Consilience: The Journal of Sustainable Development
Vol. 5, Iss. 1 (2011), Pp. 53-70

Health or Agricultural Development: Boundary Objects and Organizations in a Soya Project in Western Kenya

Jennifer Lamb
Agricultural and Applied Economics
Virginia Tech
jenilamb@vt.edu

Abstract

Improving global health and agricultural development have been identified as two of the most important objectives in fighting global poverty. However, the two approaches come at development from different perspectives and can actually undermine each other in practice. Successful management of the competing demands of health and agriculture through organizations and technologies is crucial to advancing sustainable development. The turn toward local procurement of agricultural products in the administration of global food aid is evidence of attempts to bring these approaches together at the global scale, but has not delivered the promised benefits at the local level. This article presents a case study of a small Kenyan community based organization (CBO), Community Action for Rural Development (CARD), as it has attempted to negotiate between nutrition and agricultural development in global and local networks. Specifically, the case study addresses CARD's experience with a small scale soya beans project as a part of a World Food Program (WFP) local procurement program and a transition toward developing a local soya bean project.

Keywords: soybeans, appropriate technology, agricultural development, food aid, boundary objects, boundary organizations

1. Introduction

Health and agricultural development are consistently raised as key priorities in improving the livelihoods of smallholders[i] and the rural poor. However, an analysis of the respective development discourses of health and agriculture reveals that the two more often compete, rather than complement each other in development practice (Escobar, 1995). Successfully managing the boundary between health and agriculture through organizations and technologies is crucial to advancing sustainable development. As one of the few crops to simultaneously answer to the demands of both fields, an analysis of soybeans (commonly known in the development context as soya beans) and their use in aid and development projects provides an interesting entry point into this boundary management discussion. The initial literature review situates soya beans within the framework of competing agricultural development and health and nutrition discourses to address food security. As a result of shifting prioritization of funding for health and nutrition from the late 1980s, the administration of global food aid is a primary mechanism for

managing demands of nutrition and agriculture, especially through the turn toward local procurement policies.

The core of the article presents a case study of a small Kenyan community based organization (CBO), Community Action for Rural Development (CARD), as it has attempted to negotiate between nutrition and agricultural development in global and local networks. Specifically, the case study addresses CARD's experience with a small scale soya beans project as a part of a World Food Program (WFP) local procurement program and a transition toward developing a local soya bean project. The case study draws upon e-mail exchanges from November 2007-May 2009 and survey work and field notes collected during semi-structured interviews from June-August 2009. Utilizing theory from the science and technology studies, nutrition, and agricultural economics literature, the concepts of boundary organizations, dietary diversity, appropriate technology and agricultural marketing are applied in an active interdisciplinary research framework for the development of successful local soya bean project.

2. Boundary Management in Health, Nutrition and Agriculture: Conceptualizations of Hunger and Famine

In development policy and practice, the boundary between health, nutrition and agricultural development has proved to be one of the most difficult to manage. Health hinges upon adequate nutrition as a state of being which individuals accessed through consumption of sufficient quality and quantity of food in harmony with the local landscape. By contrast, agriculture is the process through which that quality and quantity of food are produced. Subsequently, health perspectives and their embodied nutrition development discourse have focused on the documentation of biophysical manifestations of malnutrition[ii] and the delivery of food as aid to ameliorate these effects. Historically, the primary role of agricultural development has been to raise the supply of foodstuffs through technology transfer. More recently, development thinking in agriculture has shifted toward system based approaches (Barrett, 2001; Moore, 2009).

The key moment in which these discourses come together is in the conceptualization of famine and hunger. Historic notions of famine capture the conflict between the symmetry of human nutritional need and the asymmetric distribution of resources to meet that need through agricultural production. In his path-breaking work in 1981, Nobel Prize winning economist Amartya Sen reworked the conception of famine and hunger to create a common denominator between nutrition and agriculture. Sen describes starvation as "the characteristic of some people not *having* enough food to eat…not the characteristic of there not *being* enough food to eat". Sen argues that individual *exchange entitlement*, (ability to labor and earn an income) dictates the ability to obtain food. This recasts the problem of hunger as the need to increase access as well as availability of food (Sen, 1981).

