



INNOVATION AND PATENTS

November 2010

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Advantage India

India's economy has been witnessing rapid growth over the past few years, with its average growth rate being recorded at 8.5 per cent between 2005–06 and 2009–2010. It is expected to grow at 7.2 per cent in 2009–2010, an increase over 6.7 per cent growth achieved in the preceding year.

Favourable government policies

- As a signatory to the World Trade Organisation (WTO) and based on the agreement on Trade-Related Intellectual Property Rights (TRIPS), India entered the product patent regime in 2005, which has led to a significant increase in innovation.

Strong public R&D system supported by a robust skilled workforce

- Premier institutes such as the CSIR conduct research activities in various areas, including agriculture, space, science and technology.
- The Indian Institute of Technology (IIT), a chain of engineering and technology-oriented institutes of higher education, were created to train scientists and engineers.
- Around 15,500 undergraduate and 12,000 graduate students study at IIT and research schools.

Advantage India

India's growing economy

- Growth of 4.6 per cent in per capita GDP in 2008–09 has resulted in an increase in disposable income. This, in turn, has led to an enhanced demand for better and more innovative products.

Low R&D costs

- India is fast emerging as a potential R&D destination for global companies and outpacing China due to low costs, faster and more cost-effective time-to-market opportunities and the availability of a significant number of scientists.
- The cost of conducting a clinical trial in India is 50 per cent lower than that in a developed market.

Sources: Economic Survey 2008–09, and 2009–2010, Chapter 1, Government of India, website of All India Council for Technical Education (AICTE), "India's R&D — The Future Forward", BioSpectrumIndia website. <http://biospectrumindia.ciol.com/content/bioEvents/11002041.asp>, accessed 16 November 2010.

CSIR: Council of Scientific and Industrial Research, IIT: Indian Institute of Technology

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Innovation in India — R&D ... (1/6)

- Around 0.9 per cent of India's GDP is invested in R&D, which the public sector mainly accounts for. In 2009 India spent approximately 0.6 per cent of agri-GDP on agri-R&D.
- National expenditure on R&D was valued at US\$ 5.9 billion (INR 287.76 billion) in 2005–06. It was expected to achieve a value of US\$ 6.9 billion (INR 329.41 billion) in 2006–07 and US\$ 7.9 (INR 377.77) billion in 2007–08.
- In 2005–06, the contribution of the Central Government to R&D expenditure was the highest, with a share of 57.5 per cent, followed by the State Governments' share of 7.7 per cent, while the industrial and higher education sectors contributed 30.4 per cent and 4.4 per cent, respectively.
- The industrial sector in India currently spends around 0.54 per cent of the sales turnover on R&D. In industrial R&D expenditure, drugs and pharmaceuticals contributed the largest share, (37.4 per cent), followed by the transportation and defence industries, with 14.7 per cent and 6.9 per cent, respectively, in the same period.
- Most research activity in India is undertaken in the pharmaceutical, biotechnology, software, IT and auto component segments.

Source: Economic Survey 2008–09; "Research and Development Statistics at a Glance 2007-08," Department of Science and Technology website. <http://dst.gov.in/scientific-programme/r&d-eng.pdf>, accessed 16 November 2010

Innovation in India — R&D ... (2/6)

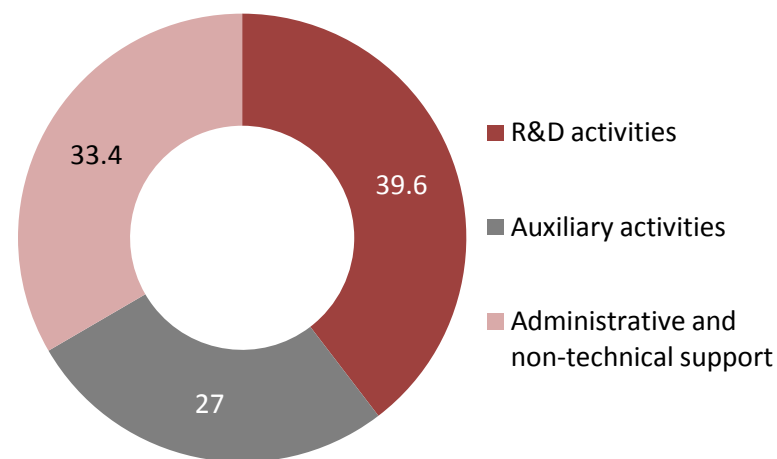
- According to a survey undertaken by the National Knowledge Commission in 2007, in most large companies, the intensity of innovation is the highest in the operations department, followed by the marketing department. Only pharmaceutical companies claimed that maximum innovation takes place in their R&D labs.
- The pharmaceutical industry is the most research-intensive, with its share of R&D, relative to sales, increasing from 0.4 per cent in 1991 to 4.8 per cent in 2004.
- According to Pharmabiz, R&D expenditure on the top 25 Indian drugs amounted to US\$ 690 million in 2008–09, an increase of 17 per cent over the previous year.
- The R&D expenditure of some Indian companies:
 - Tata Motors spent US\$ 255 million in 2009, as against US\$ 246 million in 2008.
 - BHEL spent US\$ 180 million in 2009, an increase of 57 per cent over the previous year.
 - Dr Reddy's Laboratories spent US\$ 79 million in 2009, compared with US\$ 84 million in 2008.
 - Sun Pharmaceuticals spent US\$ 71 million in 2008, which was 6 per cent of the company's net revenue.

