

Internationalisation of Research and Development (R&D centres) in Emerging Economies

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Key Global Issues of Importance Impacting Future R&D Efforts

U.S.

Healthcare for the Aging

Demand for Renewable/Sustainable Energy

Global Population Growth

Growth in Consumerism in Emerging Markets

Threat of Global Pandemics

Non-U.S.

Demand for Renewable/Sustainable Energy

Global Population Growth

Climate Change/Global Warming

Healthcare for the Aging

Environmental Clean-up/Remediation

HEALTHCARE R&D EXPENDITURE - ANNUAL



US\$ 7 billion +



US\$ 5 billion +



US\$ 4.5 billion +



US\$ 4 billion +

R&D PAYS BACK – Annual Sales of a product



Sanofi
US\$ 9 bn +



Astra Zeneca
US\$ 8 bn +



GSK
US\$ 7 bn +

Products of the future

Anticipated Sales 2014



Roche
US\$ 8 bn +



Abbott
US\$ 8 bn +



Pfizer
US\$ 8 bn +



THE LIPITOR EXAMPLE

Pfizer purchased Warner Lambert for
US\$ 90.27 billion



Annual Sales of LIPITOR
US\$ 13 billion +
= $\frac{1}{2}$ GDP of Paraguay
= $\frac{1}{6}$ GDP of Ecuador
= $\frac{1}{6}$ GDP of Cuba
Losing patent in November 2011

Why the emerging economies ?

“Eighty-five percent of the world's population lives in the emerging markets, and during the past 5 years, all real economic growth has come from these markets,”

(Patrick Keohane, Vice President (VP) for R&D Asia Pacific at AstraZeneca)

GE Healthcare



has had significant medical device R&D operations in **China** for some time, announced in October 2008 that it was increasing its R&D for products geared to the rural Chinese market. Specifically, the company expanded the R&D capabilities of its branch in Wuxi, China, with the goal of putting out five new medical devices for the rural Chinese market.



The John F. Welch Center in Bangalore has already filed in excess of 185 patents emanating from this center and 12 have already been granted.



has 4 research centers in Brazil. The fifth research center to be set up in Rio will cost US\$ 150 million and will house over 300 engineers.



opened a Global Technology Center in Gurgaon, **India** (near New Delhi) in March 2007 to research and develop products in all of its business lines, including joint, spine, neurology, endoscopy and imaging.



- Caterpillar's today has 16 manufacturing facilities, 4 R&D centers and 3 logistics and parts centers in **China**.



Qiagen, the Netherlands-based in-vitro diagnostic firm, has formed a joint venture with Bio*One, a biotech investment company affiliated with the **Singapore** government. The joint venture's purpose is developing new molecular assays.



EMC Corporation to invest an additional \$100 million over the next five years in **Brazil** to strengthen its research and development (R&D) by establishing a new R&D center in Rio de Janeiro primarily focused on the acquisition, analysis, collaboration and visualization of seismic data generated by the oil and gas industry. EMC's initial plan for the facility is to house an applied research center, solutions laboratories and an executive briefing center.

Global R&D Spending Forecast

	2009 GERD PPP Billions, U.S.\$	2009 R&D as % of GDP	2010 GERD PPP Billions, U.S.\$	2010 R&D as % of GDP	2011 GERD PPP Billions, U.S.\$	2011 R&D as % of GDP
Americas	433.2	2.2%	446.7	2.2%	458.0	2.2%
<i>U.S.</i>	<i>383.6</i>	<i>2.7%</i>	<i>395.8</i>	<i>2.7%</i>	<i>405.3</i>	<i>2.7%</i>
Asia	372.5	1.9%	400.4	1.9%	421.1	1.8%
<i>Japan</i>	<i>139.6</i>	<i>3.4%</i>	<i>142.0</i>	<i>3.3%</i>	<i>144.1</i>	<i>3.3%</i>
<i>China</i>	<i>123.7</i>	<i>1.4%</i>	<i>141.4</i>	<i>1.4%</i>	<i>153.7</i>	<i>1.4%</i>
<i>India</i>	<i>28.1</i>	<i>0.8%</i>	<i>33.3</i>	<i>0.9%</i>	<i>36.1</i>	<i>0.9%</i>
Europe	267.0	1.7%	268.6	1.6%	276.6	1.7%
Rest of World	34.2	1.2%	34.8	1.2%	36.3	1.2%
Total	1,107.0	1.9%	1,150.6	1.9%	1,192.0	1.9%

