

Book Review

UNESCO Science Report: Towards 2030 by United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris: UNESCO Publishing, 2015, 820 pp.

UNESCO Science Report: Towards 2030 was released in November 2015. It presents developments and activities related to science, technology and innovation (STI), Research and Development (R&D), and higher education development around the world since 2010. The Report consists of three global overview chapters: Chapter 1: A world in search of an effective growth strategy 20; Chapter 2: Tracking trends in innovation and mobility; and Chapter 3: Is the gender gap narrowing in science and engineering? There are also 24 country- or region-specific chapters. More than 50 experts were involved in producing the report, each covering a region or country.

The Report reveals that many countries are now incorporating STI policies to transform their economies into knowledge based ones and reduce dependence on raw materials; implementing policies towards sustainable development and promoting use of 'green' technologies to combat climate change in addition to ensuring energy security. The Report also shows that global expenditure on R&D (2007-2013) grew faster than the global economy despite the financial crisis.

Some key influences on STI policy and governance are identified in this Report: Major geopolitical changes such as the Arab Spring in 2011; the nuclear deal with Iran in 2015; creation of the Association of Southeast Asian Nations (ASEAN) Economic Community in 2015; growing role of STI policy framework in the regional economic communities in sub-Saharan Africa; environmental crises such as the Fukushima nuclear disaster (2011) in Japan which brought about serious rethinking on nuclear power in many countries (e.g. Germany decided to phase out nuclear energy by 2020); and growing natural disasters forcing both developed and developing countries to adopt climate change strategies.

The Report also traces some major global trends in R&D expenditure and concludes that the global financial crisis did not affect global investment in R&D.

In 2013, world Gross domestic expenditure on research and development (GERD) increased significantly and amounted to purchasing power parity (PPP) \$1,478 billion, compared with only PPP\$1,132 billion in 2007. The GERD grew faster than global gross domestic product (GDP), which resulted in global R&D increase from 1.57% (2007) to 1.70% (2013) of GDP. The main drivers were quick recovery of major economies in Asia

such as China and South Korea and the United States and European Union maintaining their own R&D intensity at pre-crisis levels (GERD of the Triad rose well above the 2007 levels).

The Report highlights that between 2010 and 2015 there has been a converging trend among high and lower income countries: disengagement in R&D by the public sector in high income countries such as Australia, Canada, US and a growing investment in R&D in many lower income countries particularly in Africa such as Ethiopia (its GERD of GDP increased from 0.24% in 2009 to 0.61% in 2013) Malawi, Uganda, Cameroon, Kenya, and Rwanda, mainly driven by increased investment by both the public and private sectors. Among the BRICS (emerging economies of Brazil, Russia, India, China and South Africa) countries, both public and private R&D have progressed significantly. Among EU countries, public R&D increased only in Germany while it declined in France and the UK.

The Report is concerned about the lower level of investment in basic research across many countries and raises the question: ‘what is the optimal balance between basic and applied research?’ and warns that “in the race to improve national competitiveness, countries may lose sight of the old adage that ‘without basic science, there would be no science to apply’”.

The Report also shows how gap in R&D expenditure is narrowing among the top ranking countries. The US still ranks number one, with 28% of global investment in R&D. But China is catching up fast with 20% of global share ahead of the EU (19%) and Japan (10%). The share of the rest of the world is just 23%. Notably, the combined global Business Expenditure on R&D (BERD) share of China and India (between 2001 and 2011) jumped from 5% to 20% and their contribution to the global stock of knowledge is rapidly rising.

In terms of global trends in human capital, the Report says that although there has been a notable increase in the number of researchers, there is little change in the global balance and the EU remains the world leader in terms of its global share of researchers, with 22.2%. A notable development is that China (19.1%) has overtaken the USA (16.7%) since 2011. Both Japan and Russia have seen their world share of researchers decline between 2007 and 2013 from 10.7% to 8.5% and from 7.3% to 5.7% respectively. These last five countries still account for 72% of world researchers.

Another interesting development is the rapid increase of international students at Doctoral level. It was found that students from the Arab States, Central Asia, sub-Saharan African and Western Europe were more likely to study abroad than their peers from other regions.

The Report is concerned that women constitute a minority in the research world whereby they are constrained by limited access to funding than men and less represented in prestigious universities and among senior faculty. It identified Southeast Europe (49%) and the Caribbean, Central

Asia and Latin America (44%) as regions having the highest shares of women researchers. However, the Report found that globally, women have achieved parity (45–55%) at the Bachelor's and Master's levels, where they represent 53% of graduates. At the PhD level, the share is 43%.

The trend in knowledge generation shows that the world shares of both the EU and the US have fallen and China's share increased rapidly between 2010 and 2015. Research publications in China have nearly doubled to 20% of the global output (from about 5% 10 years ago) reflecting “the coming of age of the Chinese research system” (p.17).

In terms of specialisations in scientific disciplines, there are large differences among countries. France's scientific strength still seems to lie in mathematics. The US and UK focus more on life sciences and medicine and Japan on chemistry, France on mathematics, Russia on physics, astronomy, geosciences, mathematics and chemistry, Brazil on agriculture and life sciences, Malaysia on engineering and computer sciences. China's scientific output shows a fairly well-balanced pattern, with the exception of psychology, social and life sciences

The Report also traces the patenting behaviour which provides insights into the impact of innovation. Unsurprisingly, high-income economies dominate the Triadic patents (the same invention being patented by the same inventor in the USA, EU and Japan). But what is interesting is that both the Republic of Korea and China have made inroads into Triad patenting. Between 2002 and 2012, Korea's share almost doubled to 5.5% and China's share jumped from 0.5% to 3.6%. The share of other G20 members doubled to 1.6%. The Report also revealed the extreme concentration of patent applications in North America, Asia and Europe, while the rest of the world's share amounted to a meagre 2%.

Overall, the Report provides a mine of information, statistics, in-depth analysis on STI policies and governance, research investment, higher education, patenting and women researchers at three levels: global, regional and country. There are extensive resources provided across chapters in the Report which is 820 pages long and can serve as a useful reference for researchers and policy makers working in the STI areas.

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