

November 2023

East Asia Education Insights

East Asia's Research Activity in Review part 1 (of 2)

China and northeast Asia

Introduction

This report is part one of a **two-part series** examining research output across East Asia.

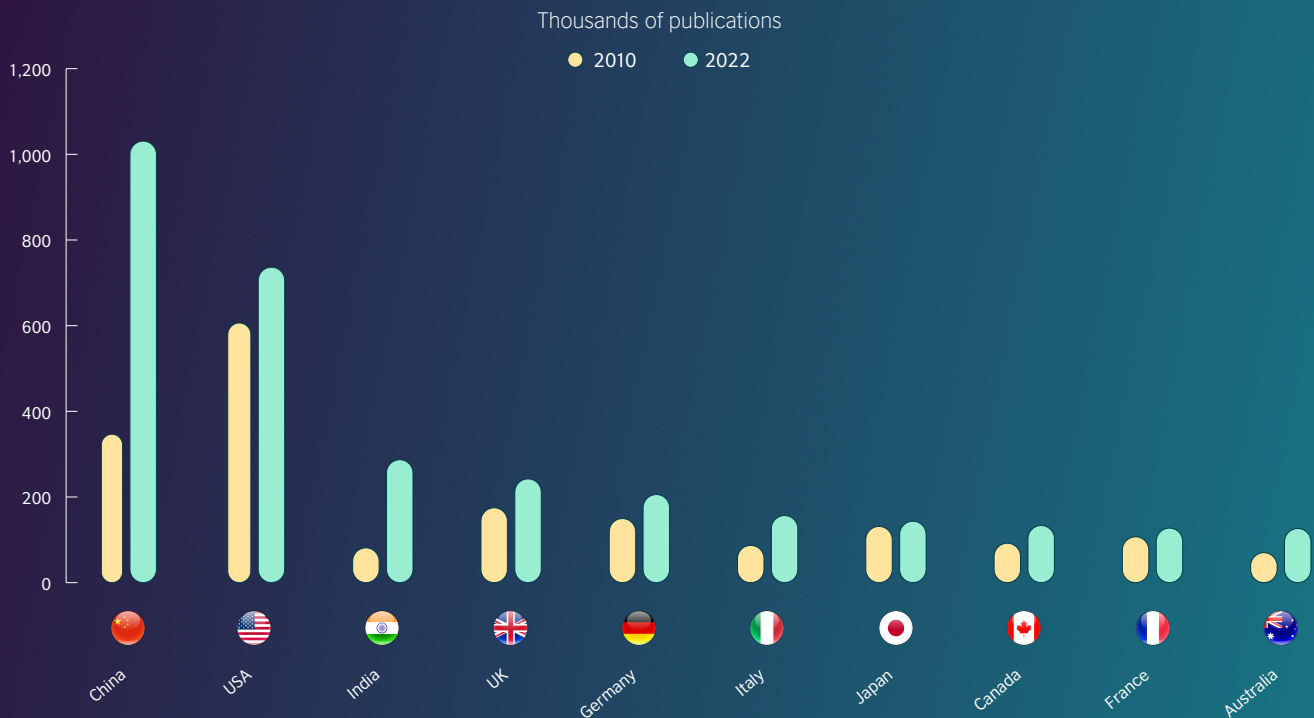
Part 1 focuses on mainland China and the rest of northeast Asia (Hong Kong SAR, Japan, South Korea and Taiwan).

Part 2 will look at research trends in the 10 countries of Southeast Asia.

Global view - mainland China

China is now the world's largest producer of research

Scholarly output of world's largest producers of research



Mainland China's research output has left the rest of the world in the dust. In 2020, China overtook the United States as the top producer of scholarly research for the first time. By 2022, it produced 40 per cent more output than the U.S., and through the first seven months of 2023, researchers in China produced 46 per cent more publications than their America counterparts.

