

Application for DFID-ESRC China and Africa Research Program: Chinese FDI and Structural Transformation in Africa: Technology Transfer, Linkages, and Learning

1. Aims and Objectives

China has been involved in African development since the late 1950s, and this engagement has increased markedly in the new millennium. As the cost of production in China's coastal manufacturing belt continues to increase, some Chinese firms have sought new investment locations. Firms have also set up agricultural technology demonstration centres, acquired existing farms, or, more rarely, established new commercial farms. Our research investigates the dynamic impact of this recent investment in Africa, using several distinct, parallel methodologies.

Understanding the lessons of China-Africa engagement has been hampered by a lack of evidence. Myths and misconceptions abound about its size, nature, and impact. Further, Chinese engagement has often been seen as *sui generis*, when there is much to learn by comparing Chinese approaches: today, to those in the past; with other powerful countries, in Africa; with other powerful countries as they invested in China; and Chinese engagement in other parts of the developing world. A broad goal of the research is to continue to present an evidence-based analysis of China's role in Africa. The specific objective is to shed new light on technology transfer, learning, and spill-overs.

The mixed-method research proposed here builds on a strong track record of previous research by the PI and team members. It focuses on Chinese engagement in Africa in comparative perspective, and it investigates its potential for enhancing structural transformation through direct training, technology dissemination, backward and forward linkages, subcontracting, and personnel transfers. Four components are envisaged: data collection, mapping, and scoping studies; comparative, analytical narrative case studies; new survey research; and dissemination. These are linked through the focus on verified data, innovation, and technology transfer. The topics we outline below have been the subject of much interest from practitioners and decision-makers. Indeed, team members developed this proposal after many years of advising potential users of this research, including bilateral donor governments, international institutions such as the World Bank, the IMF, and UNDP, and NGOs on these and other China-Africa issues.

2. Foreign Investment and Structural Transformation

Structural transformation is a central economic development challenge facing low-income Africa. Structural transformation requires investment in better infrastructure, more productive agriculture, and competitive manufacturing. It involves taking advantage of technologies already available to move land, labour, and capital into higher value activities. China's development trajectory over recent decades provides an example of how a government focused on modernization can marshal resources – foreign capital and technology, local entrepreneurial talent, incentives and leadership – to reduce poverty and transform its economy.

For the past decade, Sub-Saharan Africa has been growing, but growth is not the same as structural transformation. Africa's assets of abundant low-wage labour and arable land are not yet being utilized at close to their full potential. Structural change involves (1) the establishment of new and more productive uses for land, labour and capital, and (2) shifts from traditional activities to these newer pursuits. Structural change that creates opportunities for labour to move from subsistence, informal trade, and other low productivity activities to higher productivity sectors (some forms of commercial agriculture and manufacturing) would provide a significant boost to real incomes (McMillan and Rodrik, 2011). The good jobs, increases in household income, and diversification that accompany these changes are central to increases in well-being and broad-based sustainable growth.

Rodrik (2011) has shown that large productivity gains can be made by imitating existing technologies (see also Haskel, Pereira and Slaughter, 2007). Historically, the transfer of innovations and ideas from one country to another has often served as a stimulus for local firms to adopt new practices (Findlay, 1978; Blomström and Kokko, 1998; Wang and Blomström,

1992; Harrison and Rodríguez-Clare, 2010; Harding and Javorcik, 2011; Havranek and Irsova, 2011). Technology and ideas can spill over to local firms through imitation, “poaching” of skilled workers, subcontracting, and other backward and forward linkages. However, foreign firms can also operate as enclaves, with little connection to the rest of the economy, and they can compete with local firms for limited markets and supplies (Winkler, 2012; Paus and Gallagher, 2008). It takes time to bring local producers up to the level of quality, speed, and consistency that the foreign investor’s existing suppliers can provide (Shrank, 2001). Foreign firms with robust interactions with training institutes, research centres and universities, and circulation of managers and skilled workers are far more likely to stimulate broader economic transformation (White, 2011; Hoekman and Javorcik, 2006). East Asian countries like China have been particularly successful in promoting backward linkages and encouraging connections between foreign firms and local institutions, however, the nationality of the foreign firm can make a significant difference (Buckley, Wang, and Clegg, 2007; Lin, Liu, and Zhang, 2009). Local government involvement may also have been critical to success of FDI in zones, commercial agriculture and manufacturing in China (c.f. Ampalavanar-Brown, 1998). Recent research drawing on the World Bank’s Enterprise Surveys across developing countries suggests that much remains to be learned about positive (knowledge diffusion) and negative (competition) FDI spill-overs, particularly in direct global value chain relationships (Farole and Winkler, 2012; Winkler 2013).