Today, the most common definition of food security is "access by all people at all times to enough and appropriate food to provide energy and nutrients needed to maintain an active and healthy life"(Barrett, 2001). Barrett (2002) describes three main phases of food security measurement: 1) supply based measures 2) household access and biometric measures 3) measures which assess constraints on individual

Food Aid and Public Private Partnerships

Food aid consists of the provision of supplements and fortified food products. Fortification refers to the processing of staple foods so that they also include nutrients which may be deficient in the targeted population. Supplementation involves the provision of powders and/or pills to be blended or taken with meals to provide "missing" nutrients[1]. Generally, these fortified products or supplements are produced on a commercial scale and often distributed as convenience style foods to targeted populations in an immediate, short term timeline. The WFP commonly refers to these programs as public private partnerships, wherein the WFP supplies of basic grains are processed by large food manufacturers at a reduced cost for distribution to developing countries.

choice, risk exposure, and lack of ability to cope with economic shocks. Evolving definitions which capture the increasing depth and complexity of the food security problem have translated to a rapid emergence of revised techniques through which food security may be measured(Coates, et al., 2006). Scales which measure behavioral coping mechanisms have been developed in the United States and adapted for application internationally. Additional access based indicators of food security include measures of dietary diversity and the recording of 24-hour dietary recalls[iii].

3. The Food Aid and Agricultural Development Trap

The proliferation of measurement tools to address the complex nature of food security has not been matched by equally comprehensive development frameworks. Conversely, when nutrition and agricultural development projects operate at scale they tend to assume that improving either consumptive or productive practice will result in a food security benefit and can end up working in opposing directions. As evidence of this, agricultural development paradigms remain entrenched in the rhetoric of improving yields through technology transfer and systems based approaches, continuously hypothesizing that closing the yield gap between developing and developed nations will enhance food security for smallholders (Schreinemachers, 2006). In particular, scientists have recently identified declining soil fertility as a key barrier to obtaining and sustaining food security in Sub-Saharan Africa (SSA). Soil fertility decline is caused by a cycle of population growth and reduction in farm size which leads to limited the opportunities for fallowing and increasing pressure on the land for food production. Examples of popular policies and programs to address soil fertility decline include national fertilizer subsidy programs, attempts to develop conservation agriculture production systems and experimentation with local soil fertility improvement technologies.

Productivity growth must benefit farmers so that they are producing above a subsistence level. In particular, farmers must be able to link to input and output markets in at least semi-commercialized production processes for sustainable productivity growth.

Despite the promise of agricultural development, the primary mechanism to address food insecurity in SSA has been through the delivery of food aid. Most often food aid is manufactured from developed country agricultural products and with

developed country processing equipment. The introduction of food aid has short and long term implications for agricultural development. In the short term, ill-timed deliveries of food lower agricultural prices for developing country smallholders. In the long term, bypassing local structures undermines the development of agro-industry in developing nations and has the potential to increase food dependency. Unfortunately, with increased concentration on health and nutrition relative to agriculture in development programming since the late 1980s, the delivery of food aid has been the primary mechanism for boundary management between nutrition and agriculture (Ashley and Maxwell, 2001).

4. The Interpretive Flexibility of Soya in Agriculture and Nutrition Discourse and Application to Sub-Saharan Africa

A global agricultural commodity commonly caught in the midst of this trap is soya or soybeans. Soya presents a diverse set of characteristics which allow it to be highly valued by both nutrition and agricultural development approaches. Agriculturally, soya beans have the ability to fix atmospheric nitrogen in the soil[iv], for use by the growing plant and crops to be grown after soya in rotation (Chianu, et al., 2009; Misiko, et al, 2008). Moreover, soya is relatively easy to grow and has a low incidence of pest and disease. Further advantages include the structure of the crop itself. As a relatively low plant, most soya varieties are about 14 inches tall and once established fan out into a broad canopy that blocks out light for weed competition.

Nutritionally, soya is the only "complete" plant based source of protein, meaning that it provides ample quantities of all eight amino acids that the body cannot make on its own. Soya protein quality[v] also outranks all other protein sources with the exception of egg-whites. Thus, in areas where high quality protein sources such as eggs, meats and dairy are not available or affordable, soya provides a nutritious substitute that is lower in both fats and cholesterol. Soya also provides a number of additional vitamins and minerals and is a source of Omega 3 and Omega 6 fatty acids, all of which combine for it to be considered a highly nutritious food (American Soybean Association, 2004).

This combination of agronomic and nutritional properties has led soya to be a key aspect of systems based soil fertility agricultural development programs, while the affordability and nutritional value of soya (and its abundance in the United States) have made it a popular choice for food aid. In the social construction of technology literature the appeal of a technology or technological process to different sets of stakeholders is referred to as interpretive flexibility. Innovations with interpretive flexibility possess a broader range of appeal to stakeholders of different value systems and priorities, and when harnessed effectively can be developed and scaled more rapidly to societal benefit. The interpretive flexibility of soya beans has made it one of the most widely transferred and adapted crops around the world[vi](Chainu, et al., 2009).

The soil fertility and nutritional opportunities of soya have not been fully explored in SSA. Despite its favorable agronomic and nutritional properties, soya is much more difficult to process and prepare than other legumes. Soya contains the enzyme trypsin, which prevents the body from actually being able to absorb any

protein. A number of techniques such as boiling the beans for thirty minutes in preparation for further processing and roasting can inhibit the enzyme's activity. However, utilization of soya is constrained by the fact that it must undergo some form of value added processing before human consumption (American Soybean Association, 2004). As will be demonstrated, the technologies developed to process soya have confined the use of soya to largely nutrition-based and even undermined agricultural applications in the development context.

