



# MAPPING SCIENCE AND TECHNOLOGY INNOVATION HUBS

Developed to evaluate innovation hubs worldwide, the Global Innovation Hubs Index highlights the roles of scientific research, a vibrant economy, and an open environment for driving innovation.

## As the fourth industrial

revolution gets underway, we are seeing rapid technological advancements, from biotechnologies to quantum information and artificial intelligence, which bring significant economic and societal changes. To benefit from these advancements, countries are pursuing science and technology innovations to drive their economies. As some cities or metropolitan areas bring scientific research and businesses together, innovation hubs emerge, leading technological transformation and economic development with new ideas and technologies. They also connect the world to innovation outcomes with extensive research and economic networks.

How best to characterize these innovation hubs, and evaluate their innovation capacities? At the 2020 Zhong Guan Cun Forum held in Beijing, China, a high-profile international

conference focusing on science and technology innovation, a report, titled Global Innovation Hubs Index (GIHI), was released, attempting to address these questions. A collaborative effort by Tsinghua University and Nature Research, it sets up an index system, and gives a preliminary worldwide ranking of science and technology innovation hubs of global influence.

"Ranking these innovation hubs worldwide is not easy, as we had to collect multi-dimensional city-level data, which are usually very limited," says Ling Chen, a professor from Tsinghua University in Beijing, whose team led the effort, which was sponsored by the Beijing Science and Technology Commission.

"We hope our efforts can give a framework for evaluating science and technology innovation hubs, help them identify ways to improve

capacities," she says.

## Evaluating innovation capacities

According to the report, for a city to be categorized as a science and technology innovation hub, it first needs to have a strong research base, with some leading universities or research institutions that serve as a source of knowledge creation, along with abundant human resources, including leading scientists, who produce high-quality research output, supported by state-of-the-art facilities.

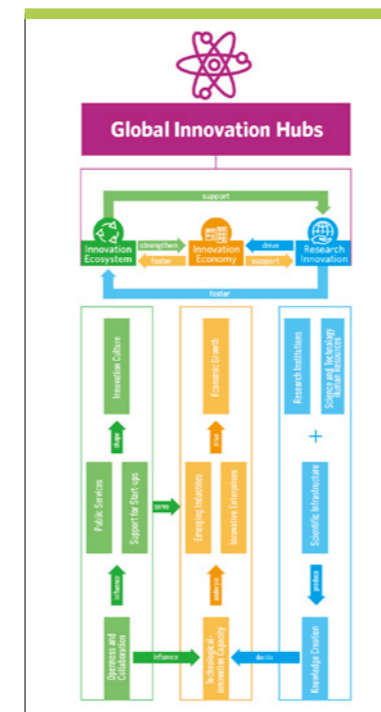
It also needs to have a vibrant technology-driven economy, represented by high output of invention patents, a cluster of high-tech enterprises, with profits of scale for emerging industries, and healthy economic growth.

A supportive ecosystem for innovation is essential, including, an open environment that features active international science and technology

collaboration and extensive involvement in the globalized economy, demonstrated by high foreign direct investment; strong support to start-ups, with the ability to raise finance for them; established public service infrastructure, particularly for supporting digital technology and global exchange; and an attractive city culture that brings innovative and entrepreneurial minds together.