Over this same period, China's share of global research output has also surged, from less than 14 per cent of all scholarly publications in 2010 to 25.6 per cent in 2022. So far in 2023, China's portion of global research has increased again – now surpassing 27 per cent¹.

Among the developing world, China has no research peer. While the regions of South Asia and Africa have also recorded impressive growth rates in research output – publications have more than tripled in both regions from 2010 to 2022 – China continues to publish nearly twice as much research as South Asia and Africa combined.

Source: SciVal

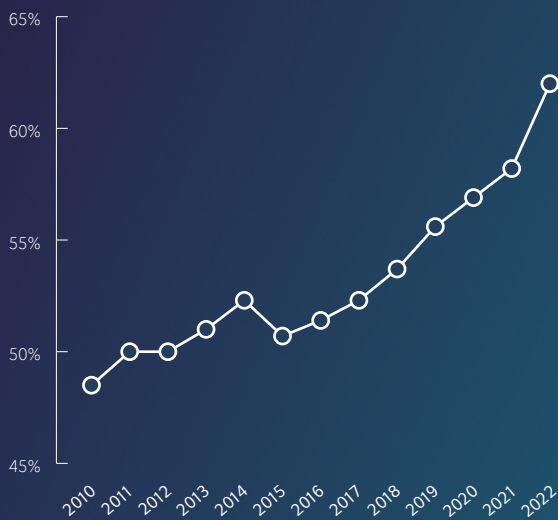
Note: All mentions of China in this report refer to mainland China only, unless otherwise specified.

1. All data as of 31 July 2023.

Regional view - mainland China

China accounts for more than 60 per cent of all research output in East Asia

China as % share of East Asia's total research output



Annual % change in research output



Within East Asia, China has long stood alone in terms of total research output. In recent years, its lead has only grown, with research publications in China increasing at a faster rate than the rest of the East Asia region¹ in 10 out of the last 12 years. Over this period, China's share of the East Asia region's total research output surged from 48.5% in 2010 to 62.0% in 2022.

Since 2018, only three other producers of research in East Asia have increased research output at a faster annual rate than China's 13.8%: Brunei and Vietnam saw average annual growth of 19.6% in research publications from 2018 to 2022, with the Philippines increasing 18.5% per annum. Yet combined, these three producers of research accounted for only 1.7% of total research output in the region in 2022, putting them in a different class than China.

The other major producers of scholarly research in East Asia – Japan (8.6% of regional output in 2022), Australia (7.6%) and South Korea (6.2%) – have seen research production grow at far more modest rates since 2018. Japan's research output has increased only 0.7% per year since 2018, while Australia grew 3.2% per year and South Korea by 4.2%.

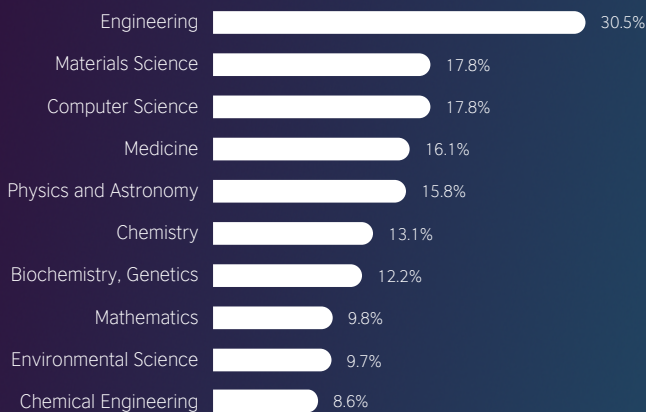
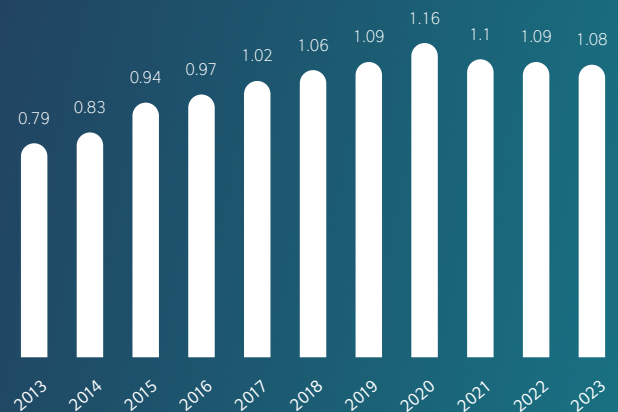
Source: SciVal