5. The Primacy of Processing and the Turn toward Local Purchase Programs

With modern processing technology, soya beans have one of the most diverse ranges of use of any processed commodity. In developed countries, the majority of soya is processed in large scale oil and meal processing facilities. The meal is mostly fed to livestock but also commonly blended with maize meal for delivery as food aid (American Soybean Association, 2004). Soya is also commonly processed into soy milk, tofu, and soy nuts. However, few developing economies have such extensive large scale processing facilities. In the development context, the lack of large scale processing has typically confined the application of soya beans to roasting, boiling, frying, and milling in local cereal grain mills[vii]. For conventional home preparation, boiling the soya beans, a process used to prepare most other legumes, requires as much as 3-4 hours until the beans are soft and consumable. As availability of energy and cooking fuel are often constrained in SSA, this additional preparatory burden, combined with the distinctive flavor of soya beans has been a major barrier to adoption.

The necessity of more intensive value added processing in working with soya beans through nutritional and agricultural paradigms brings to light an important micro and macro disconnect in hunger and malnutrition approaches in SSA. Projects which have attempted to scale up agricultural production and use of soya beans in Africa have often had to overcome the use of soya in food aid programs. For example, Nigeria and Zimbabwe conducted outreach campaigns to promote soy as a nutritious food crop and as a soil friendly nitrogen fixing legume throughout the 1990s. These efforts involved education on soya's nutritional, agricultural, and preparation applications at the household level. Specifically, both countries refused to import soya beans as food aid, in hopes of developing their own local production and processing capacity (Chianu, et al, 2009).

As an alternative to this kind of tension between agricultural development and nutritional food aid programming, critics have argued that donors should purchase food aid as close to the region where food aid is needed as possible (Lappe and Collins, 1998). Representative of this, the WFP has held what it refers to as a "local procurement policy" since 1996[viii]. However, it must be understood that local procurement does not necessarily imply procurement from developing countries. WFP financial regulations stipulate that only "when conditions are equal, preference will be given to purchasing from developing countries"(World Food Program, 1996). In the development context where conditions will clearly not be equal, the statement discredits the notion that local purchase will assist the rural poor in developing agricultural economies[ix]. The assertion reflects a desire to make legible the needs of

nutrition sourcing as a higher priority than working with farmers toward longer term development goals (Scott, 1998). In 2006, the WFP recognized that it has been unsuccessful in sourcing food from developing countries, and that greater effort needs to be made in order to make local procurement programs "more friendly" to developing country producers(World Food Program, 1996). The latter half of this paper explores the experience of CARD as a part of a WFP soya beans local procurement contract and eventually the development of a community soya project in Western Kenya.

6. Local Procurement in the CARD Soya Beans Project in Western Kenya: CARD as a Boundary Organization in Local and Global Networks

The concept of developing country CBOs and local non-governmental organizations (NGOs) as boundary organizations in agricultural development projects is not new, especially in Kenya (Golderberger, 2008; Schrum, 2001). Like many developing countries, Kenya has seen a massive surge in the number of registered non-governmental organization over the course of the 1990s. Many have diagnosed this as a function of the fact that international donors have utilized these organizations to avoid corruption and misuse of funds encountered when development projects are channeled through the state. Such NGOs have been given credibility (only sometimes deserved) as representations of local communities capable of translating the wishes of donors into actual change at the field level. In Kenya, Goldberger (1999) points out that such organizations have been crucial in the promotion and rise of alternative agriculture, while Shrum demonstrates how NGO's have further been able to become an integral element of the agricultural development research apparatus (Goldberger 2008).

CARD is a small CBO that was founded in 1998. Based in the provincial town of Kakamega, the CARD strategy has focused on creating opportunities for rural income generation as a way to reduce pressures on the Kakamega forest to harvest wood for fuel and conversion to charcoal. The organization's founding projects in beekeeping and soya beans represented its desire to be viewed as an organization capable of facilitating rural development through global and local networks. CARD contracted with the WFP to supply soya beans for food aid just as the WFP began to experiment with local procurement programs in 1998.

Initially, the interpretive flexibility of soya was capable of meeting CARD objectives to promote income generating activities through rural development and increase environmental sustainability. However, the structure of the WFP local procurement contract was largely incompatible to work with smallholder production calendars. The WFP required quarterly quotas from its suppliers, consistent with its objective to provide a steady nutritional supply but not with the seasonal nature of agriculture or smallholder production volatility. While farmers could double crop soya beans in the long and short rains for a July and November harvest, smallholders had to pool their production to meet the WFP quota. The role of CARD was to organize 40 farmers to gather their current stocks of soya shortly before the quarterly deadlines. As such, CARD positioned itself as a boundary organization between the

global nutrition network of the WFP and a local agricultural production network of soya farmers.

