The China-Africa Bond: Science, Technology and Engineering Diplomacy

The next phase of China's relations with Africa should focus on deepening science, technology and engineering cooperation, especially in agriculture

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The challenge for Africa is not the absence of scientific and technical knowledge. What is missing is appropriate institutional arrangements through which scientific and technical knowledge can be transmitted from research facilities to farms.

A key attribute of China's diplomacy in recent years is its increasing presence in Africa. With its rising investments and aid in infrastructure, mining, oil exploration and agriculture in Africa, China is has emerged as a major economic force in Africa.

China's trade with Africa stood at US$ 10 billion in 2000 and is projected to exceed US$110 billion 2011. According to the Chinese Ministry of Foreign Affairs, China's investment in Africa increased from US$22 million in 2000 to US$1.44 billion in 2009. It is notable that Africa's investment in China grew from US$280 million to US$1.31 billion over the same period.

It is expected that China-Africa relations will continue to deepen and evolve in the coming years.

In addition to investment in traditional sectors, there are great opportunities for China-Africa cooperation in science, technology and engineering.

The 2012 Forum on China-Africa Cooperation (FOCAC) will be decisive moment for mapping out new opportunities for charting out new paths that bring science, technology and engineering at the center of the diplomatic cooperation between the two partners.

The Triumph of China's Pragmatism

A key feature of China's economic transformation has been the triumph of pragmatism over ideology. At the center of this practical approach lies a strong technological foundation. Nowhere is this more evident than in China's emphasis on technical training and the role of engineering sciences in solving economic problems.

African countries have been steadily focusing on science, technology and engineering as a critical development driver.

For example, the 19-member Common Market for Eastern and Southern Africa (COMESA) has held two successive summits in 2010 and 2011 on the theme of "harnessing science and technology for development." The 2011 COMESA summit held in Lilongwe, Malawi agreed to establish "science, technology and innovation parks, and priority industry clusters and develop mechanisms for exchange and sharing of experiences."

These and many other decisions of the African Union reinforce the growing appreciation of science, technology and engineering in development. The challenge is finding an entry point for fostering science, technology and engineering cooperation between China and Africa.

An obvious starting point is agriculture. There are two reasons for this suggestion. First, agricultural transformation was one of the first major programs launched by China after the adoption of the 1982 constitution.

Many of the pragmatic approaches adopted by China in agriculture are notable for their creativity and focus. For example, China's mission-oriented Spark Programme and the associated township and village enterprises (TVEs) helped to popularize modern agricultural technology. The impact was truly transformational and has more than 90 percent of the country's counties. Second, African leaders are determined to find a lasting solution to famine. They are approaching this individually and collectively.

These strategies will benefit immensely from cooperation with China in a wide range of fields of relevance to agricultural transformation such as information and communications technology, biotechnology, nanotechnology. But little of it can be absorbed by Africa without fundamental reforms in institutional arrangements to create genuine innovation systems.

The African Agricultural Challenge

In sub-Saharan Africa, agriculture directly contributes to 34 percent of gross domestic product (GDP) and 64 percent of employment. Growth in agriculture is at least two to four times more effective in reducing poverty than other sectors. Growth in agriculture also stimulates productivity in other sectors such as food processing. Agricultural products also compose about 20 percent of Africa's exports. Given these figures, it is no surprise that agricultural research and extension services can yield a 35 percent rate of return, and irrigation projects a 15-20 percent return in sub-Saharan Africa.

Even before the global financial and fuel crises hit, hunger was increasing in Africa. In 1990, over 150 million Africans were hungry; as of 2008, the number had increased to nearly 250 million. Starting in 2004, the proportion of undernourished began increasing, reversing several decades of decline, prompting 100 million people to fall into poverty.

One-third of people in sub-Saharan Africa are chronically hungry — many of whom are smallholder farmers. High food prices in local markets price out the poorer consumers — forcing them to purchase less food and less nutritious food, as well as to divert spending from education and health and to sell their assets. This hunger-weak agricultural sector cycle is self-perpetuating.

Over the last 25 years, growth in agricultural GDP in Africa has averaged approximately 3 percent but has varied significantly among countries. As such, productivity has been basically stagnant over 40 years — despite significant growth in other regions, particularly Asia, thanks to the Green Revolution. Different explanations derive from a lack of political prioritization, underinvestment, and ineffective policies.