Sources: "Research and Development Statistics at a Glance 2007-08," Department of Science and Technology website. <http://dst.gov.in/scientific-programme/r&d-eng.pdf>, accessed 16 November 2010; "R&D spend: Just 4 Indian companies in global list", The Economic Times website, <http://economictimes.indiatimes.com/news/news-by-company/corporate-trends/RD-spend-just-4-Indian-cos-in-global-list/articleshow/5228760.cms>, accessed 16 November 2010; Tata Motors 2010 annual report; BHEL 2010 annual report; Dr Reddy's Laboratories 2010 annual report; Sun Pharmaceuticals 2010 annual report;

Innovation in India — R&D ... (3/6)

- In 2006, there were 3,960 R&D institutions in India, with Maharashtra accounting for the maximum number — 835 (21 per cent).
- The number of doctorates produced in 2005–06 was 18,730, of which 45 per cent belonged to science faculties.
- A study of the human resource sector suggests that nearly 391,000 people were employed in R&D establishments in the country, including in the in-house R&D units of industries, as on April 1, 2005.
- The majority (63 per cent) of R&D personnel were employed in institutional and higher educational sectors, while the industrial sector deployed 37 per cent of its total R&D personnel.

Share of personnel involved in different roles in R&D establishments (per cent) in 2007–08

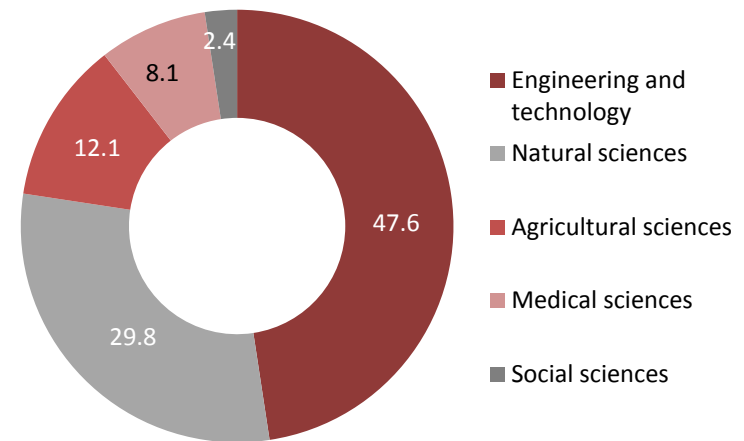


Sources: “Research and Development Statistics at a Glance 2007-08,” Department of Science and Technology website. <http://dst.gov.in/scientific-programme/r&d-eng.pdf>, accessed 16 November 2010.

Innovation in India — R&D ... (4/6)

- Of the total number of personnel employed in R&D in 2007–08, a large percentage (47.6 per cent) was specialised in engineering and technology.
- Of total Central Government R&D expenditure, 86 per cent has been incurred by 12 major scientific agencies — CSIR, Defence Research and Development Organisation (DRDO), Department of Atomic Energy (DAE), Department of Biotechnology (DBT), Department of Science and Technology (DST), Ministry of Earth Sciences (MOES), Indian Council of Agricultural Research (ICAR) and Ministry of New and Renewable Energy (MNRE) — while other central ministries, departments or public sector industries have incurred the remaining 14 per cent.
- The public sector has been focusing extensively on areas such as plant and animal science, space science and agricultural science.

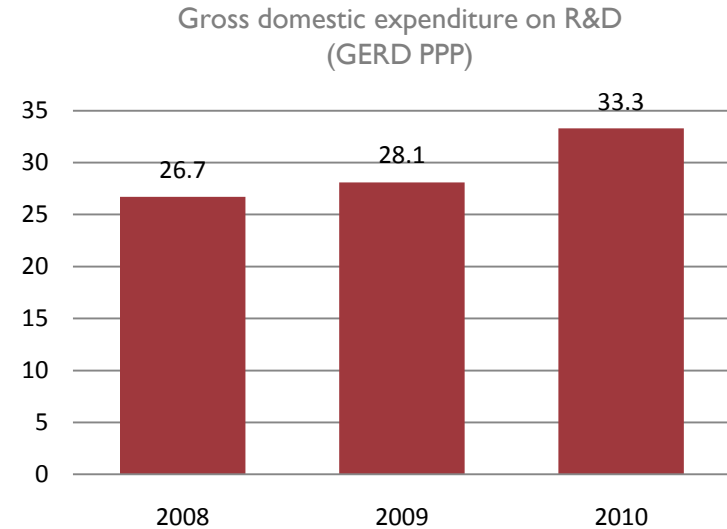
Share of R&D personnel with a specialisation in different areas (per cent)



Sources: “Research and Development Statistics at a Glance 2007-08,” Department of Science and Technology website. <http://dst.gov.in/scientific-programme/r&d-eng.pdf>, accessed 16 November 2010.

Innovation in India — R&D ... (5/6)

It is estimated that overall global R&D will increase by 4 per cent in 2010 to US\$ 1,156.5 billion from US\$ 1,112.5 billion in 2009. India and China, which are likely to contribute a 7.5 per cent increase in Asia's R&D, are expected to mainly drive this increase.



Source: "2010 Global R&D Funding Forecast: An Overview" R&D Mag website, <http://www.rdmag.com/Featured-Articles/2009/12/Policy-and-Industry-2010-Global-R-D-Funding-Forecast-An-Overview/>, accessed 16 November 2010.