The type of negotiation CARD was asked to perform as the contracting agent for the WFP local procurement program was dramatically different than the boundary management activities encountered in the works of either Goldberger or Shrum. In addition to translating between global to local scales, CARD was also caught in a more difficult mediation between the scaled discourses of nutrition and agriculture. CARD staff members still with the organization in 2009 from the first soya project recalled how they had felt inadequate to communicate to either side. Speaking with the WFP procurement officer, it was obvious that the project needed soy on a quarterly basis, but to the farmer this externalized the undue burden of storing and saving seed and losing the opportunity to sell soy at appropriate times in the local market.

When a drought in 2005 prevented the double cropping of soya beans during the short rains, CARD missed two sequential production quotas. By the time the WFP dropped the CARD managed cooperative as a supplier, the farmers already had a crop of soya planted for the long rains. Frustration with the inability to either sell or process the beans at harvest because local markets were underdeveloped caused many farmers to abandon soya production all together. With a full-time staff of only eight people and in the face of the collapse of the project, CARD began to focus its efforts elsewhere.

CARD's decision to concentrate its efforts on its projects in beekeeping, biogas, and HIV/AIDS sustainable living reflected a shift in three primary areas: 1) the decision to engage in local versus global networks 2) to devolve control and ownership of the project back to stakeholders 3) to meet people where they are in recognizing the significant impact of HIV positive status on pursuing a livelihood. When I pressed members of the CARD staff on this last issue, they pointedly told me that community development simply could not go forward without working with HIV/AIDS. As HIV/AIDS affected nearly one of every five people in the community, literally everyone knew someone who was HIV positive and many households faced labor and income constraints as a direct result of the epidemic.

In making a transition and moving out of its role as a boundary organization between the WFP and soya farmers, CARD actually strengthened its capacity to act as an effective boundary organization between the discourses of health and agricultural development. For one, it gave CARD a chance to work within the context of a social system where HIV/AIDS is a major factor in day to day livelihood choices, instead of attempting to operate in spite of those constraints.

In devolving control to its stakeholders, CARD shifted toward a mindset of partnering rather than directing or leading development processes. Increased stakeholder control also freed up limited CARD human and financial resources, the staff also had increased opportunities to pursue adequate training to make themselves accountable to members of the health and agricultural communities in Kakamega. As evidence of its success in reorganizing itself as a boundary organization, by summer 2009 CARD had helped to install over 10,000 farmer managed beehives in the area and 15 biogas digesters to make use of animal feces for energy. CARD had also become increasingly well known as a major proponent of HIV/AIDS education and sustainable living.

7. A Participatory Action Research Agenda: Measuring Nutrition and Agricultural Development with Smallholders

When I contacted CARD in the fall of 2007 the organization had just begun to consider the possibility of a local soya project. First, fitting with its reorientation as a boundary organization in the Kakamega community, CARD emphasized the need to incorporate both producer and consumer perspectives. In March of 2008, the project was given a grant for $1,000 from the Jimmy and Rossalyn Carter Partnership Foundation to explore soya value added processing technologies for smallholders. During the summer of 2008, CARD held meetings with remaining soya project farmers and with some members of persons living with HIV (PLWHIV) sustainable living network to gauge interest levels from different groups. In April 2009 I was granted a research fellowship from the Fralin Life Sciences Institute to explore consumption patterns and potential nutritional benefits of soya by persons in CARD's network of PLWHIV over summer 2009. This positioning as a researcher, intern and project coordinator at CARD offered the opportunity to approach development reflexively in simultaneously striving to study and catalyze change processes at the intersection of nutrition and agriculture (Parfitt 2002).

The participatory action research program wished to document and analyze the tradeoffs between health, nutrition, and agricultural decision making processes of agricultural smallholders. Upon arriving in Kakamega, an initial priority was to assess the opportunities and constraints of the soya project working with local persons living with HIV support groups, and a local farmer group composed of several previous soya farmers and a few additional farmers interested in transitioning some of their land to soya cultivation. Given the local orientation of the project, the sample size is small, including 15 farmers, 15 town-based Tujengane support group members, and 19 Jiinue rural support group members. Initially, surveys were distributed at the farmer and support group meetings. However, it quickly became clear in the support groups that literacy would be a major constraint in accurate reporting. Subsequently, a member of the CARD staff fluent in Kiluhya and Kiswahili and I followed up individually with members whose surveys appeared incomplete. While responses remained low amongst support group members even after this process, we felt that we could have relative confidence in the quality of the data.