Only 4 percent of Africa's crop area is irrigated, compared to 39 percent in South Asia. Much of rural Africa lacks passable roads, translating to high transportation costs and trade barriers. Cropland per agricultural population has been decreasing for decades. Soil infertility is a result of degradation: nearly 75 percent of the farmland is affected by the excessive extraction of soil nutrients.

Fertilizer use in Africa is less than 10 percent of the world average of 100

Triumph of pragmatism over ideology is a feature of the economic shift in China

kilograms. Part of the reason why fertilizer usage is so low is because of the high costs of imports and transportation: fertilizer in Africa is two to six times the average world price. This results in low usage of improved seed: as of 2000, about 24 percent of the cereal-growing area used improved varieties, compared to 85 percent in East Asia and the Pacific. As of 2005, 70 percent of wheat crop area and 40 percent of maize crop area used improved seeds, a significant improvement.

The challenge for Africa if the missing of appropriate institutional arrangements through which scientific and technical knowledge can be transmitted from research facilities to farms. The challenge is there one of institutional innovation. This could form a basis for renewed cooperation between China and Africa.

Fostering Universities

The challenges facing African agriculture will require fundamental changes in the way universities train their students. It is notable that most African universities do not specifically train agriculture students to work on farms in the same way medical schools train students to work in hospitals. Part of the problem arises from the traditional separation between research and teaching — the former is carried out in national research institutes and the latter in universities.

National Agricultural Research Institutes (NARIs) operate a large number of research programs that provide a strong basis for building new initiatives aimed at upgrading their innovative capabilities. In effect, what is needed is to strengthen the educational, commercialization, and extension functions of the NARIs.

More specifically, clustering these functions would result in dedicated research universities whose curriculum would be modeled along full value chains of specific commodities. Internally, the new universities should redefine their academic foci to adjust to the changes facing the continent. This can be better done through continuous interaction with farmers, businesses, government, and civil society organizations. Governance systems that allow for such continuous feedback to universities will need to be established.

Cooperation will not succeed without institutional reform

The reform must include specific measures. First, the universities need a clear vision and strategic plans for training future agricultural leaders with a focus on practical applications. These plans should be prepared in partnership with key stakeholders.

Second, the new universities need to improve their curricula to make them relevant to the communities in which they are located. More important, they should serve as critical hubs in local innovation systems or clusters.Many of the NARIs are located in the proximity of a wide range of productive facilities with which they can foster long-term working relations. They can also branch into new knowledge-based fields.

Third, the universities should give students more opportunities to gain experience outside the classroom. This can be done through traditional internships and research activities. But the teaching method could also be adjusted so that it is experiential and capable of imparting direct skills. More important, such training should also include the acquisition of entrepreneurial skills and other forms of experiential learning.

Fourth, NARIs have extensive programs that involve working directly with farmers. This outreach is a large part of their mandate and efforts to reach farming communities. A "reverse outreach" approach under which farmers and entrepreneurs can selectively participate in "open classroom" programs would help to strengthen extension services.

Fifth, in addition to degree courses, universities for agricultural innovation will also need to extend their reach into the sphere of vocational training. This can be done directly through various programs such as "farmer schools" or in conjunction with high schools.

Sixth, one of the main teaching missions of universities for innovation is to translate ideas into goods and services through enterprise development. Training young people to learn how to create enterprises should be part of the mission of such universities. This can be done in partnership with financial institutions.

Seventh, continuous faculty training and research are critical for maintaining high academic standards. The new universities should invest more in undergraduate agricultural educators to promote research and teaching and to design new courses. Researchers at NARIs would only need minimum training to acquire the necessary pedagogical skills.

Finally, providing tangible rewards and incentives to teachers for exemplary teaching raises the profile of teaching and improves education.

The roadmap outlined above is just one area of science, technology and engineering that China and Africa cooperate on. The specific areas of cooperation could focus on key technology missions such as genomics, space technology, energy and environmental management.

But such detailed areas of cooperation will have little chance for success without the types of institutional reforms that are outlined above. China has extensive lessons to offer Africa on additional reforms needed to create genuine systems of innovation.

If adopted and implemented, these suggestions would herald a new era in international development cooperation by reinforcing the role of innovation in the co-development of China and Africa. It will also send a powerful signal to the rest of the world on the emergence of science, technology and engineering diplomacy and the globalization of pragmatism.

By focusing on science, technology and engineering in the coming years, FOCAC will have lived up to its promise as a major force deepening cooperation between the two partners. This will also help bring the practice of international development cooperation into the 21st century. ✦