Innovation in India — R&D ... (6/6)

Growth in the number of Indian scientific publications			
Category	Number (1999–2003)	Number (2004–08)	Growth (per cent)
Chemistry	21,206	33,504	10
Physics	11,700	17,295	14
Plant and animal science	8,132	10,190	19
Engineering	8,101	14,103	5
Materials science	6,960	11,126	9
Agricultural science	4,303	5,634	17
Geosciences	2,839	4,266	13
Pharmacology	2,034	3,866	3
Space science	1,322	1,665	18
Microbiology	1,078	2,273	2

Indicator	India
R&D as percentage of GDP (2008)	0.8
R&D as percentage of GDP (2010)	0.9

Source: “2010 Global R&D Funding Forecast: An Overview” R&D Mag website, <http://www.rdmag.com/Featured-Articles/2009/12/Policy-and-Industry-2010-Global-R-D-Funding-Forecast-An-Overview/>, accessed 16 November 2010.

Key drivers ... (1/3)

The various drivers of innovation include:

Increasing focus on R&D

- India's position in the field of global scientific research, measured by the number of research papers published in the country, has improved from 13 in 1996 to 10 in 2009 (according to the Scopus international database).
- The growth rate of research papers published between 1996 and 2006 was recorded at 7 per cent, higher than the world average of 4.1 per cent.

Obsolescence of existing products or technology

- With the propensity of Indian consumers to spend on new products and services rising, companies across industries are increasingly focusing on incremental and radical innovation.

Sources: "Scientific Research and Development," Department of Science and Technology press release, http://www.dst.gov.in/admin_finance/un-sq5339.htm, 28 April 2010;

Key drivers ... (2/3)

Education — several new courses, which have industry-specific curricula, have been introduced.

- IIT — In 2007–08, Chennai, Kanpur, Kolkata, the National Manufacturing Competitiveness Council (NMCC) and the Ministry of HRD collaborated to introduce Visionary Leadership in Manufacturing, a postgraduate diploma for executives to enhance competitiveness in the manufacturing sector.
- IIT Kanpur (IITK) has signed a Memorandum of understanding (MoU) with Bharat Sanchar Nigam Limited (BSNL) to set up a BSNL-IITK telecom centre of excellence.
- IIT Delhi and the Delhi Metro Rail Corporation (DMRC) introduced a one-year postgraduate diploma in Metro Rail Transport, Technology and Management in 2008–09.

Source: Department of Higher Education, Ministry of Human Resource Development (HRD) 2008–09 annual report.

Key drivers ... (3/3)

Competition

- The automobile industry has been witness to constant innovation in recent times, with companies regularly introducing variants of existing cars and new models with enhanced features. According to the Society of Indian Automobile Manufacturers, the production of automobiles has increased from 7.24 million in 2003–04 to 14.05 million in 2009–2010.
- Low costs, coupled with the increasing disposable income of customers and easy options for finance, have exponentially increased the demand for vehicles. This, in turn, has motivated companies to devise innovative strategies to capture a significant share of the market.

Source: “Competition to heat-up as biggies gear up for small-car launch,” The Economic Times website, <http://economictimes.indiatimes.com/news/news-by-industry/auto/automobiles/Competition-to-heat-up-as-biggies-gear-up-for-small-car-launch/articleshow/5332991.cms>, accessed 16 November 2010.

Innovation in agriculture — ITC e-Choupal

- e-Choupal, a unique web-based initiative of ITC’s agri-business division, offers farmers information on requisite products and services to enhance their productivity, improve price realisation and reduce transaction costs.
- Farmers can access information on the weather, farming practices and market prices from their respective village locations through this website.
- In addition, the website is available in regional languages commonly used in villages.
- ITC has also introduced the concept of Choupal Saagars, which function as agri-sourcing centres (providing farmers with the best price), as well as shopping and facilitation centres that offer various farm-related services.

e-Choupals — current and projected status

Type	Existing	Projected
e-Choupals	6,500	20,000
States covered	9	15
Villages covered	40,000	1,00,000
Farmers empowered	4 million	10 million

Source: “Initiatives of Rural Development in India by ITC Limited,” ITC e-Choupal’s website, http://www.itcportal.com/ruraldevp_philosophy/echoupal.htm, accessed 16 November 2010.

Source: “Initiatives of Rural Development in India by ITC Limited,” ITC e-Choupal’s website, http://www.itcportal.com/ruraldevp_philosophy/echoupal.htm, accessed 16 November 2010.

Innovation in the automotive industry

- Tata Nano — world's first sub US\$ 2,500 car
 - Tata Nano is a first-in-class vehicle in the small car segment in the Indian automobile industry and is targeted at the large Indian middle class.
 - The car has the smallest exterior footprint in India and is 21 per cent more spacious than the smallest car available in the domestic market.
 - The car's fuel efficiency, at 23.6 km per litre, is the highest among petrol cars in India.
 - Tata Nano has the lowest CO₂ emission in the country due to its high fuel efficiency.
 - Tata Motors won the *Wall Street Journal* Technology Innovation Award in the transportation category for the Nano.
 - Tata Nano won the Frost & Sullivan 2009 Innovation Award for its outstanding innovation and exceptional contribution to the auto industry.
- Mahindra & Mahindra is another automaker at the forefront of innovation, especially in the farm equipment sector. In 2008, Mahindra Tractors launched India's first bio-diesel tractor. The group's farm equipment segment was awarded the Golden Peacock Innovative Product/Service Award 2010 for *Yuvraj 215*, the first-of-its-kind in the tractor industry, targeted at small and marginal farmers. The group received the Best Innovation award at the UTVi Autocar Awards 2009 for its FuelSmart System in its Scorpio and Bolero variants in the Indian market. The technology enables the vehicle's engine to automatically switch off at a traffic light when idle and in neutral gear.

