be applied across the country. In fact, an economic growth strategy report released in April called for childcare capacity to be increased by 400,000 nationwide.

Why the sudden focus on such a progressive issue from a man who refuses even to consider a popular amendment to Japanese law that would allow the imperial line to pass through female members of the family? The momentum for change seems to be coming largely from a recognition of economic and demographic realities. Japan's population, and its labour force, are shrinking, and its economic competitiveness is faltering. The country has been frittering away a resource that could help to meet these challenges. And the call is getting louder.

In 2010, for example, the investment bank Goldman Sachs, headquartered in New York, released a widely cited report on 'Womenomics' in Japan stating that closing the country's gender gap — bringing the employment rate of women up to that of men — would increase the workforce by 8.2 million and boost gross domestic product by 15%.

Such figures have grabbed the attention of business leaders. Companies are more likely to allow flexible working hours for mothers, for example; government officials are making women's issues part of their political platforms; and 'Abenomics', as the prime minister's aggressive financial and economic plans are called, seems to be endorsing Womenomics (see page 548). But will the right improvements be made?

The problem facing women in Japan has nowhere been as glaring as in science and engineering. The country has taken steps to remedy the situation, but there is much more to be done. In 2006, for example, the science and education ministry brought in a programme to improve support systems for female scientists. Renewed in 2011, the programme has so far supported projects at 88 universities and research institutions.

These projects led to increased on-campus childcare facilities and practical support for scientists with children. Most universities now have at least one childcare centre. Another programme, launched by the science ministry in 2009, and called Supporting Positive Activities for Female Researchers, has funded 5-year programmes at 12 universities to increase the number and promotion rate of female faculty members. These 'affirmative action' programmes have ramped up the number of female scientists, especially at higher-level positions.

And such policies have created momentum. At institutions that implemented the plans, the proportion of women among the research staff grew from 12.5% in 2005 to 15.4% in 2011. Nationwide figures have risen from 11.9% to 13.8% over the same period. But this increase is too slow. Japan still has the lowest number of females as a percentage of total science researchers in developed countries, according to figures collected by the science ministry. A new innovation policy from the Council for Science and Technology Policy, currently in draft form, calls for the percentage of female new hirings at universities and research institutes to reach 30% by 2016. It is an ambitious goal, considering that this figure now is just over 20%.

"The Japanese government seems to be waking up to women's potential importance to the economy."

Ensuring equal opportunities for women scientists is a global problem. But Hisako Ohtsubo, a molecular biologist at Nihon University near Funabashi, says that Japan is more than 25 years behind some countries, noting that the US National Science Foundation brought in such policies in the 1980s. To catch up, the government should expand its programmes, which have so far been short-term and on too limited a scale, and ensure that they encourage women not only to engage in science but also to fight for leadership positions in the scientific community.

With competition growing, especially from China and South Korea, Japan's position as a scientific power is no more secure than its status as an economic power. The Japanese government seems to be waking up to women's potential importance to the economy. Making the most of their talent could be just as potentially transforming for Japanese science. The Abe government needs to stick by his promises and take the targets seriously. ■

Without borders

Increasing scientific globalization is welcome, but could compromise national efforts.

"It might be a good idea," the US journalist Bill Vaughan once suggested, "if the various countries of the world would occasionally swap history books, just to see what other people are doing with the same set of facts."

History is famously written by the winners, and does tend to huddle inside national boundaries. Science is different, or so researchers like to believe. It is an international process. Facts are shared. Differences are ironed out. Scientists know what other people are doing. Correct?

Yes and no. As an impressive analysis of some 25 million research papers in a Comment on page 557 shows, international collaboration plays an increasing part in twenty-first-century research. The growth in scientific output from the United States and western Europe in the past three decades, for example, is entirely down to international collaboration. The number of journal articles that feature authors entirely from a single country in those regions has remained the same.

Only because of global links can the UK government claim, as it did in a 2011 report, that the country creates "14 per cent of the world's highly cited output" with just "4 per cent of the world's gross expenditure" on research and development. Most of those high-impact papers include the contribution of a foreign scientist. In fact, in 2010, the number of 'British' papers produced with help from abroad exceeded those made entirely in Britain for the first time.

According to the US National Science Foundation, almost one-quarter of global research articles in 2010 featured authors from more than one country, up from 10% in 1990. The average number of authors has doubled since 1980 and now stands at 4.5.

Although *Nature* welcomes the global reach of science, we have previously pointed out that internationalization will rub up against some natural boundaries. National pride and prestige matter, not least because science is still mostly funded and managed on a national basis.

Last October, in a special issue on the globalization of science, we said: "Mobility cannot stretch infinitely: relationships, families and quality of life put limits on how much researchers want to travel, and for how long" (*Nature* **490,** 309–310; 2012). And we pointed out that collaboration could blur the borders of national priorities, especially for countries that are just beginning to develop their science bases.

The science bases of some of the bigger developing economies are coming along just fine, thank you. As the Comment points out, most of the scientific growth in China, Brazil and South Korea is driven by domestic work. And quality is rising. The citation impact of more than 10% of China's domestic research is greater than twice the world average.

What does this mean? A change in international dynamics for starters, as Jonathan Adams points out in the Comment: "The older economies can no longer rely on the best foreign researchers to come and visit."

There are opportunities galore in this new world, but Adams also highlights some of the threats. The best institutions in different countries already tend to work together the most. Others can find it hard to join this global competition. "There is a growing divide between international and domestic research," Adams notes. "This will influence each nation's ability to draw on the global knowledge base, and could in turn compromise national scientific wealth." It is not just between nations that science must be shared, but within their borders too. ■

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