FIVE IN ASIA

HONG KONG, MALAYSIA, SINGAPORE, SOUTH KOREA AND TAIWAN ARE INVESTING HEAVILY IN RESEARCH AS AN ENGINE FOR GROWTH.

BY RICHARD VAN NOORDEN

Which economies invest the most in research and development (R&D)? The answer might not be what you think. South Korea ploughs a whopping 4.24% of its gross domestic product (GDP) into science and technology — neck and neck with Israel, and putting much of Europe and the United States to shame. Taiwan also invests heavily, beating science heavyweight Japan in 2016 in terms of the share of its economy devoted to R&D.

In East Asia, several science powerhouses are investing strongly in science. Although mainland China and Japan get much of the attention here — they are the area's biggest economies and have giant scientific workforces — South Korea, Taiwan, Singapore and Hong Kong have established themselves as strong supporters of research, and Malaysia is fast growing its scientific output.

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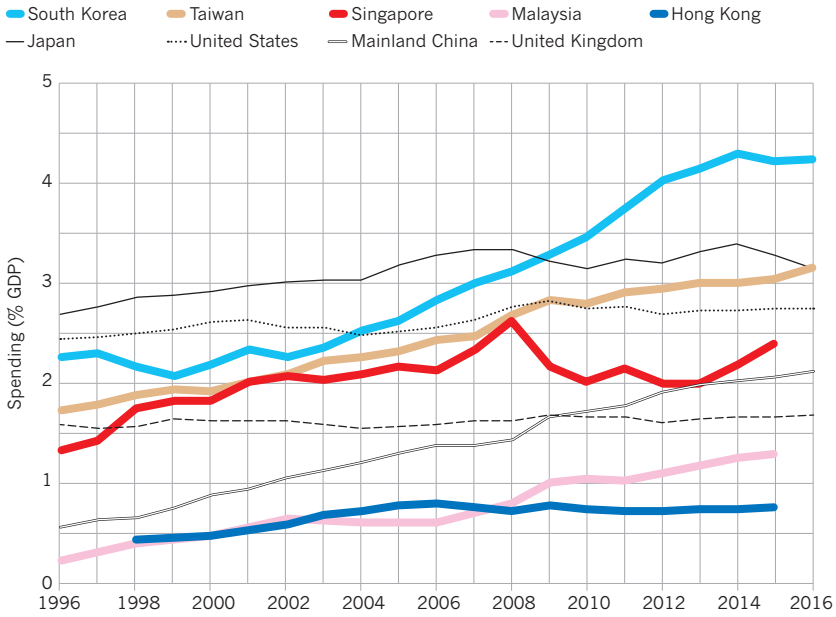
SPENDING

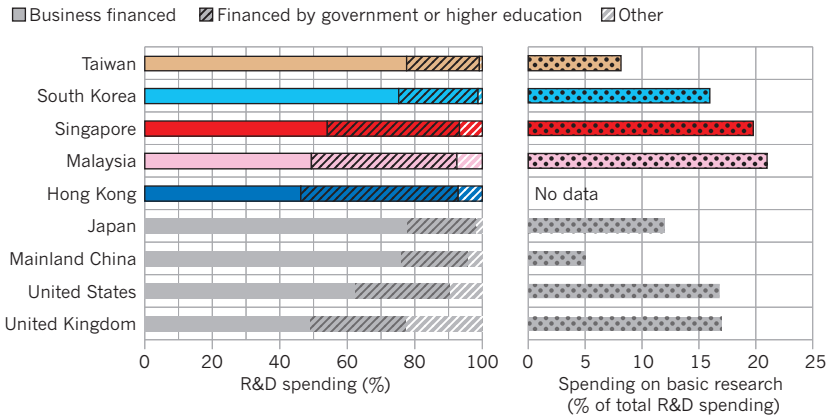
Research and development (R&D) investment is rising rapidly in South Korea, Taiwan and Malaysia — albeit from different bases. In two decades, South Korea has close to doubled the share of its economy spent on research. Taiwan's proportion is not far behind, and it overtook Japan in 2016. Singapore's spending was keeping pace with Taiwan's, but has dropped off because of a decline in business R&D spending. Only Hong Kong's investment has plateaued in the past decade or so.