Sources: "Frost & Sullivan 2009 Innovation Award for the Tata Nano," Tata Nano press release, <http://tatanano.inservices.tatamotors.com/tatamotors/> 2010; "India - Fast, Sustained and Stable Growth Story," Mahindra & Mahindra website, http://www.mahindra.com/investorsrelations/Investor_Presentation_Post2QFY11-results.pdf, accessed 16 November 2010.

Innovation in services ... (1/2)

- The Government of India (GoI) launched the Incredible India campaign in 2002 to promote the country as a tourist destination. The campaign received the Global Shop America Salutes Innovation (SASI) Award from the National Geographic Society in the US for innovation in creating long-lasting and authentic shopping opportunities for both travellers and Indian residents.
- India's insurance industry has witnessed rapid growth since the GoI's liberalisation reforms in 2000. The number of industry players increased from four in the life insurance segment and eight in the general insurance segment in 2000 to 22 each in 2009. The insurance market grew at a CAGR of 27.1 per cent between 2001 and 2008.
- This growth can be primarily attributed to continuous innovation in product design and delivery. Insurance companies have also been exploring new distribution channels such as bancassurance, brokers and e-channels to boost their sales and expand their outreach. Companies have devised attractive insurance policies in niche areas, specific for people from all walks of life. The use of IT has enabled fast access to customers by managing and tracking accounts online, billing and electronic funds transfer. Over the years, the General Insurance Corporation of India has introduced several products such as overseas mediclaim insurance, terrorism cover and several rural insurance packages. Products have also been introduced for corporate customers in the form of customer-specific contingency policies. Some of the major insurance companies in the country include Life Insurance Corporation (LIC), ICICI Prudential, Bajaj Allianz, HDFC Standard, Birla Sunlife, Max New York, Tata AIG and Met Life.

Sources: Ministry of Tourism 2010 annual report, Government of India; "Insurance industry: key trends and perspectives," Ernst & Young, 2009.

Innovation in services ... (2/2)

- Bharti Airtel Limited's business model of strategically outsourcing its core functions is an exemplary model of reverse innovation (innovation originating from a developing country). With the company's lack of technical competencies and limited understanding of the technology, Bharti Airtel handed over the responsibility for building and managing the company's telecom and IT network to vendors. Vendors for telecom network management were only paid for the capacity Bharti Airtel utilised and not for the equipment. This innovative business model converted fixed costs in capital expenditure to variable costs based on the use of capacity and revenue from services. Through its outsourcing arrangements, Bharti Airtel dramatically lowered its costs while ensuring high quality for customers.
- Manipal Cure and Care (MCC), part of the Manipal Education and Medical Group (MEMG), is a first-of-its kind venture in the healthcare industry, as it has introduced the concept of holistic wellness therapy and retail healthcare in India. MCC owns several state-of-the-art centres that provide superior quality healthcare services in the wellness, preventive health and beauty segments, which are easily accessible to customers. MCC has won the award for the Most Admired Retailer of the Year — Innovative Retail Concept 2008 — at the India Retail Forum. MCC was also honoured with the Golden Peacock Innovation Award in 2007 and 2008.
- The introduction of ATMs in India in 1987 was a stepping stone for the revolutionisation of the banking industry. Banks have now gone a step ahead with the introduction of biometric ATMs that use fingerprint technology instead of pin numbers for access. This enables illiterate people to operate ATMs. Andhra Bank was the first bank in India to introduce mobile biometric ATMs in 2007.

Source: "Manipal Cure and Care brochure," Manipal Cure and Care website, <http://www.manipalcureandcare.com/images/download/MCC%20Brochure.pdf>, accessed 16 November 2010.

Innovation in education

- The conventional form of classroom teaching has now evolved into the concept of interactive distance learning (IDL) via VSAT media.
- Several premier institutes such as the Indian Institute of Management (IIM), IIT, the Xavier Labour Relations Institute (XLRI) and the Mudra Institute of Communications Ahmedabad (MICA) offer various specialised courses through this mode, bringing together students or working professionals across India on the same platform through virtual classrooms.
- These institutes offer specialised courses on public policy, agri-business, entrepreneurship and supply chain management, among others.

Source: Websites of relevant institutes

VSAT: Very small aperture terminal

Key organisations in the Indian public sector ... (1/5)

Council of Scientific and Industrial Research (CSIR)

- The CSIR is one of the largest public-funded R&D organisations in the country, with a network of 38 laboratories and 39 outreach centres.
- The organisation's mission is to provide scientific and industrial R&D that maximises economic, environmental and societal benefits for the people of India.
- The CSIR has the highest number of international patent holders (around 1,800 patents), around 4,000 research papers and more than 300 contract R&D technology licensing agreements.
- The CSIR plans to establish an Academy of Scientific and Innovative Research (AcSIR) for post graduate and doctoral research studies. A Bill relating to this initiative has been introduced in the Lok Sabha in July 2010.

Source: Relevant organisation websites.

Key organisations in the Indian public sector ... (2/5)

Defence Research & Development Organisation (DRDO)

- The DRDO's mission is to establish a world-class science and technology base and provide India's defence services with internationally competitive systems and solutions.
- The DRDO intends to accomplish this by designing and developing state-of-the-art sensors, weapon systems, allied equipment and platforms.
- Its key technology areas include aeronautics, armaments, combat engineering, electronics and computers, life sciences, material, missiles and naval systems.
- The organisation has, on its rolls, more than 5,000 scientists and around 25,000 other scientific and technical support personnel.