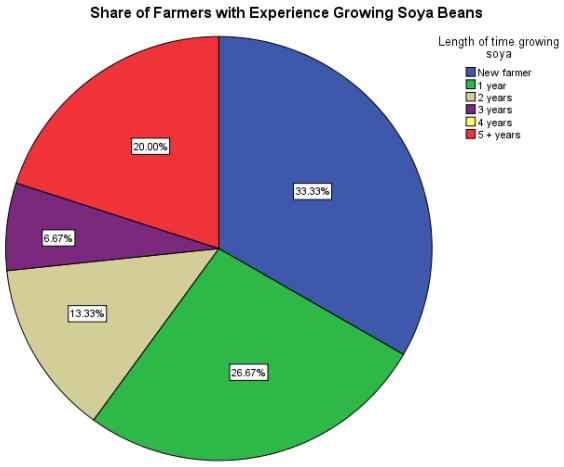

Figure 1: Share of Experience in Soya

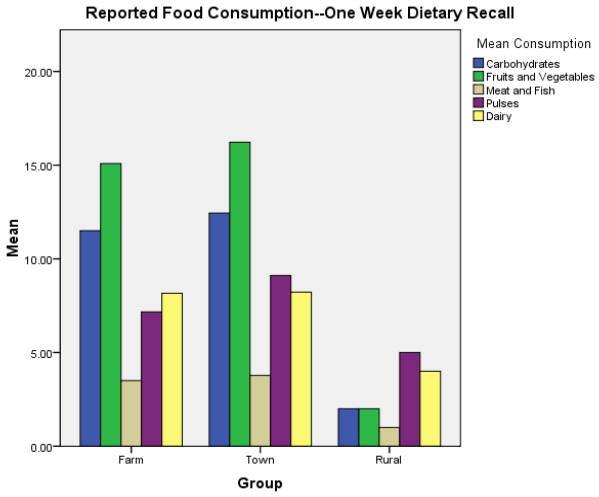

Figure 2: Comparison of farmer, Tujengane and Junue Support Group Consumption

From an agricultural development perspective, project stakeholders were surveyed about their farming activities, including their experience, crops planted, lands and crop utilization. All the farmers surveyed had less than 5 hectares in production, and commonly produced products for home consumption and sale. This extended to a strong interest in cultivating soya for home consumption and processing for sale in the market. While all of the farmers had experience cultivating maize, Figure 1 provides a sense of the mixed experience with growing soya.

Figure 3: Vitagoat pressure cooker and stove in Bukura, Kenya. Figure 4: Soya Mill used to process soya flour and soya beverage purchased by CARD in July 2009

Consistent with nutrition literature, weekly dietary recalls (where an individual reports on the number of servings consumed per day from a local consumption basket) were administered to the participating groups. These surveys were used to examine dietary diversity (Hoddinott & Yohannes 2002). In Figure 2, the project identified several interesting and relevant dietary patterns to the soya project. Meat and fish consumption were universally low across groups, and pulses consumption considerably high relative to other products in the rural PLWHIV support group. This suggested an opportunity to expand consumption of higher quality protein amongst this most vulnerable group by substituting soya beans for lower nutritional value pulses. Moreover, the chart suggests considerable differences in access to different types of foods, even within 10 kilometers of Kakamega. Not surprisingly, the PLWHIV rural support group members appear to be less food secure than the farmer or town based group members. Other significant findings include the fact that all of the participants surveyed reported that they consumed chai and ugali[x] regularly, the only two food commodities for which this was the case[xi]. Based on the results of the surveys, the CARD staff and I felt comfortable making several conclusions before moving forward:

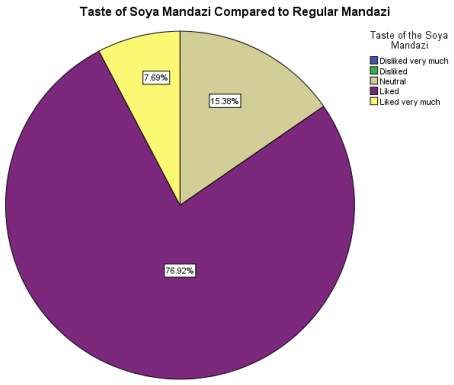

Figure 5: Chart reflecting preferences for mandazi made with 25% soya flour as compared to regular mandazi prepared **from only wheat flour**

Soya had major potential to improve protein consumption and income generation for PLWHIV who regularly face employment discrimination and have elevated protein needs.

Continuing to work with the rural and town based support group would ensure that the project benefited those most likely to be food insecure[xii].

Farmers and support group members had extensive agricultural experience and knowledge, as well as enthusiasm for experimenting with soya as an additional crop.

Ugali and chai were the most universally and commonly consumed foods. Subsequently, efforts for value added processing should seek to take advantage and not displace these socially and culturally important foods.

CARD could utilize its existing networks to expand and the project to beekeeping participants and throughout its PLWHIV network.