PPP, Purchasing Power Parity

Source: Battelle, *R&D Magazine*

Share of Total Global R&D Spending

	2009	2010	2011
Americas	39.1%	38.8%	38.4%
<i>U.S.</i>	<i>34.7%</i>	<i>34.4%</i>	<i>34.0%</i>
Asia	33.6%	34.8%	35.3%
<i>Japan</i>	<i>12.6%</i>	<i>12.3%</i>	<i>12.1%</i>
<i>China</i>	<i>11.2%</i>	<i>12.3%</i>	<i>12.9%</i>
<i>India</i>	<i>2.5%</i>	<i>2.9%</i>	<i>3.0%</i>
Europe	24.1%	23.3%	23.2%
Rest of World	3.1%	3.0%	3.0%

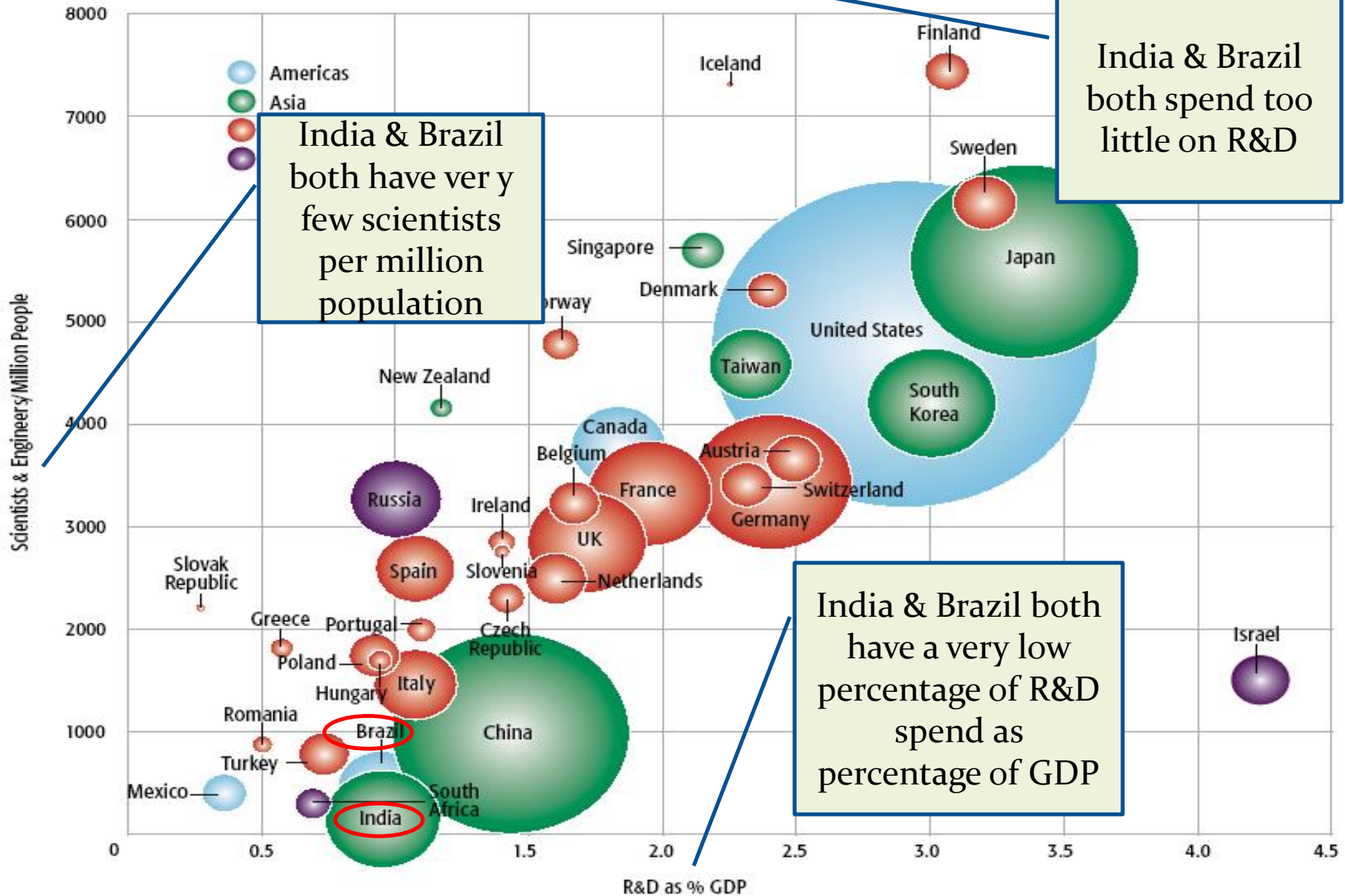
Forecast Gross Domestic Expenditures on R&D (GERD)