Source: Relevant organisation websites.

Key organisations in the Indian public sector ... (3/5)

Department of Biotechnology (DBT)

- The DBT has to its name several achievements in the application of biotechnology, in the areas of agriculture, healthcare, animal sciences, environment and industry.
- During the Tenth Five Year Plan Period (2002–07), 35 biotech facilities were established in the public sector for the production and supply of biologicals, reagents, culture collection and experimental animals to scientists, industries and students at nominal costs.
- During the Tenth Plan Period, an extensive bioinformatics network, covering 65 institutions, was established. Scientists associated with this network have published more than 1,200 research papers.
- The priority areas for the Eleventh Five Year Plan include the development of improved crops, functional foods, nutraceuticals, nutritional rich food, bioprocessing, R&D on bio-drugs, vaccines, biological reagents and adjuvants, diagnostics, implants, devices, medical bioinformatics, clinical research, stem cell research and regenerated medicine.

Source: Relevant organisation websites.

Key organisations in the Indian public sector ... (4/5)

Department of Atomic Energy (DAE)

- The DAE was established in 1954 and, since then, has created a network of institutions engaged in R&D as well as industrial activities.
- The DAE has contributed significantly to international mega science projects, particularly the CERN — European Organisation For Nuclear Research.
- The institution has also developed several new technologies for societal applications, such as seawater reverse osmosis plants for coastal areas and brackish water reverse osmosis plants in villages for the production of safe drinking water.

Source: Relevant organisation websites.

Key organisations in the Indian public sector ... (5/5)

Indian Council of Agricultural Research (ICAR)

- The ICAR is the apex body for coordinating, guiding and managing research and education in agriculture in the country, including in horticulture, fisheries and animal sciences.
- The organisation has one of the largest national agricultural systems in the world, with 97 institutes and 45 agricultural universities.
- The ICAR has also played an instrumental role in promoting higher education in agriculture.

Source: Relevant organisation websites.

Other organisations focusing on innovation ... (1/5)

Indian Institute of Technology (IIT)

- The IIT was established as an “institute of national importance” under the Institutes of Technology Act, 1961, with the objective of imparting world-class training in engineering and technology to conduct research in relevant fields for the advancement and dissemination of knowledge.
- The institutes offer several courses in interdisciplinary areas of science, and additional areas have been identified for research. Examples include new material, non-destructive evaluation technology, high-speed networking and wireless technology, biotechnology and bioinformatics, smart material, environmental energy, medical science and technology, medical instrumentation, electronics communication and membrane technology.
- In addition to the seven IITs already in existence, six new IITs were set up in Andhra Pradesh, Bihar, Rajasthan, Gujarat, Orissa and Punjab, respectively, in 2008–09. Two more were established in Madhya Pradesh and Himachal Pradesh in 2009–2010.

Source: Relevant organisation websites.

Other organisations focusing on innovation ... (2/5)

National Innovation Foundation (NIF)

- The Department of Science and Technology established the NIF in 2000 with the objective of providing institutional support in scouting, spawning, sustaining and scaling up grass-root green innovations and helping them transition into self-supporting activities.

National Agricultural Innovation Project (NAIP)

- The NAIP was conceived to pilot innovation in conducting agricultural research.
- The NAIP functions through the following components:
 - Research on production to consumption systems
 - Research on sustainable rural livelihood security
 - Basic and strategic research in frontier areas of agricultural sciences

Source: "Know us," National Innovation Foundation website, http://www.nif.org.in/know_us, accessed 16 November 2010; "Research & Development," National Agricultural Innovation Project website, <http://www.naip.icar.org.in/research&develop.htm>, accessed 16 November 2010.

Other organisations focusing on innovation ... (3/5)

National Agricultural Innovation Project (NAIP)

- R&D priorities of the NAIP
 - Agricultural diversification
 - Livestock and fisheries
 - Genetic resources
 - Natural resource management
 - Integrated pest management
 - Value addition
 - Policy analysis and market intelligence
- The NAIP's total budget is US\$ 250 million, of which the World Bank funds US\$ 200 million as credit and the Gol funds US\$ 50 million.

Source: "Research & Development," National Agricultural Innovation Project website, <http://www.naip.icar.org.in/research&develop.htm>, accessed 16 November 2010.

Other organisations focusing on innovation ... (4/5)

Marico Innovation Foundation

- The foundation was created in 2003 under the stewardship of Dr R A Mashelkar.
- Its activities include:
 - Research projects
 - Organising the Innovation for India awards
 - Organising orbit-shifting innovation, a live course in applied innovation, with business schools across India.

Source: "About us," Marico Innovation Foundation website, http://www.maricoinnovationfoundation.org/the_foundation/about_us.html, accessed 16 November 2010.

Other organisations focusing on innovation ... (5/5)

New Millennium Indian Technology Leadership Initiative (NMITLI)

- NMITLI is a significant initiative in the public-private partnership (PPP) mode within the R&D domain in the country, under the aegis of the CSIR.
- The initiative seeks to catalyse innovation-centred scientific and technological developments.
- The organisation has successfully completed 57 largely-networked projects in diverse areas such as agriculture and plant biotechnology, bioinformatics, pharmaceuticals, chemicals, materials, ICT and energy.