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1. East Asia consists of: Australia, Brunei, Cambodia, mainland China, Hong Kong SAR, Indonesia, Japan, South Korea, Laos, Malaysia, Myanmar, Philippines, Singapore, Taiwan, Thailand, and Vietnam.

Research quality - mainland China

STEM subjects continue to dominate China's research output

China's most frequent research subjects¹, 2018-23²China's research impact (FWCI³)

The vast majority of China's research output continues to be in STEM-related subjects, particularly engineering. Over the last five years, China's top 13 most frequent areas for research were all in STEM subjects. Over this period, more than 30 per cent of all research publications in China were related to engineering, compared with only 13.8% in the UK and 13.7% in the United States.

This disparity in research subjects is likely driven by greater funding opportunities for engineering-related subjects in China, which is in turn driven by the needs of industry.

In terms of research impact, the field-weighted citation impact (FWCI) of China's research output has plateaued in the last three years, after steadily improving from 2013 to 2020. China surpassed the global average FWCI in 2017 for the first time and peaked in 2020.

Compared with its regional peers, China's FWCI ranked 12th out of 16 producers of

research in East Asia in 2022, indicating that China may struggle to improve the overall 'quality' of its research at the same rate that it has improved the quantity of its output. Relatively low and declining rates of international research collaboration in China may be partly to blame (see next page), as publications with authors residing in multiple countries are generally cited far more often than research produced only domestically. As a greater proportion of China's research is produced domestically, language barriers may also contribute to falling numbers of citations.

Source: SciVal

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1. Research publications can be mapped to multiple subject areas, so the sum of all publications by subject area is greater than 100%.

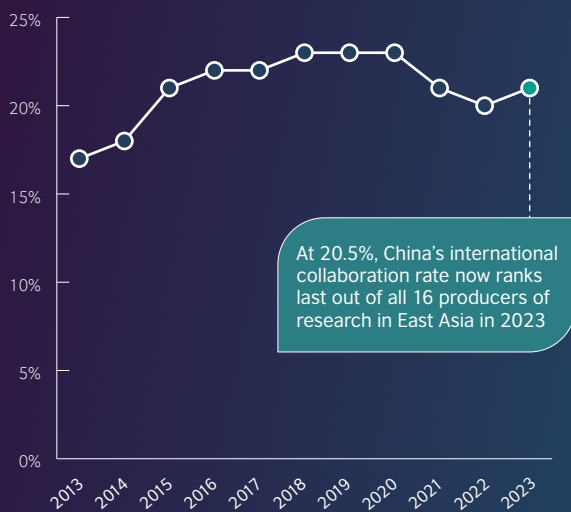
2. All data as of 31 July 2023.

3. Field-weighted citation impact is a measure of research quality that compares the number of citations research publications receive against the expected number received by similar publications, with 1.0 representing the global average.

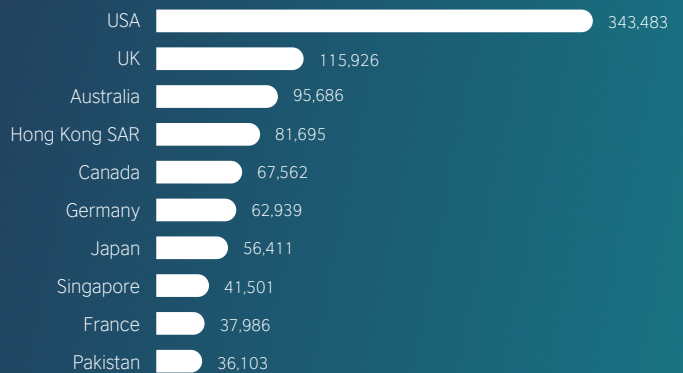
International collaboration - mainland China

China's international collaboration rate remains low, ranking last in the East Asia region since 2022

China's share of research publications with international co-authors



China's top international research partners (2018-23¹)



Source: SciVal

Note: All mentions of China in this report refer to mainland China only, unless otherwise specified.