Billions of U.S. Dollars

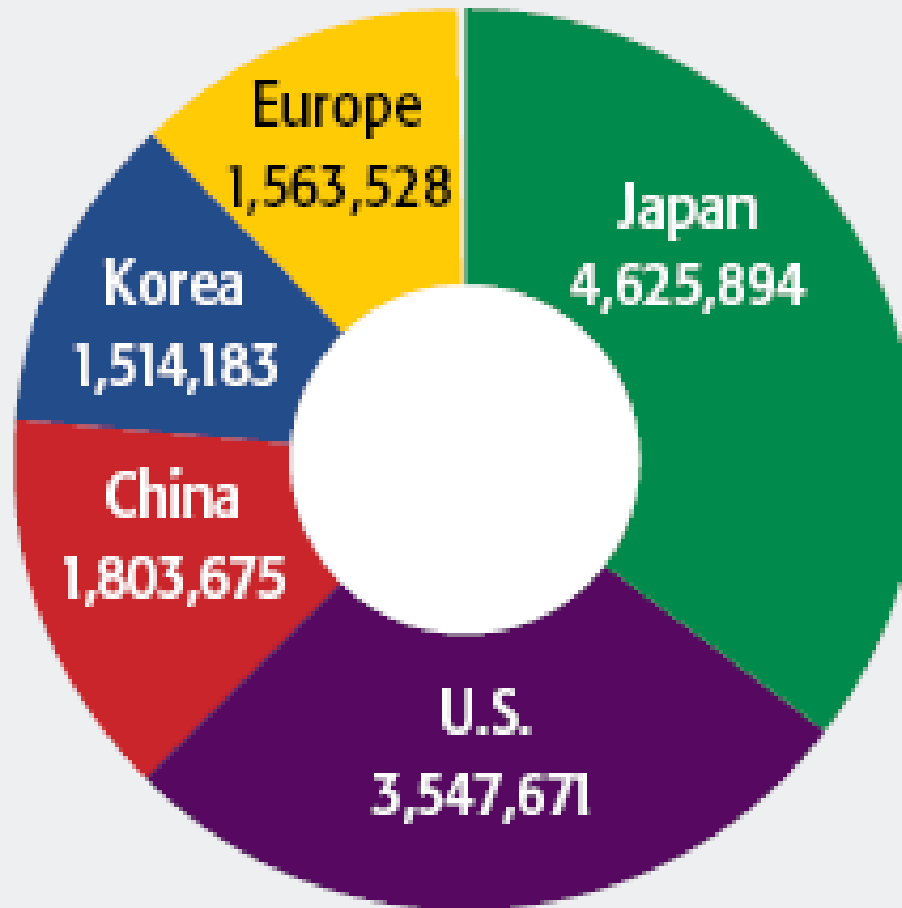
Global Rank	Country	2009 GERD PPP Billions, US\$	2009 R&D as % of GDP	2010 GERD PPP Billions, US\$	2010 R&D as % of GDP	2010-11 GDP Growth	2011 GDP PPP Billions, US\$	2011 GERD PPP Billions, US\$	2011 R&D as % of GDP
1	United States	383.6	2.7%	395.8	2.8%	2.3%	14,963	405.3	2.7%
2	China	123.7	1.4%	141.4	1.4%	9.0%	10,747	153.7	1.4%
3	Japan	139.6	3.4%	142.0	3.3%	1.5%	4,339	144.1	3.3%
4	Germany	68.0	2.4%	68.2	2.4%	2.0%	2,957	69.5	2.3%
5	South Korea	41.4	3.0%	42.9	3.0%	4.5%	1,512	44.8	3.0%
6	France	41.1	2.0%	41.5	1.9%	1.6%	2,176	42.2	1.9%
7	United Kingdom	37.2	1.7%	37.6	1.7%	2.0%	2,218	38.4	1.7%
8	India	28.1	0.8%	33.3	0.9%	8.4%	4,193	36.1	0.9%
9	Canada	23.2	1.8%	23.7	1.8%	2.7%	1,357	24.3	1.8%
10	Russia	21.8	1.0%	22.1	1.0%	4.3%	2,288	23.1	1.0%
11	Brazil	18.0	0.9%	18.6	0.9%	4.1%	2,253	19.4	0.9%
12	Italy	18.7	1.1%	18.7	1.1%	1.0%	1,775	19.0	1.1%
13	Taiwan	17.6	2.4%	18.2	2.3%	4.4%	839	19.0	2.3%
14	Spain	17.3	1.3%	17.2	1.3%	0.7%	1,366	17.2	1.3%
15	Australia	15.0	1.8%	15.3	1.8%	3.5%	907	15.9	1.7%
16	Sweden	11.5	3.4%	11.6	3.3%	2.6%	366	11.9	3.3%
17	Netherlands	10.5	1.6%	10.6	1.6%	1.7%	681	10.8	1.6%
18	Israel	8.8	4.3%	9.1	4.2%	3.8%	223	9.4	4.2%
19	Austria	8.2	2.5%	8.2	2.5%	1.6%	339	8.3	2.5%
20	Switzerland	7.3	2.3%	7.4	2.3%	1.7%	327	7.5	2.3%