SOURCE: UNESCO/OECD



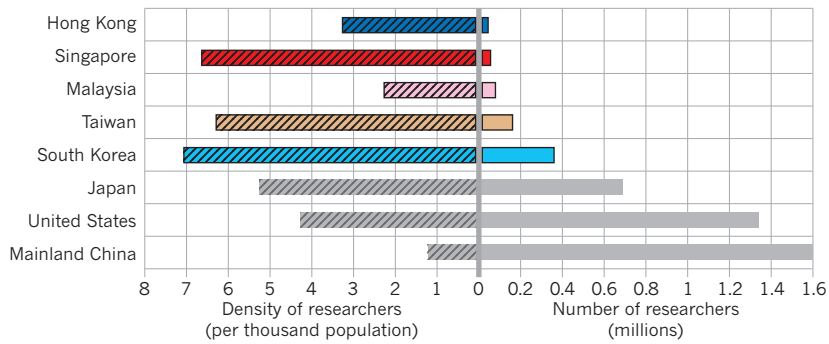
BUSINESS VERSUS GOVERNMENT

Taiwan and South Korea's R&D investment comes mainly from the business sector, and the proportions invested in basic research are accordingly lower. In Singapore, Malaysia and Hong Kong, businesses provide around half the R&D financing, more like the United States and United Kingdom.



SCIENCE WORKFORCE

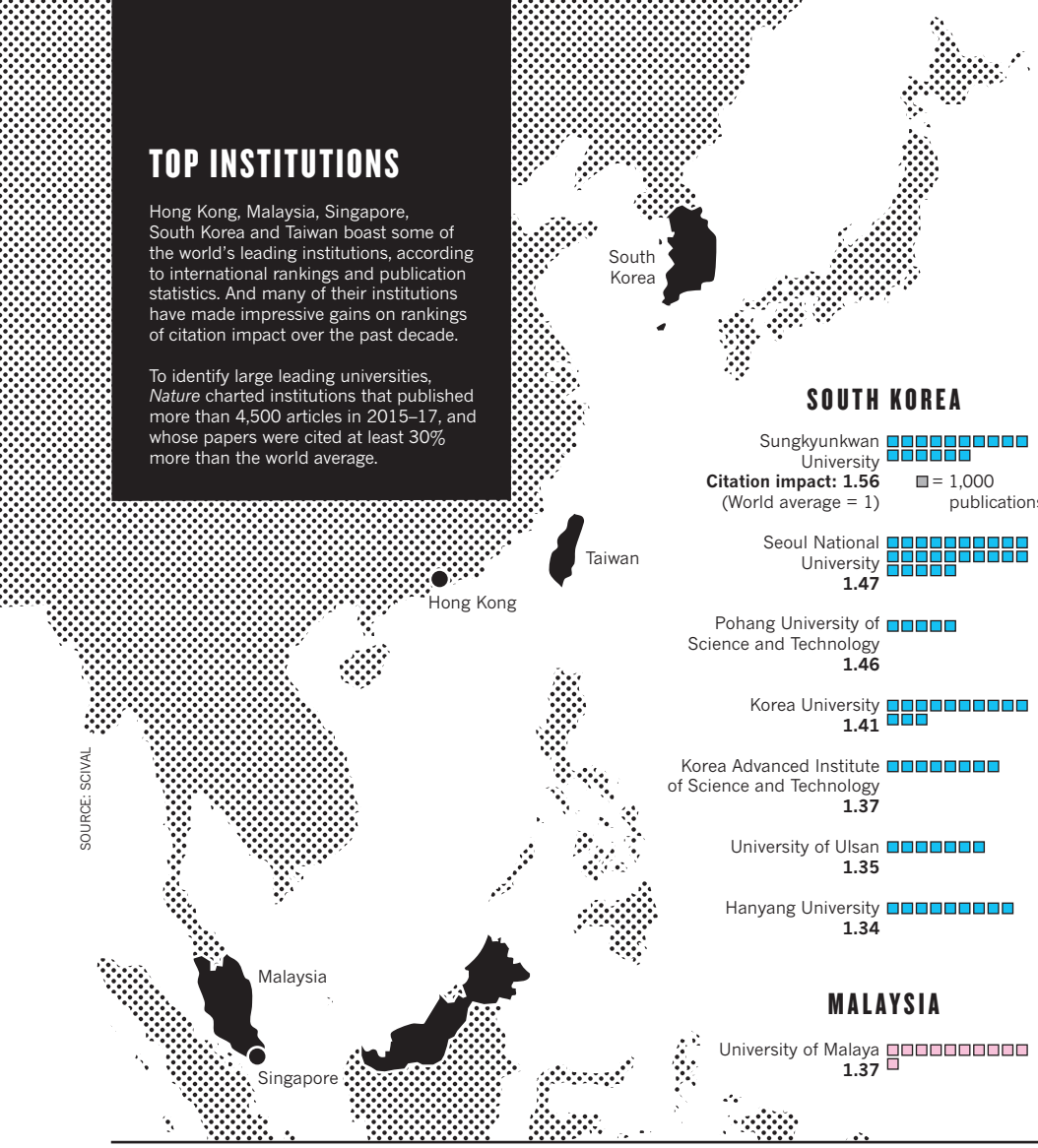
After mainland China and Japan, South Korea has the most researchers in East Asia — and Malaysia has grown its science workforce to a point where it is now ahead of Singapore and Hong Kong. But in terms of researcher density, South Korea, Taiwan and Singapore stand out.



