UNESCO Science Report
Towards 2030

Focus on
INDIA

Presentation by Susan Schneegans, Editor-in-Chief of the UNESCO Science Report, to students and staff from Indian Institutes of Technology

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Message 1: India’s world share of research spending and publications has progressed faster than its contribution to the global research pool

*India = 17.5% of world population*
*China = 19.3% of world population*

**RESEARCH EXPENDITURE:** between 2007 and 2013,
- global research spending progressed faster (+30.5%) than the global economy (+20.1%);
- high-income countries’ share of research expenditure dropped from 80% to 69%;
- China’s world share progressed from 10.2% to 19.6% (*China is an upper middle-income country*);
- the world share of lower-middle income countries (including India) progressed slightly: 4.1% → 4.6%;
- India’s world share of research spending rose from 2.7% (2007) to 3.2% (2011)

**RESEARCHERS:** between 2007 and 2013,
- the number of researchers worldwide increased by 21%;
- high-income countries’ share of researchers dropped from 70% to 64%;
- China’s world share progressed from 16.7% (2009) to 19.1% (2013) *N.B. USA = 16.7% in 2012*;
- The world share of lower-middle income countries dropped slightly: 6.9% → 6.4%;
- India’s world share of researchers remained stable: 2.6% (2005) → 2.7% (2010)

**PUBLICATIONS:** between 2008 and 2014,
- the number of scientific publications worldwide (Web of Science) grew by 23%;
- high-income countries’ share of publications dropped from 79% to 71.5%;
- China’s world share doubled to 20.2%;
- the share of lower-middle income countries rose from 5.7% to 6.8%;
- India’s world share of scientific publications rose from 3.6% to 4.2%
Much of the current convergence results from the progression of large emerging economies like China, India and the Rep. of Korea and the drop registered in high-income countries such as Canada, France, Italy, Japan, the Russian Federation, UK and USA.

**Figure 1.7** World shares of GDP, GERD, researchers and publications for the G20*, 2009 and 2013 (%)

*G20 = 64% of global population, 92% of research spending, 87% of researchers, 94% of publications, 94% of USPTO patents*
Message 2: **India’s national innovation system is becoming increasingly business-oriented**

The Indian economy is dominated by services (57%), compared to 13% for manufacturing. The Modi government wishes to develop export-oriented manufacturing to combat ‘jobless growth’.

Public and private enterprises performed nearly 36% of research and development (R&D) in 2011, up from 29% in 2005.

Industrial investment in R&D grew by 250% between 2005 and 2010.

Total domestic expenditure on R&D remained stable between 2005 and 2011 (0.81% of GDP), meaning that government commitment to R&D receded (Argentina = 0.60%, South Africa = 0.73%, Brazil = 1.15%, China = 2.08%, EU average = 2.02%;).

The government plans to raise the GERD/GDP ratio to 2% by 2018 (STI policy of 2013), half of which is to come from the business enterprise sector. This target was originally fixed for 2007 (S&T policy of 2003).
Message 3: The amount of research conducted by Indian industry remains modest

Figure 1.2: GERD performed by business enterprises as a share of GDP, 2005–2013 (%)
Message 4: **The innovation culture in India remains restricted to a small number of industries**

More than half of business research expenditure is distributed across just three industries: pharmaceuticals, automotive and IT (computer software).

Six industries concentrate about 85% of research expenditure, within a handful of large firms.

India has one of the world’s most generous tax regimes for R&D but these have largely favoured pharma; the government needs to support the emergence of technology-based start-ups to widen the innovation culture in India.
Message 5: **Innovative firms are concentrated in just a few states**

Six Indian states (out of 29) concentrate:

- 46% of research expenditure
- 80% of granted patents
- 58% of value-added manufacturing
- 78% of foreign direct investment

Namely, the States of:

- Maharashtra
- Gujarat
- Andhra Pradesh
- Telangana
- Karnataka
- Delhi
Message 6: **Pharma firms are domestic, IT firms are foreign**

A steep rise in overall patenting and the share of high-tech patents; high-tech products now account for 7% of manufactured exports; A steep rise in foreign multinational firms (mainly IT); They now account for 82% of domestic USPTO patents (2013), compared to 23% in 1995; pharma (mainly domestic firms) has receded in importance, IT is filling the gap.

