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on Borderless Higher Education

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The global race for STEM skills

Higher education is often seen as an export industry in the developed world, but the economic crisis has exposed once again its role as a driver for economic growth. Investment in STEM (science, technology, engineering and mathematics) disciplines is increasingly seen in the US and Europe as a means to boost innovation, particularly in **manufacturing**, the sector which helped Asian economies grow exponentially over the last two decades. A debate on the importance of science education is brewing on both sides of the Atlantic but gets particularly heated when it intersects with immigration.

A 'STEM cliff' in the US

In no other country is this debate fiercer than the US. Currently, all foreign graduates are eligible to stay in the country for 29 months after they graduate. Most of them do so. According to a**2012 report** by the National Science Board, two-thirds of the international students who received a PhD in a science subject in 2004 were still in the country in 2009.

Imported talent is necessary to meet increasing demand for STEM skills. According to a **report**by the Information Technology & Innovation Foundation in 2010, the number of STEM graduates will have to increase by 20-30% by 2016 to meet the projected growth of the US economy. Overall, STEM employment grew three times more than non-STEM employment over the last twelve years, and is expected to grow twice as fast by 2018.

The political establishment and the business community have acknowledged the need to import international talent. In a rare moment of bipartisan agreement, the House of Representatives passed the **STEM Jobs Act 2012** in November. It was later blocked by the Senate, but is expected to be **reintroduced** in amended form in

2013. This piece of legislation will make 55,000 visas available to immigrants who hold PhDs and Master's degrees in STEM fields from US universities, thereby exempting them from immigration quotas.

Both Barack Obama and Mitt Romney supported the Act during their campaigns, recognising that foreign STEM students are job-creators. A recent University of California-Berkeley and Duke University **study** found that 25% of engineering and tech companies set up in the US between 1995 and 2005 had at least one foreign-born founder. The benefits to US workers are obvious. According to a 2011 **report** by the American Enterprise Institute and the Partnership for a New American Economy, every foreign-born worker with a STEM degree creates an average 2.6 extra jobs for native-born workers.

These numbers do not convince the anti-immigration lobby, which claims that the import of skilled labour suppresses wages, thereby disincentivising STEM graduates from seeking careers in these fields. It also encourages high school students to apply for degrees in other subjects, such as law and business. More than anything else, anti-immigration groups claim that foreign STEM graduates returning to their home countries steal from America the valuable skills that are necessary in the global race for innovation.

Some even question the alleged shortage of STEM skills. A much-debated **2007 Urban Institute report** claimed that data do not support the case of a labour shortage in STEM fields. According to **Norm Mattlof**, a professor of computer science at UC-Davis, salary data for ICT graduates show that there is no spike in demand for these skills in the US.

An indication of stagnant demand might be the fact that for every STEM graduate who works in a STEM field there are another three who work in non-STEM fields. However, this might just be an indication of how important STEM skills are across all sectors - a point made by Euan Robertson, Executive Vice-President of the **New York City Economic Development Corporation (NYCDC)**, in an interview {link} with the Observatory. An example is the increasing commercial use of **big data** in various industries, a trend that will boost the demand for workers with analytical skills.

What the anti-immigration lobby perceives as a lack of demand for STEM skills in the US can be explained by the increasing location mismatch between employers and employees. Over the last two decades several US firms have moved their R&D operations offshore, which diminishes the number of STEM jobs in the US. Demand has not dropped, but has relocated to economies such as China and India. A consequence is that STEM graduates in the US are less employable and their salaries are kept relatively stagnant, although still high enough by international standards.

One could also claim that outsourcing is preferred by US companies precisely because there is a lack of affordable skilled labour in the US, particularly in comparison to the BRIC countries. But recent **wage rises in China** have instigated a slow repatriation of R&D activity to North America and Europe, which means that a future suppression of STEM wages in the US might not be a bad thing after all.

A skills crisis in Europe

Europe is in a similar position to the US, but with less flexible immigration policies. Unemployment is on the rise across Europe but in STEM fields the real problem is a shortage of skilled talent.**Cedefop**, the Thessaloniki-based European Centre for the Development of Vocational Training, predicts that by 2015 there will be a shortage of

between 380,000-700,000 ICT workers in Europe. Germany alone was short 114,000 STEM-skilled workers in 2011.

STEM supply has remained relatively stagnant over the last decade. According to a **2011 report**by BusinessEurope, a lobbying group representing national business organisations, interest in undertaking STEM studies is dropping in many EU countries, and the share of STEM graduates fell in relation to the total number of graduates from 24.8% in 1999 to 22.7% in 2005.

Moreover, Europe attracts fewer high-skilled workers than the US, Canada and Australia. Only 3% of scientists in the EU come from non-EU countries, whereas in the US 16% of scientists come from abroad. Internal mobility has also been stagnant. In 2011 only 2.4% of Europeans lived in another member state.

The skills crisis has prompted some policy reforms. The European Commission passed the **Blue Card Directive** in 2009 (it is **yet to be fully implemented** in all member states) which makes it easier for foreign researchers to work in Europe. The European Higher Education Area is also expected to boost labour mobility within the EU, as workers will have comparable and compatible qualifications.