7. Appropriate Technology for Managing the Boundary between Nutrition and Agriculture

Exploring options for value added processing of soya beans to meet these recommendations, it was frustrating to discover that available technologies had been developed largely from a nutrition intervention rather than agricultural development perspective. Malnutrition Matters, the NGO most well-known for soy processing in developing countries, has been successful in creating two machines for soymilk production: the Vitacow and the Vitagoat (Figure 3). The earlier technology, the Vitacow, was designed for large scale soya production and required the use of electricity and fuel to grind the soya beans and run the pressure cooker for soyamilk. In an attempt to adapt the technology to rural settings for use by farmers and development NGOs, the Vitagoat was designed to operate using manpower and locally available fuels (American Soybean Association 2004).

Yet the "appropriateness" of the Vitagoat technology to the Kenyan context remained constrained despite its adaptations (Hazeltine, Barrett, & Bull 1999). The Vitagoat still could only be manufactured and serviced in India due to sophisticated design of its pressure cooker and low availability of high quality steel. The Vitagoat

also required an input of 8kg of soy per batch, greater than the yield of most of the part-time soya farmers surveyed, suggesting that the scale of the machines capability was also not suitable for smallholder processing.

As a food product, soyamilk was forced to compete with dairy milk. As dairy milk is already accepted and integrated into the culture, even optimistic soymilk pricing scenarios estimate that soymilk would only command two thirds of the price of dairy milk in Kenya (Chianu, Ohiokpeai, Vanlauwe, Adesina, De Groote & Sanginga 2009). Furthermore, unlike dairy milk, soymilk cannot be high temperature processed and therefore must be marketed, delivered, and sold under refrigerated conditions. The lack of availability of a refrigerated distribution chain largely confined the optimal utilization of Vitagoat technologies to a feeding program rather than a mechanism for soya farmers to begin to capture higher returns for their agricultural products in Western Kenya.

The low functionality of the Vitagoat system as a tool for smallholders was demonstrated on a field visit to the Agricultural Technology Center in Bukura. While the Ministry of Agriculture in Kakamega had reported the Bukura project to be an example of significant success in soya bean processing in Western Kenya, a field visit revealed that the nearly year-old Vitagoat system was operated at a quarter of its daily capacity and was utilized actively by a sole soya farmer, who operated a mildly successful soya yoghurt business by selling door to door in the surrounding area.

In the wake of these disappointing findings, CARD leveraged its horizontal ties in the community in order to discover additional options for value added processing. From a reference of a posho mill[xiii] owner, CARD learned that there were mills designed to process soya beans available in Nairobi. The decision to purchase one of these machines (See Figure 4) was the result of a culmination of factors. First, the machines themselves were much simpler in their design, using a sieve and grinder to produce fine flour from the oil seed. Therefore, the machine could be serviced by most posho mill operators.

From a product standpoint, the mill allowed for the resource and labor saving production of soya flour and soya beverage, both shelf stable products that a farmer could store and market for a period of up to six months. Further, soya flour and soya beverage do not face the same constraints as soya milk in terms of having to compete with existing products. Rather, soya flour can be marketed as a nutritional extender of both maize and wheat flour.

The acceptability of both products was measured through anonymous taste tests, in which 15 participants from the Tujengane town based support group were asked to compare the soya products to their non-soy or commercially scaled counterparts. Soya beverage is a local product made by roasting soya and then grinding it to a fine powder. The soya beverage is then added to tea or served with warm milk or water and sugar. While soya beverage was considered a luxury product by most of the project stakeholders, most reported that they would consume the product if they could produce it easily themselves. Above, Figure 5 highlights the results of the taste survey for soya mandazi. CARD's search for the appropriate technology for value added processing was not only crucial to transforming the form utility of soya, but also opened the opportunity the nutritional and agronomic benefits of soya beans to be realized by producers. Moving forward, this rapid