Manufacturing. Case studies can shed light on the mechanisms through which foreign firms act as catalysts for manufacturing development through employment, technology transfer and backward and forward linkages. During the colonial period, Japanese factories served as ‘Schumpeterian innovators’ sparking a ‘cluster’ of Korean imitators (Kohli, 1999: 1280 citing Chung, 1973: 93). In Bangladesh, a Korean company brought Bangladeshi workers to Korea for training. Later, workers left to set up their own companies, sometimes as sub-contractors (Rhee and Belot 1990). Nigerian traders learned how easy manufacturing could be from site visits to Asian factories, while Mauritians formed joint ventures with firms from Hong Kong and then set up their own firms (Brautigam, 2003). Historically, the East Asian economies (including China, Japan, Korea, Singapore and Taiwan) relied on a number of policy instruments to integrate domestic producers with foreign firms: equal treatment for direct and indirect exporters, the establishment of trading companies as a means to increase exports and reduce transaction costs, and the use of industrial parks and clusters to reduce transaction costs and enhance competitiveness (Dinh, 2012; Dinh, 2013).

Commercial Agriculture. Foreign investment can also be a means to foster upgrading and greater productivity in commercial agriculture. Debates exist on the relative merits of contract farming, with evidence on both sides. Minten, Randrianarison and Swinnen (2006) find that Madagascar smallholders were able to participate successfully in global value chains, with positive spillovers for local food production, while others have been critical of the impact of contract farming on vulnerability and household incomes (Reardon and Barrett, 2000). Experience from China’s development may offer insights for shaping foreign investment in commercial farming in Africa. Chinese officials and their foreign partners made extensive use of demonstration centres, contract farming and outgrower schemes in transferring foreign technology to Chinese smallholders.¹ Investments like these are credited with helping China’s farmers withstand the competition from agricultural imports after China joined the WTO (Han, 2005). While China’s agriculture policy experience and its relevance for Africa has been much studied (Huang and Rozelle, 1996, 2013; Rozelle and Swinnen, 2004; Djurfeldt, et al, 2005), few have looked closely into China’s management of foreign investment in commercial agriculture

¹ PepsiCo, maker of Lays potato chips, operated eight demonstration farms in partnership with China’s Ministry of Agriculture, to transfer skills and ideas to Chinese farms, showing them how more advanced irrigation and scientific crop management systems could raise yields and incomes. Seagram (Tropicana Juice) invested \$11 million to build the Seagram Citrus Technical Center and Nursery in Chongqing to promote better citrus cultivation techniques to supply their juice concentrate processing plant. The Sino-Dutch Horticultural Training and Demonstration Center near Shanghai was supported by the Shanghai Agricultural Commission, the Dutch Ministry of Agriculture, and Dutch companies, which supplied horticultural equipment, seeds, and young plants (Brautigam, forthcoming).

and the use of demonstration farms and outgrower schemes to engage local farmers (Brautigam, forthcoming).

4. China in Africa: Catalyst and Competition

China's emergence as a global economic power is both a threat and an opportunity for structural transformation in African manufacturing and agriculture. At one level, Chinese imports provide competition for local firms (Kaplinsky and Morris, 2009; Wood and Mayer, 2011). As noted below, this competition can be devastating in some countries and some sectors, driving local firms out of business. Yet as Schumpeter noted with the phrase "creative destruction", capitalist competition can also be developmental. Chinese firms could be catalysts for local firms to move into manufactured exports; they can also be footloose investors, moving on with only fleeting impact on manufacturing (Bräutigam 2003; Rotunno, Vézina, and Wang, 2012). In agriculture, Chinese investment might also be enclave, with little connection to local farmers, and inadequate compensation for those losing their land – the picture presented in fears of "land grabbing" – or it might follow the pattern laid out by foreign investors in China, with outgrowers, demonstration farms, and technology and skills transfers.