Source: "About us," Marico Innovation Foundation website, http://www.maricoinnovationfoundation.org/the_foundation/about_us.html, accessed 16 November 2010; "New Millennium Indian Technology Leadership Initiative (NMITLI)," Council of Scientific & Industrial Research website, <http://www.csir.res.in/external/heads/collaborations/Nmitili/NMITLI%20Information%20in%20brief.pdf>, accessed 16 November 2010.
ICT: Information, communication and technology

India's top innovator companies

A joint survey conducted by *Business Today* and Monitor Group in 2008 listed the following companies as the top innovators in India based on their innovation-related beliefs and practices.

IT-ITeS, telecom, financial services

- Citibank India
- HDFC Bank
- ICICI Bank
- Infosys Technologies
- Wipro Technologies
- Tata Consultancy Services
- Airtel
- IBM Daksh

Aviation, automotives

- Air Deccan
- Jet airways
- Mahindra & Mahindra
- Tata Motors

Healthcare, pharmaceutical, biotechnology

- Aravind Eye Care
- Apollo Hospitals
- Narayana Hrudayalaya
- Ranbaxy
- Dr Reddy's Laboratories
- Dabur India

Retail, FMCG

- Marico
- ITC

Source: "India's most innovative companies," Business Today website, http://businesstoday.intoday.in/index.php?option=com_content&task=view&id=4541, 31 March 2008.

Key foreign players with research operations in India ... (1/5)

Adobe Systems

- The company's India R&D division, which represents around 30 per cent of the parent company's global R&D workforce, owns more than 20 products and has filed more than 100 patents in the last seven years.
- Adobe Systems plans to double its R&D capabilities in India in 2009–2010.

Google

- Google has four offices in India — one each in Gurgaon, Bengaluru, Mumbai and Hyderabad.
- The company's first engineering centres in the country, in Bengaluru and Hyderabad, were launched in 2004.
- These centres were selected because of the presence of well-educated, technology-savvy and English-speaking people.
- The core functions of these offices include engineering, online sales, operations and human resources.

Key foreign players with research operations in India ... (2/5)

GE

- GE's revenues in India currently amount to US\$ 2.6 billion, and its exports were worth more than US\$ 1 billion in 2008–09.
- The company has three technology R&D centres in India:
 - John F Welch Technology Centre at Bengaluru (established in 2000)
 - India Innovation Centre
 - Hyderabad Technology Centre

IBM

- IBM has 14 offices in India, with its regional headquarters in Bengaluru.
- IBM is the only IT company in the world that offers end-to-end solutions from hardware to software, services and consulting.
- The IBM Innovation Centre in India is one among the company's 10 such facilities worldwide. Web-based applications are developed specifically for Indian customers at this facility.
- IBM's Software Innovation Centre also offers e-business solutions to Indian organisations and the Gov through its e-governance centre.

Key foreign players with research operations in India ... (3/5)

GE

- GE's R&D centre in Bengaluru is a multi-disciplinary R&D hub, which collaborates with three of its other R&D facilities (the GE global research teams in the US, Germany and China) to conduct research, development and engineering activities for GE's businesses worldwide.
- This centre has filed more than 185 patents for R&D activities in Bengaluru and has been granted 12 of these.

Key foreign players with research operations in India ... (4/5)

Microsoft

- Microsoft has 16 offices in India, where it employs 5,500 people.
- The company's six business units include:
 - Microsoft Research India in Bengaluru
 - Microsoft India Development Centre in Hyderabad
 - Microsoft IT in Hyderabad
 - Microsoft Global Services India at Hyderabad
 - Microsoft India Corporation
 - Microsoft Global Technical Support Centre at Bengaluru

Pfizer

- Pfizer (Limited) India, headquartered in Mumbai, had a turnover of US\$ 159.52 million as on November 2009.
- The company has a state-of-the-art manufacturing facility in Thane, Maharashtra.
- Pfizer's expenditure in pharmaceutical R&D is among the highest, and it has made clinical research investments worth US\$ 6.05 million in the country.
- To lucratively tap the Indian clinical research industry, Pfizer has developed Preferred Research Centres (PRCs), which enable the company to promote education and training in clinical research and development.

Key foreign players with research operations in India ... (5/5)

Pfizer

- In 2008, PRCs were established in Hyderabad, Andhra Pradesh — the Nizam's Institute of Medical Sciences — and in Kochi, Kerala — the Amrita Institute of Medical Sciences.
- Pfizer has also established the Academy for Clinical Excellence, the country's first training centre in clinical research for capacity building in the sector.

Source: Relevant company websites
This is an indicative list.

Global Indian innovators ... (1/4)

Vinod Dham — father of the Pentium Chip

- Indian innovator Vinod Dham received worldwide acclaim for his role in the development of the Pentium processor.
- His work on developing the processor commenced in 1990 when he was working with Intel. His contribution enabled the product to become very successful in the market.
- Currently, he is the Chairman, President and CEO of Silicon Spice, a communications technology development firm.

Global Indian innovators ... (2/4)

Amar Bose — founder of Bose Corporation

- Born in the US, Amar Bose studied at the Massachusetts Institute of Technology (MIT).
- In 1964, he founded Bose Corporation after receiving recognition for creating speakers with excellent sound quality, for which he was granted patents.
- In 1968, he invented the 901(R) Direct/Reflecting(R) speaker system, one of the first stereo loudspeakers of its kind. His company also captured the car stereo market by creating stereo systems that transformed the listening experience.
- Today, Amar Bose has more than two dozen patents to his name. His products can be found in Olympics stadia, the Sistine Chapel in the Vatican City, the NASA Space Shuttle and the Japanese National Theatre.
- He featured on the 2006 Forbes Billionaires list.

NASA: National Aeronautics and Space Administration
This is an indicative list.

