Abstracts of Agriculture Sector Case Studies contributing to the paper:


**Cassava Bread in Nigeria:**

By Laura Pereira

Processed cassava is a reliable and convenient source of food for tens of millions of rural and urban dwellers in Nigeria, but despite currently being the largest producer of cassava in the world, the country offers few value added products. This case study looks at the establishment of non-traditional urban markets for cassava through the development of High Quality Cassava Flour (HQCF) being incorporated into baked goods, most notably bread. The innovative technology includes both the means of processing the cassava into HQCF as well as the method of making cassava bread.

The case study analyses barriers to the innovation at each stage of the innovation process as well as mechanisms to overcome these barriers. The main barriers in this case study are vested interests and weaknesses in the supply chain, although a long-term barrier could be cultural preferences for the incumbent technology—100% wheat flour bread. An important recognition was that in order for cassava bread to be successful, the entire cassava value chain needed attention—indeed this was the goal of developing the technology in the first place; as an incentive to improve Nigeria’s cassava value chain. The first mechanism for addressing this barrier is financial investment by international organisations, including the Gates Foundation and DATCO that were willing and able to invest both money and ingenuity in the cassava processing sector. The second is a combination of government-led economic incentives and fiscal policies under the ‘Cassava Bread Development Policy’ aimed at enabling HQCF to outcompete wheat flour. However, the realisation that these still did not overcome the cultural barrier of people’s preference for wheat bread has resulted in the more recent focus on marketing campaigns and stakeholder engagement. This leads on to an important institutional shift, which was the federal government’s realisation that in order for the cassava value chain to be self-sustaining, it required building trust between stakeholders, in particular private sector and unions that had previously refused to buy into the cassava transformation project.

The goal-oriented search for a successful recipe for cassava bread was successful, but the wider systemic weakness that its invention was supposed to address required further interventions. The global innovation system, if it is to meet sustainable development goals, must handle these contradictions. Furthermore, when the benefits of a specific product do not accrue directly to the end-users, but are felt further up the supply chain, it is difficult to incentivise the private sector to invest in these types of innovation because there is no target market. An important role for transnational actors in the global innovation system is to try to overcome the incentive...
mismatch between those who ultimately benefit from an innovation and those investing in its development.

**Development of the Cocoa Genome**  
By Christina Ingersoll

This case examines the Cocoa Genome Project, a joint effort of Mars, Inc. the United States Department of Agriculture, and several other private, public, and academic partners, through the lens of innovation for sustainable development. The case study is a historical analysis of the motivations, development, and innovation steps that the Cocoa Genome Project went through in order to map and publish the genome of a variety of *Theobroma cacao* – the cocoa tree with the goal of facilitating research and development of disease and pathogen resistant, locally applicable strains of *T. cacao* and thereby improving the production possibilities for cocoa farmers which would lead to increased income, improved livelihoods, and – at a more macro level – greater incentives for cocoa farmers to remain in the industry, and for others to join. The importance of multi-party, multi-sector partnerships is identified as critical to the innovation process for this project. Active participation of cocoa producing farmers in the work surrounding the cocoa genomic research is identified as critical stage in the innovation process for the Cocoa Genome Project to fulfill its stated goals of widespread adoption and use, but one that is a particularly challenging because of levels of human capital (e.g. literacy, education) in cocoa producing countries. Ultimate success of the Cocoa Genome Project will require a long-term perspective and active engagement with local and international institutions by the project’s leaders.

**Drip Irrigation:**  
By Lonia Friedlander, Alicia Harley and Ram Fishman

Drip irrigation’s water use efficiency shows potential for increasing agricultural intensification without exhausting freshwater resources. In addition, drip may also help poor farmers improve their livelihoods, by increasing yields and decreasing labor requirements. Thus drip is a sustainable development technology with the potential to improve human wellbeing for current and future generations. Yet, many barriers to its use remain, impeding the access of those most in need of drip technology. This case employs a model of the innovation system to study the development of the successful Israeli drip irrigation technology and its use in Israel, contrasting it with 1) the partially successful Indian and 2) almost wholly unsuccessful African innovation system for drip irrigation.

We find that drip’s success in Israel resulted from prolonged engagement between government agencies, the private sector, and farmers throughout all stages of the innovation process. Large-scale integrated innovation systems for drip like that in Israel, do not exist in Africa countries, but pockets of success demonstrate the untapped potential of the technology to African small farmers and provide some insights into strategies for overcoming barriers. In India, large state-wise variation in adoption of drip irrigation underscores the importance of strong policies to promote drip and demonstrate institutional learning between Israel and India in the design of effective drip irrigation innovation systems. In Africa and India we observed both NGOs and private companies filling the role that in Israel was led by the State to establish functional innovation systems either independently or in close coordination with State actors. The barriers that continue to prevent drip’s widespread adoption include, *imperfect information, capacity*
deficits, lack of infrastructure, land fragmentation and supply chain weaknesses. These lead to ongoing problems in adoption and widespread use of drip irrigation technology.

System of Rice Intensification in Bihar:
By Alicia Harley

The System or Rice Intensification (SRI) is a methods-based technology for improving yields and decreasing inputs including water and seeds in rice cultivation. While mainstream rice scientists have questioned the efficacy of SRI, it is increasingly accepted as an important technology for improving livelihood security for smallholder farmers. Its applicability to larger farms, or to farms where yields are already high is less certain. This case study looks at the development of SRI by farmers and missionaries in Madagascar and reviews the adoption of SRI on a global scale. The case then zooms into Bihar, India to look at the challenges and opportunities of adoption, adaptation and widespread-use of SRI by marginal farmers in drought prone south Bihar.

The case finds that the invention stage of SRI represents an important example of local invention where technology “bubbled up” from experimentation by end-users. A small network of key technology champions at international, regional and local scales largely drove selection and promotion of SRI. At the same time some actors such as the International Rice Research Institute (IRRI) were sceptical of SRI for a number of reasons including its bottom-up origins, which delayed selection of SRI by many actors and continues to limit research on both physical science questions raised by SRI as well as adoption dynamics.

In Bihar, adoption of SRI technologies by smallholder farmers requires extensive support from State or NGO-led extension services. The most successful models for promoting SRI adoption are taking place under the guidance of local NGOs, but there are important spill-over effects from the NGO practices to the government-led extension services. The efficacy of SRI for larger farmers in Bihar remains uncertain and factors such as labour scarcity, and market prices for rice and other crops play a large role in determining the appropriateness of SRI for different farmer groups.

Bio-Pesticides in Kenya:
By Alicia Harley and Hyundo Choi

The case study on Biopesticides in Kenya is an example of public private partnership (PPP) between an international research center (ICIPE) and a local business (Real IPM) to select and produce a new, more environmentally friendly technology for pest control in sub-Saharan Africa. In addition, institutional developments in Europe, which placed environmental regulations on imported flowers, incentivized Kenya’s flower growers to adopt bio-pesticides, and created the market opportunity for Real IPM to grow. The case highlights the importance of multiple actors and institutions across different sectors to create a successful innovation system and not only invent, but also select and produce a new technology with potentially significant social benefits, but uncertain market potential. Despite the success of the PPP, most farmers in Kenya adopting SRI remain larger farmers with export-oriented businesses. There remain significant barriers to adoption of this knowledge-intensive technology by small and marginal farmers, which would require increased investment in extension services to promote bio-pesticide use by small farmers. Pockets of success amongst small farmers, largely driven by innovative business models
and supported by outside donors, demonstrate that small farmers have the potential to benefit from adoption of bio-pesticides, but widespread use will require significant support which will require continued engagement of NGOs or State extension services.