1. All data as of 31 July 2023.

The rate at which researchers in China collaborate with international partners is far lower than the regional average. Over the last five years, China ranks 15th out of 16 producers of research in East Asia in international collaboration rate, ahead of only Indonesia. While the absolute number of China's research publications with international co-authors continues to increase, the share of these publications in the country's total output has fallen.

The proportion of China's research publications that include international co-authors peaked in 2018 at 23.1% and dropped to 19.8% by 2022. In the last two years, China has ranked last in the East Asia region in its international collaboration rate, with far reaching implications for the citation impact of the country's research output (see previous page).

This dynamic may also be driven in part by geopolitics, with academics in the countries/territories with which China collaborates most frequently also reluctant to pursue some research links. Since 2018, 22.8% of all Chinese research publications with international co-authors were produced with academics in the United States. Of China's 10 next most frequent international partners, eight are close U.S. allies, with the exception of Hong Kong and Pakistan.

Regardless of the cause, the world's largest producer of academic research in volume terms also collaborates internationally at significantly lower rates than most other major research producers.

 Key takeaways

China is the world's top research market, but its researchers are increasingly disconnected from the rest of the globe

China is a research juggernaut **BUT** It is also facing serious challenges

① China produces more research than any other country – and it's not even close. In 2022, scholarly publications in China outnumbered research output in the UK and U.S. combined.

② Despite its enormous size, China's research output continues to grow at an impressive clip, nearly tripling from 2010 to 2022. China now produces more than 62 per cent of all research output in East Asia.

③ So far in 2023, China has increased its share of global research output, singlehandedly accounting for more than 27 per cent of worldwide research publications. This is nearly double China's share of worldwide research publications in 2010.

① The impact of China's research output, as measured by field-weighted citation impact, appears to have plateaued. After improving every year from 2013 to 2020, China's FWCI has declined every year since 2020.

② The share of China's research produced with international co-authors – never high to begin with – has also steadily declined since 2018. Lower rates of international collaboration contribute to declining research impact.

③ Amid rising geopolitical tensions, the willingness of researchers in other countries to collaborate with their counterparts in China may continue to fall, even in less sensitive fields.