Global Indian innovators ... (3/4)

Sabeer Bhatia — co-founder of Hotmail

- Born in India, Sabeer Bhatia obtained his postgraduate engineering degree from Stanford University in the US.
- He worked at Apple Computers for a year before joining a start-up company, after which he co-founded Hotmail Corporation along with a colleague from Apple.
- Together, they launched a pioneering web-based e-mail service, Hotmail, which was later sold to Microsoft in 1997.
- Sabeer has won several awards such as the Entrepreneur of the Year from venture capital firm Draper Fisher Jurvetson in 1997. He was named “one of the people to watch” in international business (2002) by *TIME* magazine.

Global Indian innovators ... (4/4)

Vinod Khosla — co-founder of Sun Microsystems

- Born in India, Vinod Khosla completed his engineering from Carnegie-Mellon University in the US, followed by a management degree from Stanford University.
- In 1982, he co-founded Sun Microsystems, where he pioneered open systems and Reduced Instruction Set Computer (RISC) processors.
- In 1985, Khosla left Sun Microsystems and joined Kleiner Perkins Caufield & Byers (KPCB).
- Vinod is also one of the founding fathers of The Indus Entrepreneur (TiE), a not-for-profit global network of entrepreneurs and professionals, which was established in 1992.
- In 2004, he founded Khosla Ventures, which funds knowledgeable entrepreneurs in new ventures.

This is an indicative list.

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Patents ... (1/2)

Patents 2008–09

Type	Units
Total no. of patent applications filed in India (Indian and foreign in origin)	36,812
Patent applications of Indian origin	6,161
Indian state with maximum applications	Maharashtra (1,990)
Patent applications of foreign origin	30,651
Country with maximum applications in India	US (9,013)
Total no. of patents granted in India	16,061
Patents granted to applicants of Indian origin	2,541

The major contributors to PCT international applications in 2008–09 included CSIR, Cadila Healthcare Ltd, Reliance Industries Ltd, Sun Pharmaceuticals Ltd, Sun Pharmaceuticals Advanced Research Lab, Aditya Birla Science and Technology, Alkem Labs, Reliance Life Sciences. Ltd, Glenmark Generics Ltd, Alembic Ltd and Arch Pharma Labs.

Source: Office of the Controller General of Patents, Designs and Trademarks 2008–09 annual report.
 PCT: Patent Cooperation Treaty

Patents ... (2/2)

Number of patent applications filed in different fields of invention (2008–09)

Field	Number
Mechanical	6,360
Chemical	5,884
Computer/ Electronics	7,063
Drug	3,672
Electrical	2,319
Biotechnology	1,844
Physics	1,668
Biomedical	1,174

Field	Number
Polymer science	1,083
Biochemistry	878
Metallurgy/Material science	579
Textiles	439
Civil	411
Food	340
Agriculture	88
Bio-informatics	64

Source: Office of the Controller General of Patents, Designs and Trademarks 2008–09 annual report.

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Policy and regulatory framework ... (1/3)

- Assistance for teaching and research in innovative or emerging areas:
 - The main objective is to identify areas in various disciplines to encourage new ideas and innovations and support these to develop specialised courses at undergraduate and postgraduate levels.
 - The financial assistance provided is on a cent per cent basis for the most critical needs of laboratory equipment, contingency and staff, to launch courses in emerging areas.
 - In 2008–09, the Ministry of Human Resource Development (MHRD) released US\$ 1.21 million (INR 58.5 million) to universities.
- The University Grants Commission (UGC) has constituted a special focus committee on intellectual property rights (IPR) to promote IPR awareness and facilitate the protection and management of IPR generated through the university system.

Policy and regulatory framework ... (2/3)

- The MHRD provides select science and technology departments in universities that need expensive equipment with Assistance for Strengthening of Infrastructure for Science and Technology (ASIST). This scheme strengthens infrastructure for postgraduate education and research and promotes innovation.
- The DBT introduced the Small Business Innovation Research Initiative (SBIRI) in 2006 to meet the early stage technology development funding needs of private biotechnology enterprises.

Source: Department of Higher Education, Ministry of HRD 2008–09 annual report.

Policy and regulatory framework ... (3/3)

- National Mission on Education through Information and Communication Technology (NMEICT)
 - Objectives of the NMEICT:
 - Development of knowledge modules to cater to the aspirations of the academic community
 - Standardisation and quality assurance of complementary e-content of world-class quality
 - Experimentation and free trial in the area of performance optimisation of low-cost access devices for the use of ICT in devices
 - Support for the creation of a virtual technology university
 - Focus on appropriate pedagogy for e-learning, providing the facility to perform experiments through virtual laboratories, on-line testing and certification, and the utilisation of the Education Satellite (EduSAT) education satellite as new forms of learning.
 - The Planning Commission has allocated US\$ 0.96 billion (INR 46.12 billion) for the NMEICT in the Eleventh Five Year Plan (2007–2012).
- The Innovation in Science Pursuit for Inspired Research (INSPIRE) programme was launched in 2008 under the Eleventh Plan to attract students to pursue science at the higher education level.

Source: Synopsis on NMEICT, Ministry of HRD

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Opportunities ... (1/3)

The MHRD, in the Eleventh Plan, proposed the establishment of 14 new world-class universities to foster research and innovation in various fields. The establishment of these universities will augment the research activities being undertaken in the country.