China on the rise

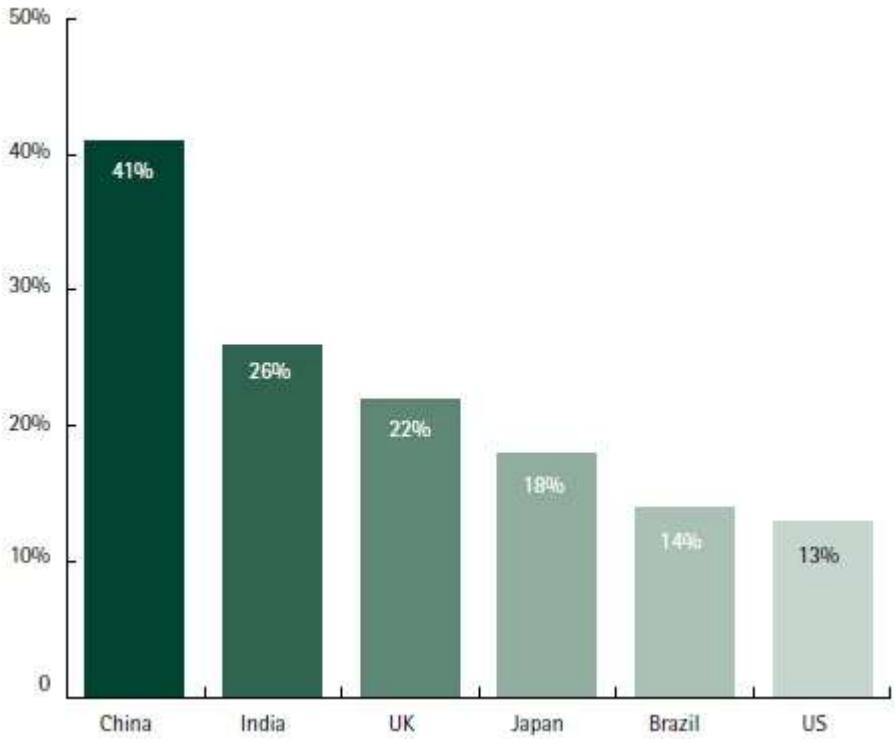
China plans a long-term funding programme for science and technology that aims to kick-start knowledge-based sectors to supplement its thriving manufacturing sector*.

This policy is driven by a broader shift in economic policy. Soon after the global economic crisis emerged in 2008, Chinese leaders decided to restructure the economy from an export-oriented model to a domestically-driven one, a shift that requires diversification of the economy and investment in innovation.

During the 11th five-year guideline (2006-10), investments from the Ministry of Science and Technology totalled 200bn yuan ($32bn). According to **Bai Chunli**, president of the Chinese Academy of Sciences, China's R&D investment stood at 861bn yuan ($138bn) in 2011, making China the second biggest R&D investor in the world. Chunli estimated that by 2020 China's investment in science and technology will account for 2.5% of the country's GDP, exceeding 2 trillion yuan.

The results are already visible. As shown by the graphic below, a staggering 41% of all degrees awarded by Chinese institutions in 2011 were in a STEM subject, almost twice the proportion of STEM degrees awarded in the UK and three times the rate in the US.

China now stands behind only the United States in the number of science and technology journals published annually, and is expected to overtake the US in scientific output within few years, according to a recent **study** by the Royal Society, the UK's science academy. The study notes however that China still lags behind most developed countries in terms of job-creating quality research.



STEM degrees as % of all degrees in 2011

(Source: Accenture Institute for High Performance)

The rest of the world is catching up

India and Brazil are rapidly increasing their STEM enrollments, as local companies operating in capital-intensive sectors become world leaders and need skilled workers. Accenture predicts that Brazil will increase its engineering graduates by 68% by 2015 and will produce more PhD engineers than the US by 2016.

The global race for STEM skills might become even more competitive in the near future, as several countries in Africa and Asia are planning to reverse the brain drain by imposing thresholds on outbound mobility and by providing incentives to foreign-educated graduates to return home. These graduates are seen to be particularly entrepreneurial. In 2011, some 30-40% of start-ups in Bangalore and Beijing were set up by STEM graduates of US universities.

A global labour market

A global labour market is already here, but we lack the institutions to make it work effectively. **Accenture affirms** that the real problem for the world economy is not a global shortage of STEM skills, but the location mismatch between employers and employees. Talent cannot move to where the jobs are.

Governments should work together to address this issue. Free trade agreements for example could include provisions for student and labour mobility. A case in point is the proposed **free trade agreement** between the EU and the US. That should include measures facilitating the free movement of students and skilled workers, perhaps through quotas.

Finally, location mismatch can be a powerful argument in the hands of universities lobbying for pro-immigration reforms. Universities usually advocate for reforms on the ground of expected revenue from international students, but more prominence could be given to the importance of international talent as a driver for innovation and economic growth.

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*The Observatory wishes to thank Mr Mike Gow of INTO for providing insight into China's economic policy.