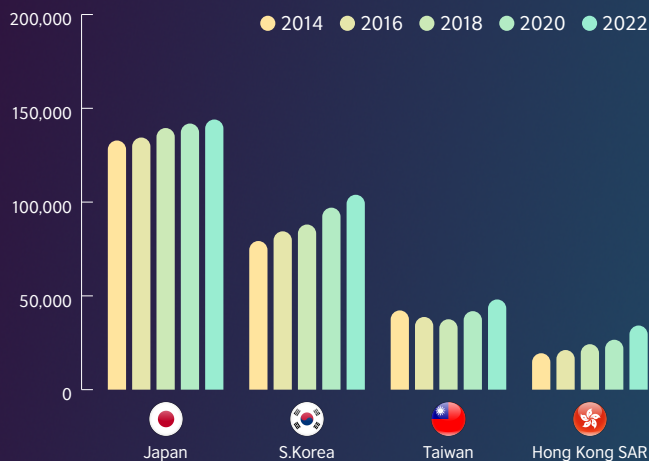
Source: SciVal

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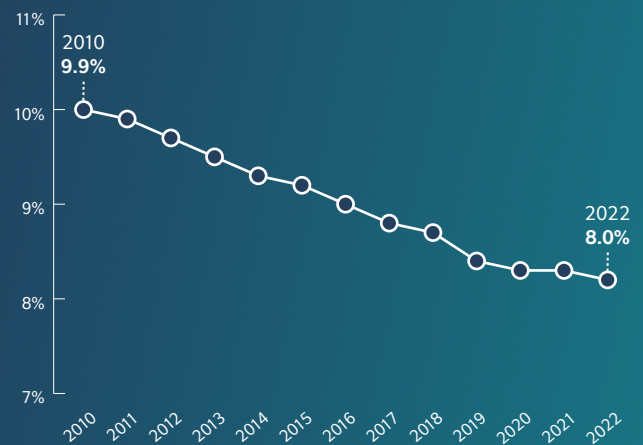
Global view - northeast Asia

While the rest of northeast Asia's global significance has waned, the region cannot be overlooked

Research publications in northeast Asia, over time



Northeast Asia's research publications as % of global output



Northeast Asia¹ is broadly viewed as the developed portion of East Asia, with income levels approaching— if not exceeding— those in Western Europe and North America. The four countries/territories in northeast Asia outside of China are also home to some of the world's lowest fertility rates, leading to rapidly aging societies and slowing economic growth rates. Against this backdrop, the research systems in all four locations are often mistakenly believed to be in decline.

Yet a closer look reveals that research output continues to grow in each of the four producers of research in northeast Asia¹, especially outside of Japan. From 2010 to 2022, research publications grew by a modest annual rate of 0.8% in Japan and 1.4% in Taiwan. Yet over this same period, research output increased by 4.5% per year in South Korea and 6.5% in Hong Kong SAR – both higher than the average 4.1% annual growth rate worldwide.

In the aggregate, northeast Asia's share of global research activity has slowly but steadily declined, from 9.9% in 2010 to 8.0% in 2022². Yet even as the region's global footprint has shrunk, the impact of its research continues to exceed the global average (again, outside of Japan). Moreover, the frequency with which researchers in the region collaborate internationally is also on the rise, and this trend is likely to gain steam.

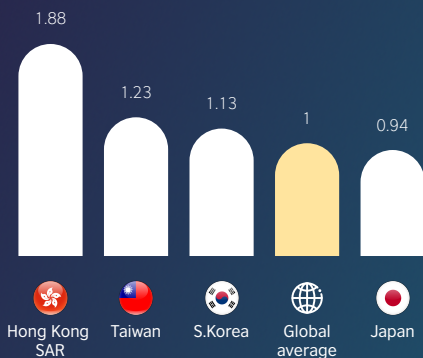
Given rising rates of research output in northeast Asia, as well as high levels of research impact and increasing openness to international collaboration, UK researchers may need to take a second look at developing partnerships in the region.

Source: SciVal

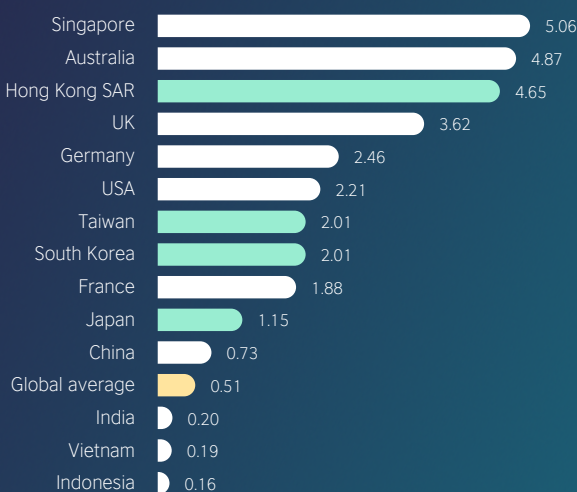
1. All mentions of northeast Asia in this report refer to these four countries/territories: Hong Kong SAR, Japan, South Korea, and Taiwan.
2. The regional research total is smaller than the sum of all reporting by the countries/territories in northeast Asia due to removal of joint publications that are counted in the national totals of two or more countries/territories in the region.