World of R&D 2010

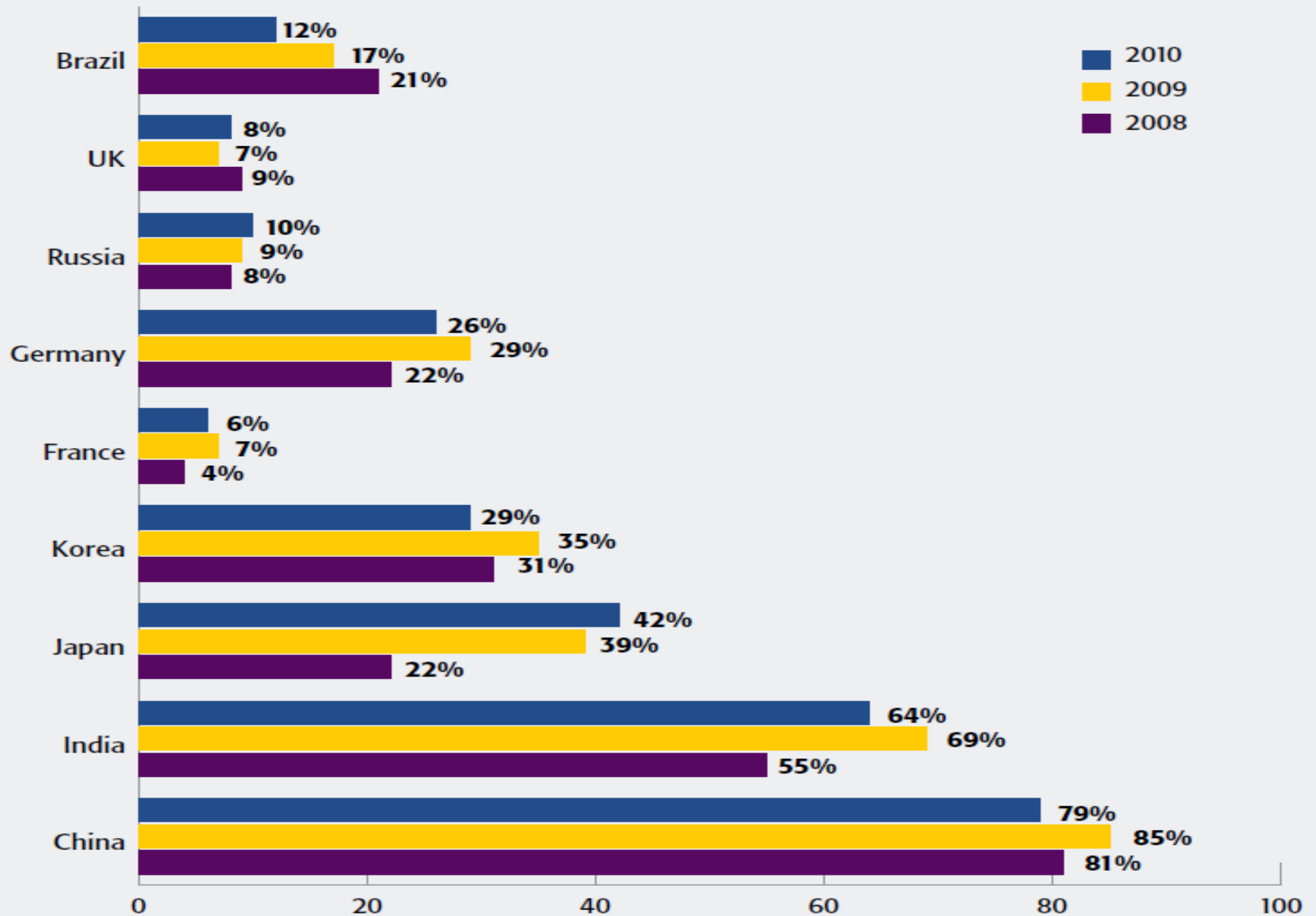
Size of circle reflects the relative amount of annual R&D spending by the country noted.



