – about 4.0% per year to 2023.<sup>9</sup> R&D spending as well as scientists and engineers per million people indicate Chinese transformation on a scale never seen before (see Figure 2).

#### 4. National Plan for Science and Technology Development

Asian countries, particularly China, are countries that export large quantities of low-value added products. In addition, China is seen as the workshop of the world. This points to a lot of drivers for China's innovations policy and creates a knowledge-driven economy (see Table 2). But now these features are changing. According to the report "The Race for Global Leadership in Innovation", the key driver of China's national innovation policy is rising energy demand and the external pressure to curb consumption.<sup>10</sup>

**Table 2.** Overview of the key drivers for China's innovation

Key drivers for innovation	Key science and technology areas
Targeting global S&T leadership position	Advanced manufacturing and materials
Developing indigenous innovation to limit reliance on imported technologies	Agriculture
Meeting domestic energy demand	Biotechnology
Increased prosperity for citizens	Clean energy technologies
Urbanisation	ICT
Population and health	Mineral resources
National defence and public security	Transportation
	Water Technologies

Source: *The Race for Global Leadership in Innovation. An Analysis of National R&D Strategies*, Toronto Region Research Alliance, Toronto 2011, p. 28.

Even though China has maintained a very rapid economic growth and development over several decades and was not funding innovation enough, now it needs to meet a challenge of ensuring further progress – in economic, social and environmental terms.<sup>11</sup> Similarly, like other modern and developed economies that increasingly appreciate innovation and intellectual capital to drive economic development and growth, China shares the same point of view.<sup>12</sup> Science and technology should play the "supporting and the leading" role in socio-economic

<sup>9</sup> *Ibidem*, p. 29.

<sup>10</sup> *The Race for...*, *op. cit.*, p. 12.

<sup>11</sup> *OECD Reviews of Innovation Policy China Synthesis Report*, OECD 2007, p. 9.

<sup>12</sup> *The Race for...*, *op. cit.*, p. 3.

development of China, and scientific development and innovation could solve a series of prominent problems occurring in China's development.<sup>13</sup>

The answer to China's challenges is innovation policy presented in "Medium- and Long-Term National Plan for Science and Technology Development (2006–2020)" (MLP), issued by the State Council in 2006.<sup>14</sup> MLP's objectives are to: "enhance indigenous innovation capability and science and technology (S&T) level in promoting economic and social development and in maintaining national security, in an effort to provide powerful support for the building of a well-to-do society; noticeably improve comprehensive strength in basic research and frontier technology development; and attain a series of high world impact S&T achievements and to join the ranks of innovative countries, thus paving the way for becoming a world S&T power by mid 21st century. By 2020, the nation's gross expenditures on R&D (GERD) are expected to rise to 2.5 percent or above of the gross domestic product (GDP) with the rate of S&T contribution to the economy reaching 60 percent or above, and dependence on imported technology reduced to 30 percent or below, and the annual invention patents granted to Chinese nationals and the international citations of scientific papers moving into the top five countries".<sup>15</sup>

The above described policy initiatives and objectives show Chinese government's determination to increase investment in science and technology, to strengthen innovative capacity, transform an export-oriented economy and built an efficient national innovation system.<sup>16</sup>

Although each modern innovations policy is implement through an active engagement of government actions,<sup>17</sup> D. Ernst claims that at present China's innovation system relies much more on the government's decisions to define strategic objectives and key parameters in comparison to the American way, where market forces and the private sector should play a primary role in innovation.<sup>18</sup>

Ernst notes, at the same time, that certainly this kind of policy is efficient in quantitative sense. In 2009 almost 90% of 976 686 patents were created in state-owned enterprises. Many of them were low-value. D. Ernst argues that China's implementation way of innovation policy is a consequence of the planned economy. Hence, he draws a conclusion that the Chinese innovations model creates incentives

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<sup>13</sup> Premier Wen Highlights Science Role as Pillar of Socio-economic Development, Premier Wen Jiabao delivers a speech at the 7th national conference of China's Association for Science and Technology in Beijing, 23 May 2006, Chinese Government's Official Web Portal, www.gov.cn, 24 May 2006 (accessed: 27.04.2012).

<sup>14</sup> *Medium- and Long-Term National Plan for Science and Technology Development*, State Council of China, February 2006.