Regional view - northeast Asia

Japan lags the rest of northeast Asia in per-capita research output and citation impact

Field-weighted citation impact² (2022)

Research publications per 1,000 people (2022)



Source: SciVal, World Bank, EF

1. EF English Proficiency Index, 2022

2. Field-weighted citation impact is a measure of research quality that compares the number of citations research publications receive against the expected number received by similar publications.

In terms of output, the four producers of research in northeast Asia are more analogous to their peer countries in Europe and North America than other parts of East Asia. Hong Kong, for example, produces more research publications on a per-capita basis than the UK, while researchers in Taiwan and South Korea publish more frequently than their counterparts in France.

While all four countries/territories in northeast Asia exceed the global average number of publications per person, Japan is a relative laggard in the region. Per-capita research production in Japan is closer to the global average than it is to Taiwan's or South Korea's figure; its research output is also four times lower than the population-weighted production of Hong Kong, despite comparable levels of economic development in the two locations.

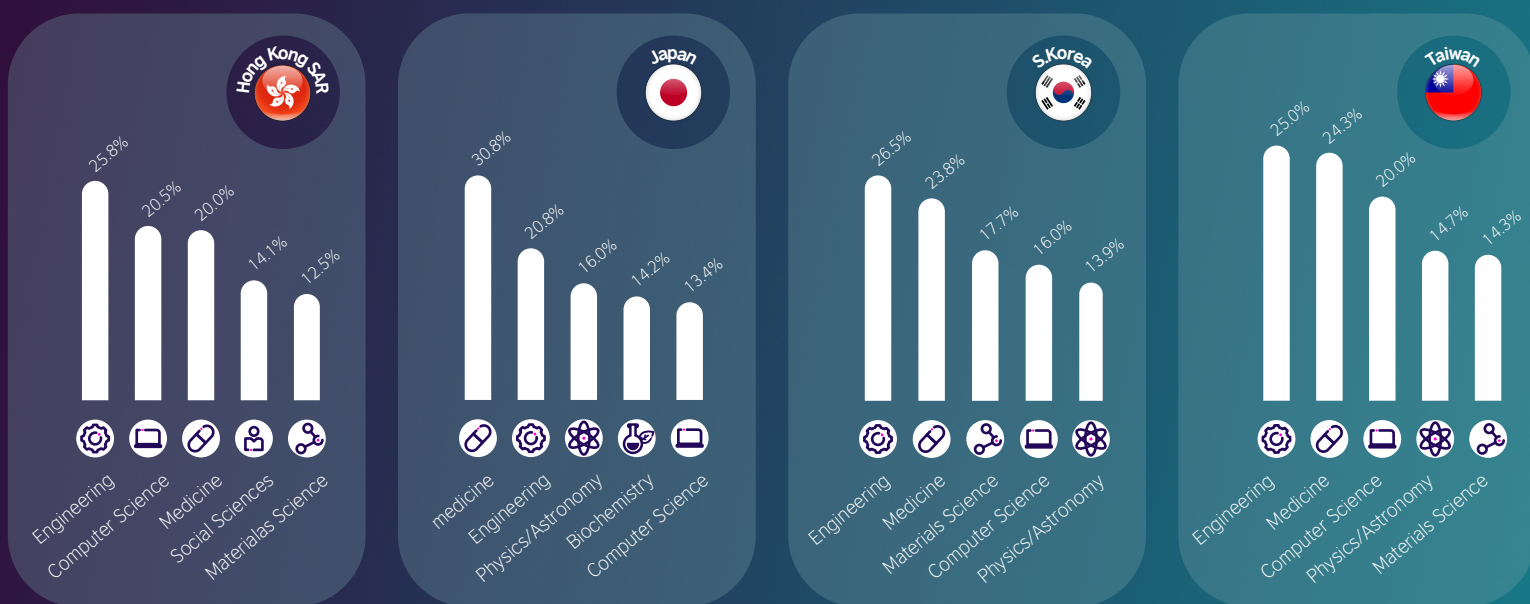
A similar dynamic plays out in terms of research impact. The field-weighted citation impact (FWCI¹) of Hong Kong's research output – a proxy for the quality of its publications – is among the world's highest. The research produced in Taiwan and South Korea is also cited more often than the global average.