TOP INSTITUTIONS

Hong Kong, Malaysia, Singapore, South Korea and Taiwan boast some of the world's leading institutions, according to international rankings and publication statistics. And many of their institutions have made impressive gains on rankings of citation impact over the past decade.

To identify large leading universities, *Nature* charted institutions that published more than 4,500 articles in 2015–17, and whose papers were cited at least 30% more than the world average.



SOURCE: SCIVAL

SOUTH KOREA

Sungkyunkwan University
Citation impact: 1.56
(World average = 1)
■ = 1,000 publications

Seoul National University
1.47

Pohang University of Science and Technology
1.46

Korea University
1.41

Korea Advanced Institute of Science and Technology
1.37

University of Ulsan
1.35

Hanyang University
1.34

MALAYSIA

University of Malaya
1.37

HONG KONG

Hong Kong University of Science and Technology
2.00

Chinese University of Hong Kong
1.94

City University of Hong Kong
1.90

The University of Hong Kong
1.84

Hong Kong Polytechnic University
1.73

TAIWAN

National Tsing Hua University
1.65

National Taiwan University
1.45

Academia Sinica
1.37

SINGAPORE

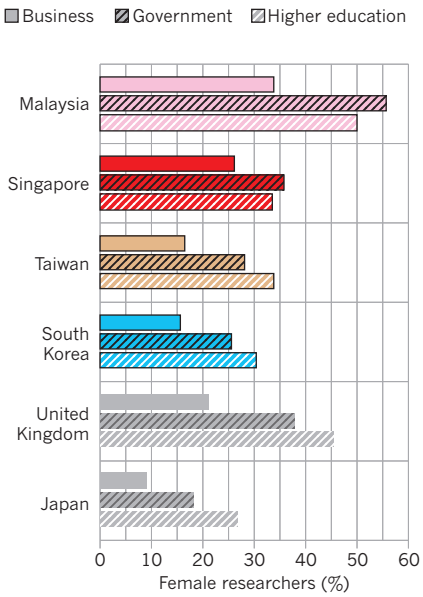
Agency for Science, Technology and Research
1.96

Nanyang Technological University
1.84

National University of Singapore
1.75

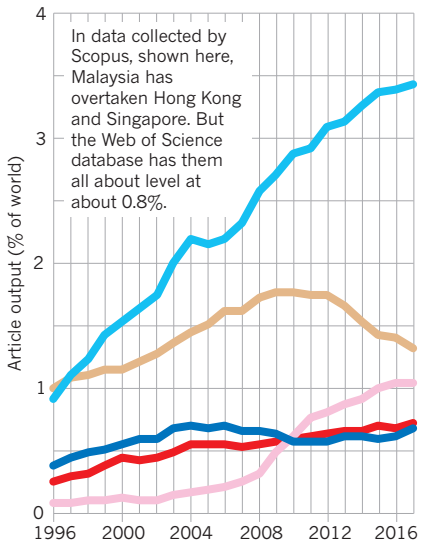
FEMALE RESEARCHERS

Female researchers are under-represented in many Asian economies, as they are across the world. But almost half of Malaysia's researchers are female, and the United Nations says that Malaysia is a world leader in encouraging girls and women to participate in science.



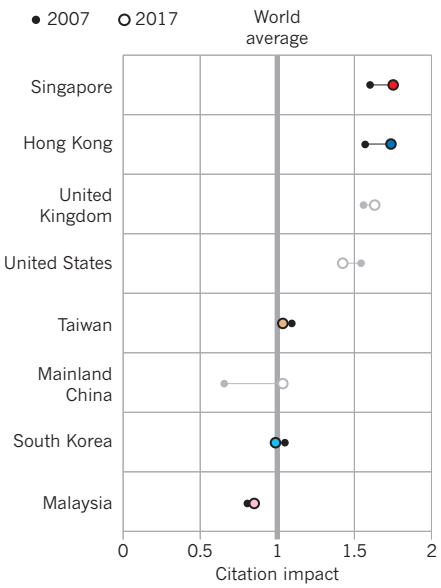
ARTICLE OUTPUT

South Korea's research output had soared to some 65,000 research articles in the Scopus database last year. (By comparison, mainland China produced more than 414,000 articles and scientists in Japan published 89,000). Taiwan's output is dipping as a proportion of the world's research, but Malaysia's volume is rising fast.



CITATION IMPACT

Singapore and Hong Kong have stretched their lead over the United States and United Kingdom in terms of the average scholarly impact of their publications — with normalized citations far above the world mean. One reason is that these economies have very high rates of international collaboration, which is linked to increased citations.



SOURCES: FEMALE RESEARCHERS: UNESCO/OECD; ARTICLE OUTPUT, CITATION IMPACT: SCIVAL