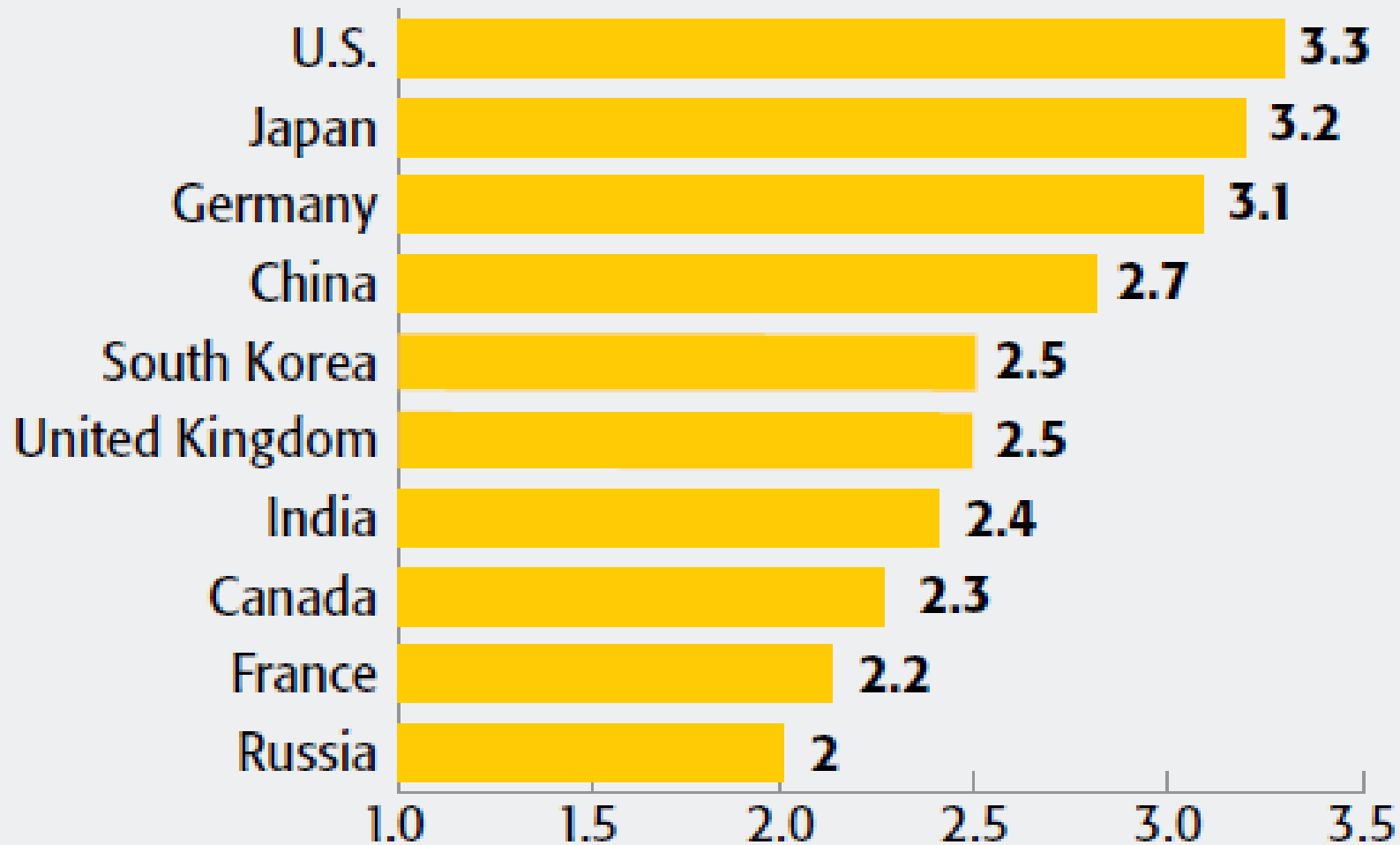
Total Patent Volume, 2003 to 2009



Which Countries Will Make the Largest Tech Gains by 2015?