However, once again, Japan is the weakest performer in northeast Asia, with the research produced by its academics consistently cited at lower rates than the other three producers of research. Japan's relatively poor performance may be partly explained by linguistic barriers; research written in non-English languages is less likely to be cited, and Japan has a lower level of English proficiency¹ than the other three profiled countries or territories which may make Japanese researchers more likely to publish in their native language.

Research subjects - northeast Asia

STEM subjects continue to dominate northeast Asia's research output

Top 5 research subjects (2018-23¹)



Despite all four producers of research in northeast Asia having reached income levels that are comparable with European and North American countries, research funding and the needs of local industry that underpin R&D spending remain heavily skewed toward the hard sciences. In particular, engineering-related subjects are the most frequent research topic in three of the four countries/territories in northeast Asia, while STEM subjects more broadly dominate research output throughout the region.

Medicine also ranks among the top three most common research subjects in all four countries/territories. This is not surprising, given both high income levels in all four locations – wealthier societies tend to spend a greater share of their national income on health care – as well as the rapidly aging populations in all four countries/territories. In this regard, the four producers of research in

northeast Asia more closely resemble Western countries – nearly 30% of research output in the UK is related to medicine – than their peers in other parts of East Asia.

Meanwhile, Hong Kong is the only country/territory in northeast Asia in which social science subjects feature among the five most common research topics. From 2018 to 2023, research related to social sciences made up 14.1% of research output in Hong Kong, not far off the 16.3% of all research publications in the UK. However, over this same period, only 7.8% of Taiwan's research output was related to the social sciences, while South Korea (5.9%) and Japan (4.3%) were even further behind.

Source: SciVal

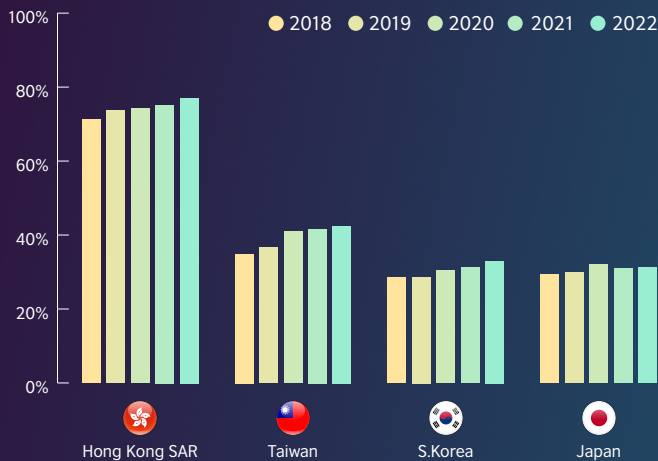
Note: Research publications can be mapped to multiple subject areas, so the sum of all publications by subject area is greater than 100%.

1. All 2023 data through 31 August 2023

International collaboration - northeast Asia

Collaboration rates are rising throughout northeast Asia, with the UK a top research partner

International collaboration rates in northeast Asia



Top 5 international research partners (2018-23¹)

Rank	Hong Kong SAR	Japan	South Korea	Taiwan
1	China	USA	USA	USA
2	USA	China	China	China
3	UK	Germany	India	Japan
4	Australia	UK	Japan	India
5	Canada	France	UK	UK

The rate at which researchers in the four countries/territories in northeast Asia collaborate with international co-authors ranges widely, yet it has trended upward in all four locations over time.