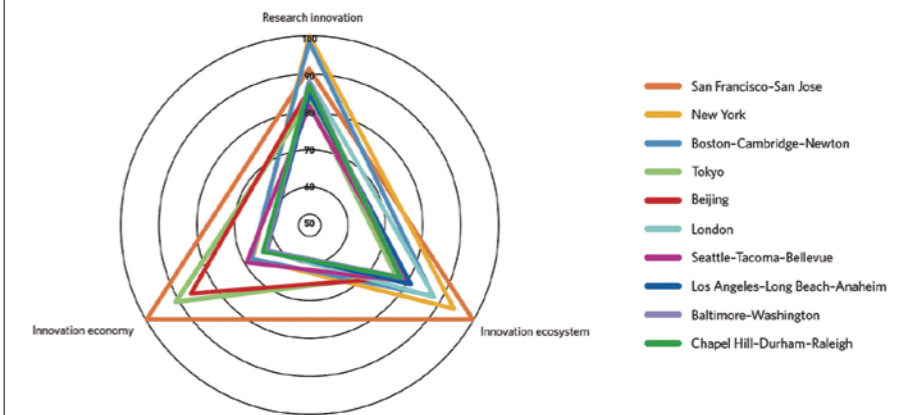
Based on these three major dimensions, indicators are developed, forming a framework to measure a city's innovation capacities. Data on a total of 31 specific metrics are collected. "In the selection of these metrics, we need to consider their relevance to innovation capacities, data availability, and whether they are quantifiable measures that allow cross-city comparisons," Chen says.

A sample of 30 cities or metropolitan areas, which are



## DEVELOPMENT MODELS OF GLOBAL INNOVATION HUBS

Based on the overall ranking of global innovation hubs and their scores on level-1 indicators, the innovation development patterns of the top 10 cities are shown.



renowned regional innovation hotspots distributed across the globe, is selected for analysis. Hubs are defined by their 'research boundaries', considering that an innovation hotspot is usually associated with a leading research institution in its vicinity; a metropolitan area, thus, may include a grouping of cities that are closely linked. They also tend to feature geographic clustering of high-tech companies and excellent transport links, both within the hub and to other global cities.

## Diverse patterns of global innovation hubs

In the ranking, US metropolitan areas dominate, having seven innovation hubs listed among the top 10; San Francisco, New York, and Boston are the top three. London is the only European city in the top 10, while Asia has two. Ranking fifth, after Tokyo, Beijing is the only Chinese city in the global top 10.

A closer look at the index shows varied innovation patterns of these global innovation hubs. San Francisco metropolitan area probably has the most balanced

development in terms of research innovation, innovation economy and ecosystem, ranking among the global top three in all the three dimensions. Particularly, it is leading in innovation economy and ecosystem, possibly given the vibrant growth of a cluster of high-tech companies in Silicon Valley, supported by an active innovative culture.

The other two US cities in the top three are also performing well in all the three dimensions. The two Asian cities, Tokyo and Beijing, are among the top three in innovation economy, while lagging slightly in innovation ecosystem, compared with the others among the top 10. In contrast, London is ranked among the top three in innovation ecosystem and performing well in research innovation, while ranking relatively low in innovation economy.

Looking at the leading cities in research innovation, again, with six of the top 10 cities, US dominance is clear, while only two are European cities. Beijing is one of two Asian cities on the list, ranked eighth. Its strength in research innovation can probably

be explained by its concentration of leading research institutions and big science facilities, as the report shows, perhaps given recent investment for research and relevant infrastructure construction.

For innovation economy, Asian cities are performing well, with seven ranking among the global top 10, including six in East Asia and one in West Asia (Tel Aviv). They are developing fast in digital economy and some emerging industries. The other three are US cities, with San Francisco leading, and the other two trailing behind Asian cities.

US cities are also ranking high in innovation ecosystem, having seven cities on the top 10 list. Europe has two cities, while Singapore is the only Asian metropolitan area on the list.

Big cities with large populations, like New York, London, Beijing and Tokyo, have their advantages, the report shows. They normally have a concentration of premier universities or research institutions, as well as multinational companies, with vibrant international exchanges in

both research and economy. The development of digital technology and economy has also seen some smaller cities, particularly those with leading universities, like the Research Triangle (Chapel Hill-Durham-Raleigh) and Boston in the US, emerging as innovation hubs. These smaller cities, like San Francisco and Seattle, are also likely to have developed supportive ecosystems for innovation.

The report demonstrates that a strong research base, vibrant economic development, and supportive ecosystem are all important elements for a global innovation hub. To sustain growth, a balanced development of these elements is needed.

"We also welcome suggestions to improve the innovation index system," Chen says. "Our core members of the GIHI research team, Xin Li and Jun Sun, are already planning for the future study now." ■



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