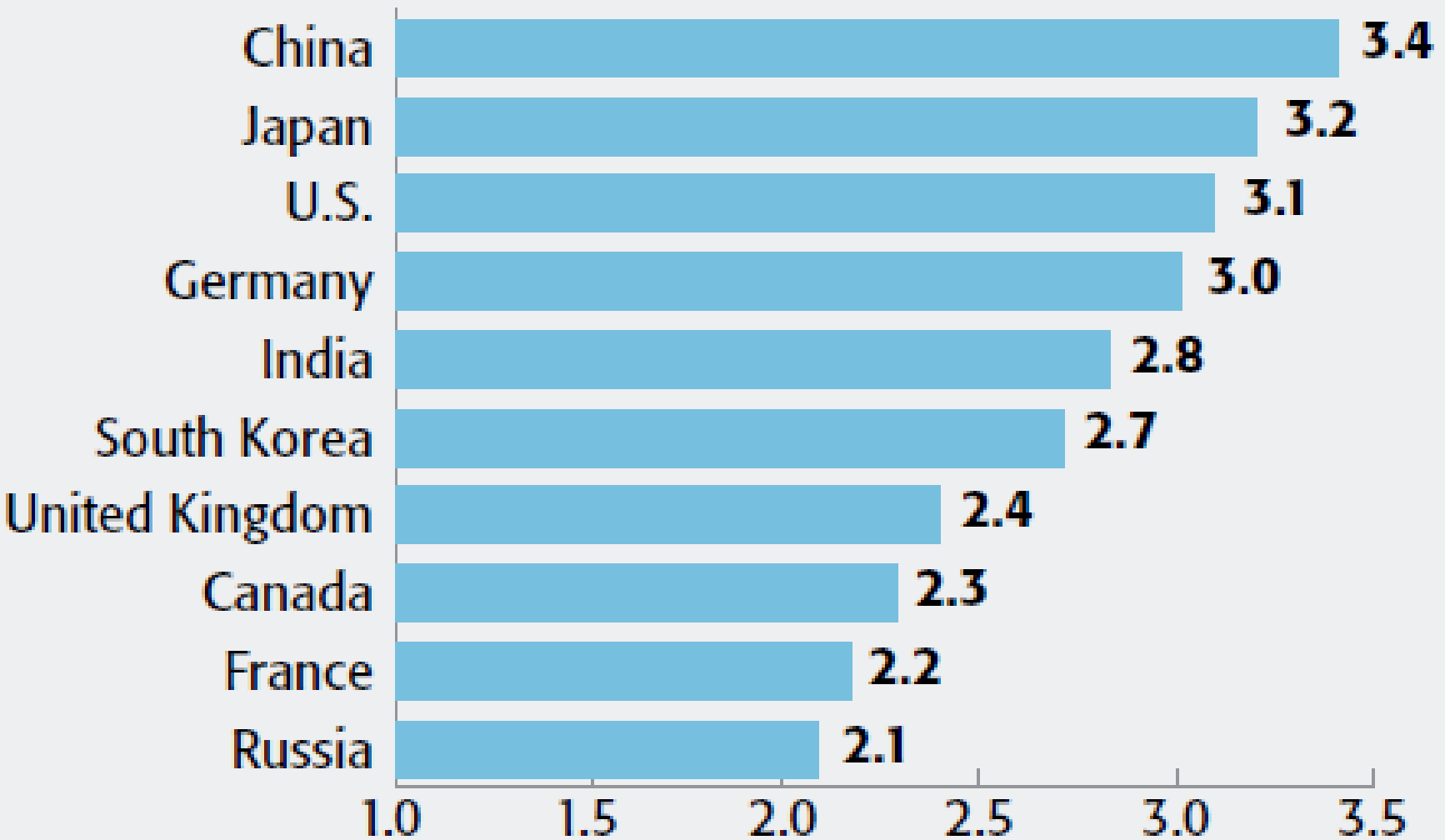


Perceived Country by Country Technical Strength (2010)



Ratings (1 = Weak to 5 = Strong)

Perceived Country by Country Technical Strength (2015)



Ratings (1 = Weak to 5 = Strong)

THE INDIAN EXAMPLE



Between 1970 and 2005 India provided virtually no patent protection to pharmaceutical products.

THE INDIAN EXAMPLE

Result : Many drugs patented internationally could be legally produced in India



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THE INDIAN EXAMPLE

Other opportunities



Prescription drugs worth US\$ 40 billion in the U.S. and 26 billion in Europe lost their patents in the year 2008.

THE INDIAN EXAMPLE



In 2005 the Patents Act was amended to bring it in line with international obligations. Patents for pharmaceuticals could be protected now.

F. Hoffman La Roche versus Cipla Ltd.
(Delhi High Court Appellate Bench)



versus



PRINCIPAL FINDINGS

RESULT : Injunction declined

PATENT : Erlotinib Hydrochloride (polymorphs A and B)

FINDING : Patent can be challenged even after three levels of checks i.e. examination, pre-grant opposition and Post-grant opposition.

FINDING : public interest over-rides other interests including encouraging innovation.



versus



PLAINTIFF'S ARGUMENT

public interest in low cost general drugs has to be balanced by the public interest in protection of **patent** rights and that the need to encourage scientific research in discovering the drug outweighs the public interest in obtaining a low cost generic drug.



versus



s. 83(e) - **patents** granted do not in any way prohibit Central Government in taking measures to promote public health



versus



s. 83(g) that **patents** are granted to make the benefit of the patented invention available at reasonably affordable prices to the public



versus



S. 84 – mandates for compulsory licenses if patented invention is not available to the public at reasonably affordable price

THE INDIAN EXAMPLE

- The Indian pharmaceutical has more than US\$ 20 billion in annual revenues with 10% share of the world market.
- It is second only to U.S.A and Japan .
- More than 5000 pharmaceutical concerns in India employing more than 340,000 people.
- India accounts for more than 25% of the world generics market and has the highest number of US FDA approved production facilities than any other country.

