
Prospects for scientific and technological cooperation between Spain and China

Mario Esteban | Senior Analyst for Asia-Pacific, Elcano Royal Institute, and Professor at the Autonomous University of Madrid | @wizma9 

Andrés Ortega | Senior Research Fellow, Elcano Royal Institute | @andresortegak 

In the course of only a few years, **China** has become a first-rank scientific and technological power (in both quantitative and qualitative terms) and is determined to close the existing gap with the US. The International Monetary Fund estimates that by 2026 China will have surpassed the US in R&D spending. Already China is the leading investor in such key strategic sectors as **Artificial Intelligence (AI)**, accounting for 48% of global investment in AI (compared with only 38% in the US and 14% in the rest of the world). Furthermore, China is now shaping the future of global technology at the level of products and users. China is installing more industrial robots than any other country. It has 56 'unicorns' (private technology companies worth more than US\$1 billion), although in 2014 it only had eight. China's growth rate in this area, according to the World Economic Forum, is beginning to be comparable with the US.

Spain, for its part, has a mature science and technology system, dominated by certain technological sectors and with leading research centres that could be of interest to China. But Spanish investment in R&D is still insufficient: 1.19% of GDP compared with an EU average of 2%. Such a context gives rise to interesting opportunities for cooperation between the two countries in basic and applied research. These are both underdeveloped areas of the Spain-China relationship when compared with the bilateral relationships China maintains with other European countries of similar scientific and technological potential.

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The first step towards deepening this scientific and technological cooperation is to have a precise idea of what the other side can offer and of the benefits that could stem from such bilateral cooperation. The scientific and economic actors of both countries have a tendency to underestimate the capacities of the other, a mutual perception which has led to little cooperation between them. To overcome this obstacle, it would be useful for the Spain-China Mixed Commission on Science and Technology to identify a series of priority sectors for cooperation in which both countries have complementary capacities and interests.

China's priority sectors are identified in the country's 13th Five-Year Plan for Science and Technology (2016-20) and in its industrial strategy, *Made in China 2025*. Some of the possible areas with the most potential for cooperation in basic science include astrophysics, biomedicine, oceanography and supercomputing. From an applied perspective, there is potential for cooperation in modern agriculture and food processing, renewable energies, biotechnology, nanotechnology and new materials (such as graphene), pharmaceuticals, electric vehicles, intelligent cities and industry 4.0.

From the Spanish perspective, devising specific forms of cooperation will require understanding the peculiarities of the Chinese science and technology system (in relation to Spain's traditional partners in these fields) and how the Chinese system will evolve in the short and middle term. Currently, the Chinese system is not yet mature, but it is maturing rapidly, and it will transform substantially over the coming decade. Such changes might not resolve certain fundamental questions that prevent the establishment of a business environment with a degree of liberalisation similar to Spain's. These include lack of transparency, discrepancies in ethical standards for research and application (which can be sensitive in fields like biotechnology and AI) and the maintenance a techno-nationalism in China. This latter phenomenon translates into Chinese state intervention that: (1) supports Chinese companies acquiring technology through the purchase of stock in foreign companies; (2) requires technology transfers from foreign companies that wish to operate in China; and (3) conceives of public finance as support for Chinese companies as opposed to support for technological development (which means a company cannot get Chinese state backing if it is not completely Chinese, leading to overcapacity in many sectors).

Nevertheless, a transition to a more mature science and technology system would facilitate bilateral cooperation in many ways. For instance, the shift in emphasis from technology transfer to technology development will reinforce the recent trend of strengthening the Chinese intellectual property rights and patent system. This suggests some potential since it has been one of the factors most discouraging

Spanish technology companies from establishing a presence in China. The growing emphasis on technological development will also stimulate Chinese research centres and companies to undertake more joint projects with foreign partners. Spanish actors that seek not to sell technological assets in China but rather to join with Chinese capacities for technological co-developments could take advantage of this trend. Furthermore, restrictions on foreign investment are loosening up and a medium-term calendar for further liberalisation has been announced. This allows cooperation in these fields to begin with Chinese players –and to work on how to achieve market access– even before these areas liberalise further. An example is the transport sector, scheduled to be liberalised in 2022. In the same way, over the coming decade the leadership and direction of Chinese research centres and companies will experience a generational change in their leadership, which will pass to individuals much more familiar with Western science and technology systems and with a greater known of foreign languages. Both of these changes will favour bilateral cooperation.

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When seeking Chinese partners, it is necessary to bear in mind that the areas with the highest technological capacities are in **eastern China**, especially in large cities like Shanghai, Beijing, Shenzhen and Tianjin. But the Chinese authorities are more interested in simulating scientific and technological cooperation with cities in the interior of the country, like Chengdu and Chongqing, or in the north-east, like Shenyang and Harbin. Chinese state authorities have set up special zones for such activities where opportunities might arise for Spanish players.

With respect to scientific cooperation, **higher mobility among researchers** between Spain and China should be promoted as a fundamental pillar on which could rest more significant scientific and technological cooperation. Researchers can serve as the nexus between both research centres and companies of the two countries, as a catalyst for joint projects between them, ideally through mixed consortiums aimed at closer application and commercialisation of technologies. These exchanges could be made more robust if there were more interest in taking advantage of European initiatives designed to boost scientific cooperation with China, including EURAXESS and the line item of the Horizon 2020 programme devoted to projects of European entities with Chinese participants. A greater visibility of the experiences of Spanish researchers in China and vice-versa would also help. In this respect, the creation of the [China-Spain Research Network](#) in 2016 was very good news. The opening of a position for a scientific coordinator in the Spanish embassy, like those in the embassies in Washington, London and Berlin, could also serve to stimulate bilateral scientific cooperation.

The institutional framework for technological cooperation between Spain and China is relatively well-developed, but it should be strengthened and streamlined. Cooperation is essentially undertaken by the Spanish Centre for Technological Development (CDTI) and China's TORCH (High Tech Industry Development Centre). Since 2006 they have been developing together the bilateral *Chineka* programme to support the joint development of innovative technology projects between Spanish and Chinese companies. The results have been highly encouraging, although project volume is still modest (six in 2016 and four in 2017). Better coordination is also needed between the different Spanish players –both in the business community and in central and local administrations– since they frequently compete to attract Chinese technology or contribute Spanish technology to China.

In summary, Spanish and Chinese research centres and technology companies are cooperating much less than they could if they had a better knowledge of the mutual capacities and resources that already exist (both within the bilateral and EU frameworks) to help materialise cooperation. Countries in Spain's immediate neighbourhood with comparable scientific and technological capacities are taking better advantage of the possibilities for cooperation with China in science and technology. This suggests that a greater effort in this regard would benefit both countries.