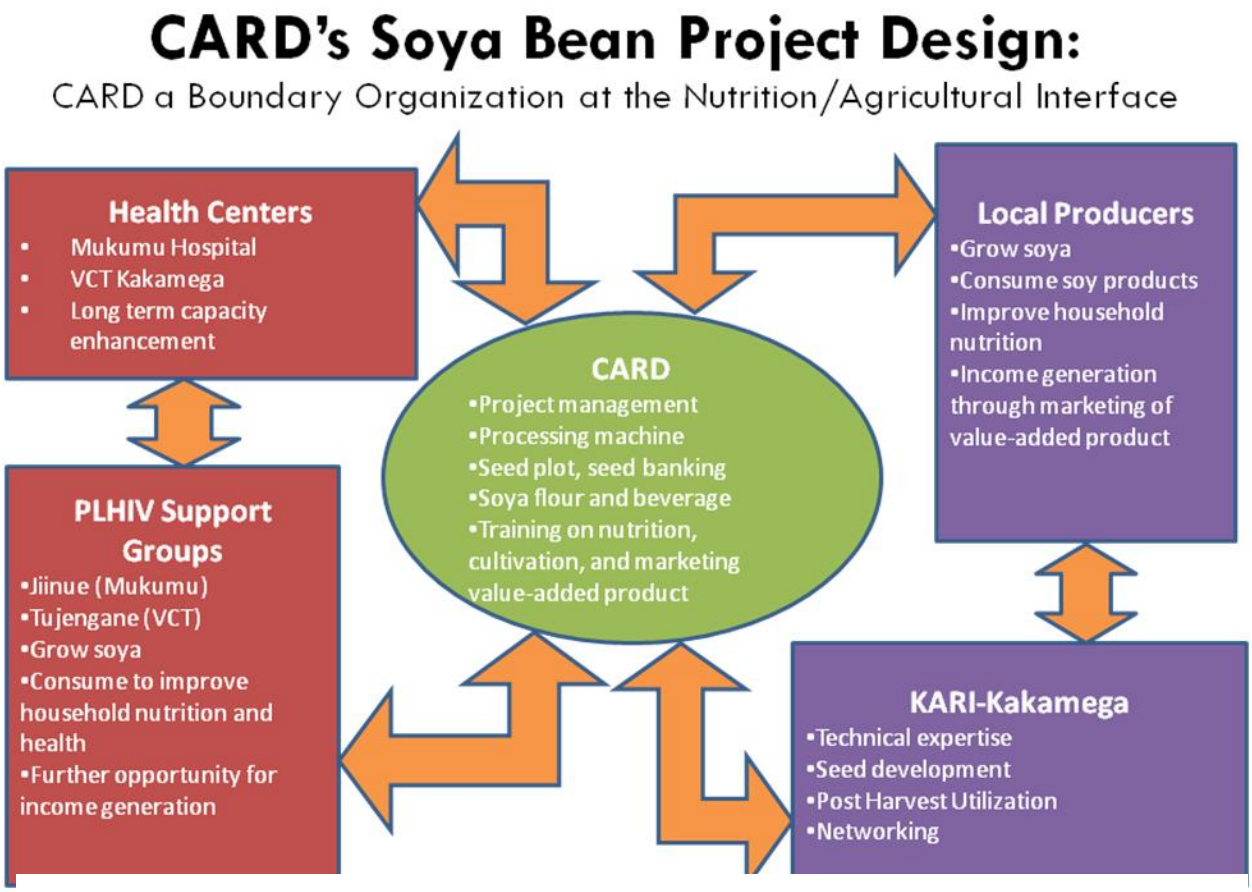

Figure 6: CARD Project Design

assessment had demonstrated that the experience with soya production (Figure 1), the need for protein resources (especially for rural PLWHIV as in Figure 2), and the commitment to a project to improve home consumption and income generation to serve as the foundation for designing a successful local soya project.

8. Discussion: Horizontal Networks in Designing a Successful Local Soya Project

With the value added processing system in place and its previous experience in working with community members in health and agriculture, CARD was in a position to further leverage its ability to work in horizontal networks within the Kakamega community to capture the interest of a diverse set of stakeholders. Using its previous work with HIV/AIDS and sustainable living, CARD was able to link to a rural and town-based support group who agreed to volunteer and work a common plot of soya beans as a substitute for double cropping maize. CARD also hosted a training for soya farmers on how to use the processing machine and enlisted the support of several of the hold-over soya growers from its previous project as well as a small group of farmers interested in transitioning some of their land to soya.

Working locally allowed CARD to appeal to the multi-dimensional nature of rural livelihoods. As one staff member put it "No one understands the need for good nutrition like an HIV positive mother working in the field". Relationships with agricultural and nutritional stakeholders were solidified through programmatic integration of larger scale organizations as well. From a nutritional perspective, the

CARD staff met with officials from the Voluntary Counseling and Testing Center in Kakamega and Mukumu Hospital, who coordinated support group activities. Regarding agricultural development, an additional major outcome of the project was the development of a Memorandum of Understanding (MOU) with the Kakamega branch of KARI. Through the MOU, KARI-Kakamega and CARD agreed to partner to establish plots for the growth of certified seed by CARD project farmers and to allow the KARI staff to provide training in CARD projects as an aspect of the KARI extension responsibility. In the longer term, CARD's increased ability to use the soya processing system has also allowed CARD to reach additional stakeholders to benefit from the nutritional value of soy. Amidst a surplus of soya flour and soya beverage, CARD began contracting with local schools and orphanages to provide ingredients for the lunchtime meal.