THE INDIAN EXAMPLE



“The deal is that GSK comes up with the ideas and Dr. Reddy's will check the intellectual property landscape and do the pharmaceutical development as far as the human bioequivalence studies. Then GSK will do the clinical studies. It is a unique combination of an R&D company like GSK and a generics company like Dr. Reddy's each doing what they do best,” (*Sandy Macrae. Senior Vice President for Asia Pacific, Japan, and Emerging Markets (APJEM) R&D at GSK*)

THE INDIAN INITIATIVE IN R&D

- India's 5 year plan for 2007-2012 stipulates a 200% increase in science and technology investment over the previous 5 year plan
- 30 new R&D based universities owned and managed by the central government to be started. 16 in states that did not have a central university.
- The number of Indian Institute of Technology (IIT) to be doubled during the period to 16.
- 10 new National Institute of Technology and 3 new Indian Institute of Science, Education and Research to be opened.

THE INDIAN INITIATIVE TO R&D

- 20 Indian Institute of Information Technology to be opened.
- Private enterprise also have committed to opening new technology institutes with one enterprise having already donated US\$ One billion.



In 2007 Tata purchased the Anglo-Dutch steel maker Corus for US\$ 12.7 billion. When Tata purchased Corus, it became a company having no patents to a company with 80 patents and 1000 researchers



In 2008 Tata purchased JAGUAR & LAND ROVER
FOR US\$ 2.3 BILLION

Globalization of R&D from Developing economies



Huawei, China has set up one of the largest R&D centers in Bangalore, India to develop a wide range of telecom software. The Center is engaged in full life-cycle product development of cutting edge telecom and networking solutions ranging from front-end process line and system conceptualization to software development, testing and delivery, to enhance the core competence for the global market. HUAWEI is owner of more than 200 patents.

The logo for Becton Dickinson, featuring the company name in a bold, sans-serif font with a horizontal line above the text.

7.5 Billion dollar company setting up R&D in India

“The uncertainty is around regulation for medical devices. The need for a harmonized, predictable and transparent regulatory system is needed to enable more FDIs to come into this sector,” he said.

General Electric and Satyam Joint Venture

- General Electric entered into Joint Venture with Satyam to form Satyam – GE Software Services Private Limited.
- The JV was entered to provide design and development work and product software for GE Industrial Systems' global product development activities in Europe and North America.

 Mahindra Satyam



HP Labs Innovation Research Program with IIT Bombay

- In 2010, HP has announced that the Indian Institute of Technology Bombay (IIT Bombay) has been selected to participate in the prestigious HP Labs Innovation Research Program (IRP).



Jubilant Life Sciences

- It is India's largest Custom Research and Manufacturing Services (CRAMS) player and a leading Drug Discovery and Development Solutions provider out of India.
- Partnered with various International Pharmaceutical companies for Drug development and research.



DuPont- Knowledge Centre in India

- In 2008, DuPont set up a world class Knowledge Centre in India focusing on high-end research & applications development.



DuPont- New Innovation Centre in India

- In 2011, DuPont announced that it will set up a new Innovation Center in India, to fuel local collaboration in support of the India growth strategy.



SRM and Queen's University, Canada

- The Sri Ramasamy Memorial (SRM) University is a major contributor and has established a bilateral research and education linkage with Queen's University.
- “Building Global Capacity for Disease Surveillance through Evidence-Based Research”.

Linkages in the area of Poultry Breeding

- Avian Genome Mapping - Roslin Institute, Edinburgh; Hebrew University, Israel University of Abertary, Dundee, U.K.
- Molecular Genetics - University of Guelph, Ontario, Canada; Oregon Regional Primate Research Centre, Beaverton, USA

CranesSci MEMS Lab

- Cranes Software International Limited and Indian Institute of Science (IISc) has set-up with private funding the CranesSci MEMS Lab” for the growth of MEMS technology



Thank You