China and manufacturing in Africa: Existing knowledge: Manufacturing is a significant focus of Chinese investment in Africa, comprising 15.3% of total stocks in 2011 and flows of \$1.33 billion between 2009 and 2012 (State Council, 2013). So far, the destructive impact of Chinese *imports* on African manufacturing has received the lion's share of analysis (Gabriel and Ahuma-Young, 2008; Edwards and Jenkins, 2012). Surveys of the Ethiopian shoe industry point to a more nuanced outcome: informal sector firms suffered most from Chinese import competition, but a significant number of small, medium, and large enterprises fought back by upgrading their capabilities; some became exporters for the first time (Gebre-Egziabher, 2009; Sonobe, Akoten, and Otsuka, 2009).

Surveys, scoping studies and case studies have shed some light on linkages of Chinese firms in Africa, although most have not separated out the manufacturing firms. Several studies suggest that ethnic Chinese firms have relatively few linkages with other firms (Broadman, 2007; Gu, 2011). Brautigam (2003, 2008) investigated industrial clusters in Nigeria and Mauritius where ethnic Chinese firms acted as catalysts. Brautigam and Tang (2014) concluded that Chinese special economic zones in Africa had potential to be instruments of structural transformation, but that the early stage of the zones precluded a firm answer. A World Bank study in Ethiopia, found that 69% of Chinese companies provided formal training programs for local employees, compared with 38% of local firms (World Bank, 2013).

Chinese firms are already thinking strategically about backward linkages. For example, in 2012, we interviewed a Chinese shoe company in Nigeria that was in discussions with a Chinese supplier about moving to Nigeria to produce soles locally from Nigerian rubber (Brautigam and Tang, 2014). Another Chinese firm in Nigeria has set up a textile-based industrial zone with firms at different levels of the value chain (Gu, 2011; Shen, 2013). A shoe company we interviewed in Ethiopia plans to establish a similar zone for the shoe industry.

In 2012, PI Brautigam and team member Tang used an exploratory grant from the Centre for Economic Policy Research to conduct a pilot survey of all formal firms in the leather industry in Ethiopia, where companies from China, India, and Europe had begun to expand export-oriented investments (Brautigam, McMillan, and Tang, 2013). We found that Ethiopian and European firms in this sector had strong technology transfer linkages with Asian (Chinese and Indian) firms and individuals, including Asians in management or technical positions, business trips and supplier relations with China, and personnel migration. Chinese firms had hired Ethiopian interns from local training institutes, apprentices and engineering and managerial staff and were connecting Ethiopia to US and even Brazilian supply chains. Backward linkages were deepening in a short period. This pilot study suggests much potential for diffusion.

China and agriculture in Africa: Existing knowledge: Africa is distinguished among other regions by the very low levels of structural transformation in agriculture. While much attention has focused on fears of Chinese (and Indian) "land-grabbing", Chinese engagement in

African agriculture also has potential for aiding productivity-enhancing technology diffusion. This can happen either through deliberate government programs, or through private firms, as with the Chinese experience with FDI in commercial agriculture, outlined above.

The transfer of Chinese agricultural technologies has long been a feature of China's foreign aid (Brautigam, 1993). Research conducted in The Gambia and Sierra Leone found that African farmers successfully increased their incomes by adopting technologies disseminated through Chinese agro-technology demonstration centers, and that these gains persisted after the Chinese technicians had returned to China (Brautigam, 1984; Brautigam, 1998). Chinese frustration with the lack of sustainability of these early projects stimulated an experiment of having agro-technology demonstration centers (ATDCs) built and operated (for three years) by Chinese companies and research institutes (Brautigam and Tang, 2009). These companies are invited to use this platform to seek out commercial opportunities in agriculture. So far, out of the nearly two dozen ATDCs being built in Africa, only a handful appear to have stimulated further investment by the companies concerned, although research is scarce on this issue (Tang, 2013).

Chinese commercial investment in agriculture in Africa appears to be far more modest than generally assumed. MOFCOM data obtained by the PI show that out of a total of 2,372 African investment proposals approved for medium and large-scale Chinese companies through early 2013, only 86 were specifically related to farming (production of grains, cash crops, or animal husbandry). Fieldwork by the PI in 2013 in Zambia and Zimbabwe showed that only a fraction of approved investments were actually in operation, often at very small levels (Brautigam and Zhang, 2013). Other Chinese agribusiness investors were not farming but operating contract relationships with local producers. Preliminary research on Chinese and Brazilian agricultural investment in Zimbabwe, Ethiopia, Mozambique and Tanzania conducted by the Future Agricultures consortium supports these conclusions (Scoones, Cabral and Tugendhat, 2013).