![Graph showing IT and Pharma patents](chart.png)

**IT firms in India tend to be foreign-owned**

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic IT-related patents (number)</th>
<th>Multinational companies IT-related patents (number)</th>
<th>Total IT-related patents (number)</th>
<th>Domestic Share (%)</th>
<th>Multinational companies Share (%)</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td>17</td>
<td>97</td>
<td>114</td>
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<td>2009</td>
<td>21</td>
<td>129</td>
<td>150</td>
<td>14.00</td>
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<td>2010</td>
<td>51</td>
<td>245</td>
<td>296</td>
<td>17.23</td>
<td>82.77</td>
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<tr>
<td>2011</td>
<td>38</td>
<td>352</td>
<td>390</td>
<td>9.74</td>
<td>90.26</td>
</tr>
<tr>
<td>2012</td>
<td>54</td>
<td>461</td>
<td>515</td>
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<td>89.51</td>
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<td>2013</td>
<td>100</td>
<td>1268</td>
<td>1368</td>
<td>7.30</td>
<td>92.71</td>
</tr>
</tbody>
</table>

Source: Computed from USPTO, 2014
Message 7: **The government is encouraging foreign multinationals to set up R&D centres in India and foreign acquisitions by Indian firms**

- **Indian companies have acquired knowledge assets from abroad** through a wave of cross-border mergers and acquisitions, particularly in manufacturing industries such as steel, pharmaceuticals, automotive, aerospace and wind turbines;

- **The government is encouraging this trend** through its liberal policy on foreign direct investment (FDI) in research, removal of restrictions on outward flows of FDI and tax incentives – the government offers one of the most generous incentive regimes in the world;

- **India has become a major exporter of R&D and testing services** to the USA, one of the biggest markets for this.

- **The main policy challenge will be to effect positive spillovers** from these foreign companies to the local economy.
Message 8: India has become a hub for frugal innovation

- One in five Indians still live beneath the poverty line;

- Frugal innovation (or engineering) has developed to serve this mass of consumers but products are now also being exported to the West;

- Frugal innovation encompasses goods and services, with an emphasis on medical devices.

- Examples are: Tata Nano car (pictured), portable electrocardiogram (ECG) machine, portable refrigerator, low-cost maternity hospitals, low-cost financial services.
Message 9: **Pharma and aircraft parts account for two-thirds of high-tech manufactured exports but there are other growth areas**

- **Growth also in biotech**, which received 2.7% of the government outlay to science agencies in 2010: 22% growth on average between 2003 and 2014 but the growth rate has slowed over time (about half of production is exported);

- **India is deploying more high-tech services**, thanks to improvements in aeronautic and astronautic segments of the IT industry. Telecom service providers have reacted to a greater diffusion of distance education and distance health (telemedicine) by lowering their tariffs;

- **Since 2013, defence** (32% of government outlay in 2010) **technologies are to be oriented towards commercial markets for civilian use**, a first for India;

- **India plans to become a nanotechnology hub by 2017** – but development is currently oriented more towards building human capacity and physical infrastructure than towards commercialization;

- **India plans to invest more in green energy technologies.**
India is the world’s fifth-largest wind turbine producer.

Solar energy accounts for just 4% of Indian green technologies, compared to 76% for wind energy (plus 10% each for small hydropower and biomass);

Just 0.1% of the government outlay for science agencies went to the Ministry of New and Renewable Energy in 2010, compared to 14.4% for the Dept of Atomic Energy;

Indian investors were granted 9 ‘green energy’ patents in 2010 and 46 in 2012;

The Modi government plans to raise investment in solar energy to US$100 billion by 2022, through ‘green bonds’ and other measures.
Thank you

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