<sup>15</sup> *Ibidem*, p. 11.

<sup>16</sup> *OECD Reviews...*, *op. cit.*, pp. 16–17.

<sup>17</sup> More detail: *Ibidem*, pp. 16–17.

<sup>18</sup> D. Ernst, China's innovation policy is a wake-up call for America, *Asia Pacific Issues, Analysis from the East-West Center* 2011, No. 100, May, p. 3.

to many low quality patents. To show that almost three-quarters of patents are utility model patents (protect the way an article is used and works) and industrial design patents (protect the way an article looks like). Simultaneously, he emphasises that this kind of innovation (particularly utility patents) play an important role on the early stage of catch-up processes because it simplifies the creation of low-budgets innovations (for example, no-name, unlicensed mobile phones that have a 40% share in the market). The same process can be observed in Germany, Japan, the Republic of Korea or Taiwan. Simultaneously, the cited author pays attention to create administrative innovation policy in the context of the global financial crisis. He also calls attention to the problem of China's being suspect for a theft of technology on a scale never seen before, which is a subject of matter of many litigations.<sup>19</sup>

According to the OECD, given the government's commitment to its strategic orientation and the dynamism of China's economic development, it is very probable that China will make headway in developing its own innovative capabilities.<sup>20</sup> China has the potential to become a major innovation player in the near future. This should bring benefits for both China and the rest of the world as a stronger innovation in China will contribute to the global knowledge economy and address global challenges. But there still remain a lot of matters, notably issues such as intellectual property rights, technology transfer and technology standards, which could be solved through dialogue and co-operation.<sup>21</sup>

However, in spite of the impressive speed of upgrading Chinese innovation capacity, there is still an innovation gap between China and the U.S., the European Union and Japan, which is a challenge that China will face in the future.<sup>22</sup>

## 5. Conclusion

China's primary aim is to develop economy in a way so as to catch up with the level of development (productivity and income) of three other biggest players: the United States, the European Union and Japan. The overarching goal of China's policy is to develop capabilities for indigenous innovations, decrease technology dependence to 30% and become the world's global leader in science and technology power by the mid-21st century. This way China wants to become a knowledge-driven, leading innovation economy with innovation-oriented society. The aim of China is to rapidly achieve a balance by means of internal economic growth.

What is interesting is that, due to the implementation of this strategy, China becomes a serious competitor in the field of science and technology. China tries

<sup>19</sup> *Ibidem*, pp. 3–8.

<sup>20</sup> *OECD Reviews...*, *op. cit.*, pp. 16–17.

<sup>21</sup> *China is Now a Global R&D player, but Needs Further Reform to Foster Domestic Innovation*, Says OECD, OECD, 12 September 2008; [http://www.oecd.org/document/47/0,3746,en\\_2649\\_34273\\_41306607\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/47/0,3746,en_2649_34273_41306607_1_1_1_1,00.html) (accessed: 27.04.2012).

<sup>22</sup> D. Ernst, *op. cit.*, p. 8.

to promote innovation policy to increase international competitiveness and become a source of sustainable economic growth. What is important to emphasise is that this kind of policy is going to result in a long period of time.

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## PRZEOBRAŻENIA POLITYKI INNOWACYJNEJ CHIN. WYBRANE ZAGADNIENIA

**Streszczenie:** Chiny w ostatnich latach stały się liczącym graczem w obszarze badań naukowych i rozwoju nowych technologii, pretendując do miana globalnego lidera. W artykule podjęto próbę odpowiedzi na pytanie dotyczące sposobu, w jaki Chiny starają się tego dokonać. Analizie poddany jest proces tworzenia systemu innowacji. Analizowane są zmiany tego procesu, jak również cele polityki innowacyjnej wraz z uwarunkowaniami realizowanej strategii. Główną determinantą tych zmian są dążenia do transformacji gospodarki, bazującej na eksporcie produktów o niskiej wartości dodanej, w gospodarkę innowacyjną opartą na eksporcie zaawansowanych technologii. Skutkiem tych dostosowań mają być korzyści dla chińskich przedsiębiorstw, wynikające z uczestnictwa w międzynarodowym transferze technologii oraz szerszy ich dostęp do rynków globalnych.

**Słowa kluczowe:** polityka innowacyjna, działalność badawczo-rozwojowa i innowacyjna, Chiny.