5. Research Questions

Our research questions bring together the recent academic literature on structural change and the focus on the impact of Chinese economic engagement in comparative perspective. Each cluster of questions stands alone as an important puzzle or lacuna. By addressing them systematically, we hope to contribute substantially both to understanding how recent investment from China/Africa has affected structural change, as well as provide policymakers with information about how to make productive use of these new investors. By limiting the focus to commercial agriculture and agro-industry, including textiles, we target our findings to entry-level sectors with important implications for gender, and technological spill-overs.

a. Scope of Investment. Which African countries have become significant locations for Chinese FDI in agro-industrial manufacturing and commercial agriculture? What is the actual scale and location of this investment? Does manufacturing occur in geographic clusters or industrial zones? How do patterns of Chinese investment differ from those of Indian and/or European firms? Are Chinese agro-manufacturing and commercial agriculture investors primarily geared toward export or toward local markets? Does this differ country by country and sector by sector?

b. Replication of Chinese Model. How has the Chinese model of FDI in its own commercial agriculture and agro-industry, including special agricultural zones, been replicated in the African context, if at all? Do Chinese agricultural firms set up demonstration projects to create demand and interest for their innovations? Do they tend to work with out-growers, or farm independently? How linked are Chinese manufacturers, agricultural investors, and Chinese overseas special economic zones to the local host economy and governments? Have other African governments assisted in forging linkages between Asian and African firms, perhaps through investment promotion tours, study tours, or field visits, as in the case of Mauritius?

c. Catalysts, Competition, and Learning. What impact has Chinese investment had on local learning, via technology transfer, training, backward and forward linkages, personnel transfers,

etc.? What is the impact of competition (in output or input markets) from Chinese-owned firms, if any, on local firms in the same sectors? Faced with competition, have local firms upgraded their own technologies? Have African entrepreneurs made the shift into manufacturing as a result of trade links or other travels to China, India, or Brazil? In what ways do Chinese/Asian/Brazilian buyers and factories connect with local firms? Are Chinese firms members of the sector associations? Have they hired staff or interns from local training institutes?

6. Proposed Research Methodology

A broad goal of the research is to continue to present an evidence-based analysis of China's role in Africa, on issues that matter to policy makers. The questions above will be explored using multiple methods, including mapping via desk studies and existing databases, scoping studies, case studies, and surveys. The team will continue to coordinate with other research efforts, such as the Future Agricultures Consortium, so as not to duplicate their efforts.

(1) Mapping Chinese investment. The researchers will continue an earlier effort to map the distribution of approved and actual Chinese agro-industrial and commercial farming ventures across Africa, drawing primarily on a database of approved investments from China's Ministry of Commerce, obtained by the PI in 2013 (Brautigam and Zhang, 2013). This will be complemented by media reports of specific investments collected by the China Africa Research Initiative (CARI) at SAIS. The data will be double-checked in parallel with the mapping work through desk-based scoping studies of Chinese agricultural and agro-industrial engagement in fifteen African countries (updating 7 existing desk scoping studies and conducting 8 new ones).²

(2) Field Scoping Studies. After the mapping and desk studies are complete, research teams will meet in a launch workshop to select five low or low-middle income countries that appear most fruitful for further investigation. Field studies will be carried out after the workshop, and will investigate the reality of investment projects on the ground, using standard snowball sampling techniques tested in Chinese agricultural and agro-industrial engagement scoping studies carried out in Ethiopia, Tanzania, Zambia and Zimbabwe between 2011 and 2013 (Brautigam and Tang 2012a; Brautigam and Tang 2012b; Brautigam and Zhang 2013). Local investment approval offices usually have data on investments approved by local offices. These provide a way to cross-check the Chinese approvals against the local data.

(3) Asian Linkages Cluster Surveys. After the field scoping studies are complete, the research teams will meet for a scoping study workshop. The workshop will allow us to use the baseline information from the studies to select the three most promising countries to conduct a survey of all formal firms engaged in an agro-industrial cluster containing significant Chinese investment. Modeled after cluster survey work undertaken by the PI in the autoparts sector in Nnewi, Nigeria (Brautigam, 1997) and the leather sector in Ethiopia (Brautigam, McMillan and Tang, 2012), the cluster surveys will allow the researchers to analyze comparatively local linkages with Chinese/Asian firms (and other foreign firms), and to gauge whether it will be possible to add a technology transfer module to an existing national survey, as we have already done in Ethiopia.