While Hong Kong continues to collaborate internationally at far higher rates than academics in the other three locations in northeast Asia, this discrepancy owes in large part to Hong Kong’s unique status as a Special Administrative Region of China. Researchers on the mainland are categorised as international co-authors when collaborating with academics in Hong Kong; and they collaborate at amazing rates: Hong Kong produced more publications with co-authors in mainland China from 2018 to 2023¹ than it did with its next nine largest international research partners combined. This makes Hong Kong officially one of the world’s most open locations to international research collaboration – ahead of even Singapore and

well in front of the UK – but the data comes with a significant caveat.

The rate at which researchers in the other three producers of research collaborate with co-authors in other countries/territories has also quietly increased in recent years. Despite facing language and geographic barriers that make international research collaboration often challenging, researchers in Taiwan and South Korea collaborated internationally at all-time high rates in 2022, while academics in Japan were only slightly off their peak reached in 2020.

Moreover, the UK remains a top-5 research partner nation for all four research locations in northeast Asia, despite only having deep historic ties with Hong Kong.

Source: SciVal

1. All 2023 data through 31 August 2023

Key takeaways

UK researchers have room to increase collaboration with partners in northeast Asia

Developed yet still developing

While all four producers of research in northeast Asia are developed economies, they continue to develop: research output, international collaboration, and citation impact in the region are all on the rise.

- However, northeast Asia’s share of global research output is slipping.

On a per-capita basis, northeast Asia's research output already rivals peer countries in Western Europe and North America.

- Yet STEM subjects continue to make up a far larger share of research output in northeast Asia than in Western countries.

The UK could collaborate even more in northeast Asia

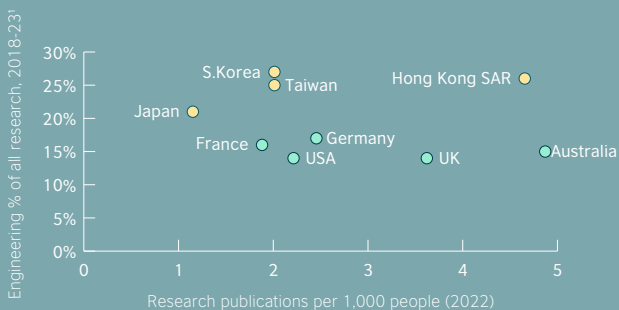
The UK is already a top-five global partner for international research collaboration with all four producers of research in northeast Asia.

- Only the US, China and the UK are among the top-five research partners in all four countries/territories in northeast Asia.





But the relative importance of the four countries/territories in northeast Asia to researchers in the UK lags both China and the US.

- There is room for UK researchers to increase collaboration rates further with co-authors in northeast Asia.

Engineering dominates research in northeast Asia



Where northeast Asia countries/territories rank among all international research partners for China, USA and UK

	 Hong Kong	 Japan	 South Korea	 Taiwan
China	4th	7th	11th	12th
USA	26th	8th	13th	19th
UK	32nd	15th	27th	41st

Source: SciVal, World Bank,

About the British Council in East Asia

We support peace and prosperity by building connections, understanding and trust between people in the UK and East Asia. We work with governments and our partners in the education, English language and cultural sectors, creating benefit for millions of people across Asia Pacific. We work directly with individuals to help them gain the skills, confidence and connections to transform their lives and shape a better world.

About our work building Education Partnerships

We enable teaching and research partnerships between Higher Education Institution in the UK and Asia Pacific to address shared global challenges through the exchange of learning and ideas. We deliver a number of programmes for Higher Education institutions, which can be found [here](#). We also deliver programmes on behalf of funding organisations, like the UK's new **International Science Partnerships Fund**, which we hope will be informed by this analysis.

About International Science Partnerships Fund

The International Science Partnerships Fund is designed to enable potential and foster prosperity. It puts research and innovation at the heart of our international relationships, supporting UK researchers and innovators to work with peers around the world on the major themes of our time: planet, health, tech, and talent. It's managed by the Department for Science, Innovation and Technology. Delivered by a consortium of the UK's leading research and innovation bodies.



*Questions
or
Comments?*

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