Increasing the quantum of investments in R&D

- Developing and implementing a national-level mechanism to formulate policies for basic research
- Expanding India's scientific talent pool and encouraging and retaining youth in these fields
- Establishing globally competitive research facilities to encourage students to study science

Developing new models of PPP in higher education

- New models of PPP in higher education (research in universities and high-technology areas) and new integrated programmes to attract students need to be developed and introduced.
- The Gol has identified some thrust areas — the creation of new interface structures such as consortia, partnership research institutions for basic and applied R&D, and the promotion of technology transfer and new venture creation. Centres of excellence may be created to achieve this objective.
- PPP can also be in the form of co-locating an industrial R&D centre within the premises of a national laboratory or academic institution and co-sharing some of the laboratory's facilities with the industry.
- The Gol has been encouraging PPP to improve the innovation infrastructure framework. India has a large segment of grass-root innovators in the informal sector, which can reap economic benefits by PPP in R&D and the commercialisation of such innovations.

Source: Eleventh Five Year Plan (2007–2012), Planning Commission, Volume 2, p. 26; “Mid-Term Appraisal of the Eleventh Five Year Plan (2007–2012), Planning Commission,” Planning Commission website, http://planningcommission.gov.in/plans/mta/11th_mta/MTA.html, accessed 16 November 2010.

Opportunities ... (2/3)

MNCs making India
an R&D hub

- Several companies have established their R&D centres in India due to the country's inherent low-cost advantage with respect to production and labour. More such companies are venturing into India. A case in point is Xerox, which set up its innovation hub in India in 2009. Such companies focus on an open innovation model, wherein they collaborate with local universities, start-up companies, governments and businesses.

Growing
collaboration
between private
enterprises

- The Increasing number of government initiatives is prompting various private enterprises to collaborate and form clusters for innovation. The CSIR is in the process of developing The Open Innovation Model, under which it is developing a new tuberculosis drug in a global collaborative effort. The research center plans to develop affordable drugs for the poor by integrating the resources of various firms.
- In a major fruit and vegetable initiative aimed at engaging large numbers of farmers directly and simultaneously increase productivity, quality and earnings, an Enterprise Solutions for Poverty (ESP) Innovation Group has brought together several large Indian companies such as ITC, Tata Chemicals, Mahindra, Reliance, and Bharti. Each of these companies is making an effort to engage small farmers in India in their businesses.
- Several other clusters and collaborative initiatives has also been initiated, including the Science and Entrepreneurship (SIEN) initiative hosted at IIT Powai, an automotive cluster in Pune and an initiative at the Comprehensive Medical Teaching Institute (CMTI) with the ISRO's involvement for the development of technologies for flexible manufacturing.

Source: Eleventh Five Year Plan (2007–2012), Planning Commission, Volume 2, p. 26; “Mid-Term Appraisal of the Eleventh Five Year Plan (2007–2012), Planning Commission,” Planning Commission website, http://planningcommission.gov.in/plans/mta/11th_mta/MTA.html, accessed 16 November 2010.

Opportunities ... (3/3)

Increasing
international
collaboration

- The implementation of mega science projects in high-technology areas is expected to result in direct technological gains for India in terms of advanced technology and equipment building, in addition to the development of capabilities to work on similar projects. Such projects involve multi-institutional teams and have high potential for international collaborations.
- These projects also aim to provide ample opportunities for students to involve them in cutting-edge research.
- India's successful participation in CERN has paved the way for its participation in the International Thermonuclear Experimental Reactor (ITER) project as an equal partner.

Thrust on cross-
disciplinary
technology areas

- India has identified potential areas where the development of a core competency is expected to significantly affect science-based technologies for societal and economic benefits as well as national security.
- These areas include desalination and water-purification technologies, nutrition, healthcare (medical diagnostics, medical devices, vaccines), advanced computing, advanced manufacturing, robotics and automation, combustion research, sensors and integrated systems, distributed sensors and networks, security technologies, and advanced functional material.

Source: "Eleventh Five Year Plan 2007-12, Volume I," Planning Commission website,
<http://planningcommission.gov.in/plans/planrel/fiveyr/welcome.html>, accessed 16 November 2010.

Opportunities — Eleventh Plan programmes

Nuclear research

- Development of new techniques for uranium exploration to increase installed capacity based on pressurised heavy water reactors (PHWRs)
- Development of material, equipment and processes for fast breeder reactors (FBRs)
- R&D on advanced fuels for FBRs, fuel reprocessing, fuel chemistry and other safety studies; separate training school for an Atomic Minerals Directorate for Exploration and Research

Space science and technology

- Development of launch vehicles
- Building capacities in space communications and navigation
- Institutionalisation of tele-education and telemedicine
- Promotion of spinoffs in the disciplines of human resource development, space science and technology education, industry-academia interface and international cooperation

Biotechnology research

- Priority areas including the development of improved crops, functional foods, nutraceuticals and nutritional food to combat malnutrition, bioprocessing and scaling up for the production and manufacture of biologicals, R&D on bio-drugs, vaccines, biological reagents and adjuvants, diagnostics, implants, devices, medical bioinformatics, clinical research, stem cell research, regenerated medicine, nano-biotechnology applications.
- Establishment of centres of excellence within existing universities
- Development of appropriate infrastructure for R&D, including large animal house facilities for testing candidate vaccines, DNA and stem cell banking facilities, depositories of biological material and testing facilities for genetically modified organisms

Source: “Eleventh Five Year Plan 2007-12, Volume I,” Planning Commission website, <http://planningcommission.gov.in/plans/planrel/fiveyr/welcome.html>, accessed 16 November 2010.

Note

Wherever applicable, numbers in the report have been rounded off to the nearest whole number.

Conversion rate used: US\$ 1 = INR 48

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