(4) Comparative Analytical Narrative Case Studies. The second goal of the scoping study workshop will be to select eight Chinese investments, pairing them either with a similar investment in China, or a similar non-Chinese investment in Africa. The cases will be selected from investments where transfers of skills and knowledge could reasonably be expected, and each will be framed by an analysis of Chinese policy and practice in managing this kind of

² Seven desk studies on agricultural and agro-industrial investment have already been completed by the PI and team members in 2011-2013, with funding by the Bill and Melinda Gates Foundation, the International Food Policy Research Institute, and Johns Hopkins University (Ethiopia, Tanzania, Nigeria, Ghana, Mali, Zambia and Zimbabwe). These will be updated, and eight new desk studies will be conducted, for a total of fifteen.

foreign investment in China. They will follow a rigorous process-tracing, analytical narrative approach (Rodrik 2003; George and Bennet, 2005). Possible examples include:

(a) M'Béwani: a 1000 ha rice perimeter operated by a Chinese firm in Mali since 1999 rents out land to local farmers, and has an agricultural demonstration center. How effective has this effort been in transferring technology to local farmers compared with the approach taken by Singapore firm Vitagrain in Mauritius? (b) China-Africa Cotton's Malawi subsidiary: how do its demonstration farm, contract farmer outreach, and ginnery compare with the similar operation by the UK firm Plexus Cotton's subsidiary, Great Lakes Cotton? (c) Both Brazilian and Chinese governments have set up vocational training institutes in Africa in part to allow their firms to find qualified workers. How do the training institutes established by Chinese interests in Ethiopia or Nigeria compare with those established by SENAI, the Brazilian National Service for Industrial Apprenticeship in Angola or Mozambique? (d) Chinese management of FDI in commercial agriculture was effective in transferring technology to smallholders. How do the Seagram, Pepsi, or Dutch projects compare with similar Chinese commercially-linked demonstration farms in Africa? (e) CP Group's FDI in China's chicken industry transformed that sector (Ampalavanar-Brown, 1998). How does this compare with Chinese investment in Zambia's chicken industry? (f) The Chinese-government has supported overseas trade and economic cooperation zones in Lagos and Ogun, Nigeria. We would compare one of these zones with a zone established by the Chinese in Vietnam, Thailand, or Cambodia. While China's domestic approach to zones would provide a frame for analysis, we believe that a comparison of China's 'going out' in another developing region is likely to offer more lessons for Africa than simply studying special economic zones within China.

(5) National Surveys. Finally, by engaging with national statistical agencies whose job it is to conduct representative annual surveys, and adding a module on technology transfer, we hope to make a contribution that will eventually be self-sustaining. We have already launched a pilot initiative of this nature with the Central Statistical Agency in Ethiopia. Together with researchers from the Ethiopian Development Research Institute (EDRI) we prepared a baseline module on technology transfer to investigate linkages between Chinese (and other foreign) investors and local formal and informal firms. The module has been translated into Amharic, enumerators have been trained and the full census is scheduled to go to the field in March 2014. The results of this survey will provide a baseline that will allow us to begin to quantify in a systematic way the nature of linkages between foreign and domestic firms. With funding from DFID-ESRC, we would conduct a second round of the Ethiopia survey, creating a panel study that will allow further analysis of spillovers from the new foreign investors. We will also launch an additional module in a second country. The results of this type of analysis will provide African governments like Ethiopia with information that can help inform choices about the kinds of policies they choose to pursue vis-a-vis foreign investors, including those from China.

7. Project Management

The project will be housed at Johns Hopkins University, School of Advanced International Studies, where it will be part of the China Africa Research Initiative launched by PI Brautigam. Brautigam will be in charge of the overall management, assisted by a Research Manager recruited to support the project activities and oversee desk research. Together with team members Dr. Xiaoyang Tang and Prof. Ian Taylor, she will lead the scoping studies, cluster surveys, and analytical narrative case studies and resulting papers and special issues/edited book. Co-investigator Dr. Margaret McMillan will oversee the technology transfer module and national survey analysis and papers resulting from that data, together with Dr. Girum Abebe of the Ethiopia Development Research Institute. Many of the dissemination activities will take place in Ethiopia, with the assistance of the EDRI and Dr. Abebe. The Ethiopia location allows us to engage with officials at the African Union, and the United Nations Economic Commission for Africa, which will extend our existing networks of government officials interested in maximizing the opportunities for Chinese technology transfer in Africa.