Through the process of developing its local soya project, CARD experimented first hand with many of the practical obstacles and considerations addressed by boundary management organizations. Specifically, Cash et al identify three common organizing themes for successful boundary management and articulating knowledge into action (2003). First, it is emphasized that boundary management should be treated seriously. Secondly, considerable effort should be dedicated to demonstrating dual accountability. Finally, effective systems utilize boundary objects (Cash et al 2003). As presented by Cash, these are projects or items in which individuals with diverse expertise may come together to develop a project and/or set of recommendations to improve the current situation. While Cash et al extrapolate these themes to broader knowledge systems, the CARD experience as a boundary organization, and with its soya bean project, demonstrate that the interpretive flexibility of soya beans can improve both agricultural and nutrition outcomes at the local level. First, CARD identified that soya could serve stakeholders with multiple interests in improving nutrition, farm sustainability, and increasing their incomes by successfully identifying a processing technology (boundary object) that could meet these needs within the cultural framework. The CARD experience also raises issues of dual accountability. In a society where no one has enough, CARD constructed a project design to attempt to make benefits flow to those most in need of assistance. The organization also leveraged its previous experience in both fields to make itself equally accountable to its agricultural and health stakeholders.

CARD's success comes at an interesting juncture as advocacy of the use of soya beans in Africa has become an increasingly high profile issue, especially in Kenya (Misiko et al 2008). While soybeans remain a prominent component of food aid programs in Kenya, as captured in the opening quote, increasing levels of soil degradation and food insecurity in Western Kenya have been recognized by agronomists and nutritionists as an opportunity to introduce soya beans as a supplement to the maize dominated cropping system and diet (Chianu et al 2009). In the works of one KARI Agronomist "I often tell Kenyans they have to supplement ugali with soybean blended foods because when there is no maize, they starve" (Njuguna 2009). However, as the CARD experience demonstrates, efforts to address food insecurity through soya production in local purchase programs have yet to be flexible enough to work with smallholders effectively. Nevertheless, a concern with current efforts to scale up soya production through localized value added processing is that they seem to still be focused toward a food aid rather than agricultural development approach by continuing to promote the installation of Vitagoat

technologies. How soya beans will integrate or fail to integrate into local knowledge systems in Kenya remains to be seen. What is clear is that local level soybean processing increases opportunities for production to be more profitable and sustainable while simultaneously meeting the protein needs of smallholders. The CARD experience emphasizes that the boundary between health and agricultural development can be effectively managed at the local level by bringing together stakeholders over their common interest to improve community well-being.

Bibliography

American Soybean Association. (2004). *Improving Health Through Soy: A Basic Training Manual.*

Ashley, C. and S. Maxwell. (2001). *Development Policy Review*. 19(4): 395-425

Barrett, C. B.. (2001). *Food security and food assistance programs*. In: Handbook of Agricultural Economics Vol. 2B Agricultural and Food Policy.

Bijker, W. E.. (1995). *Of Bicycles, Bakelites and Bulbs: Towards a Theory of Sociotechnical Change*. Cambridge, Mass.: MIT Press.

Cash, D.W., W.C. Clark, F. Alcock, N.M. Dickson, N. Eckley, D.H Guston, J. Jager and R.B. Mitchell. (2003). *Knowledge systems for sustainable development.* Proceedings of the National Academy of Sciences, 100(14).

Chianu, J.N., O. Ohiokpeai, B. Vanlauwe, A. Adesina, H. De Groote and N. Sanginga. (2009). *Promoting a versatile but yet minor crop: Soybean in the farming systems of Kenya*. Journal of Sustainable Development in Africa, 10(4).

Coates, J., E.A. Frongillo, B.L. Rogers, P.Webb, P. Wilde and R. Houser. (2006). *Commonalities in the experience of household food insecurity across cultures: What are measures missing?* American Society for Nutrition. Supplement: Advances in Developing Country Food Insecurity Measurement.

Goldberger, J.R. (2008). *Non-governmental organizations, strategic bridge building, and the"scientization" of organic agriculture in Kenya*. Agriculture and Human Values 25(2).

Hoddinott, J. and Y. Yohannes. (2002). *Dietary diversity as a measure of food insecurity*. International Food Policy Research Institute, Food Consumption and Nutrition Division Discussion Paper No. 136.

Hazeltine, Barrett and C. Bull. (1999). *Appropriate Technology: Tools, Choices, and Implications*. San Diego: Academic Press.

Lappe, F. and J. Collins. (1998). *World Hunger: Twelve Myth*s. Second ed. New York: Grove Press.

Misiko, M., P.J Tittonell, J.J. Ramisch,P. Richards and K.E. Giller. (2008). *Integrating new soyabean varieties for soil fertility management in smallholder systems through participatory research: Lessons from western Kenya*. Agricultural Systems. 7(1).

Njuguna, C. (2009) Kenya: Soybean - the Seed for Wealth, Health, and Soil Fertility. Allafrica.com Available at:http://allafrica.com/stories/200909240168.html

Parfitt, T. (2002). *The End of Development: Modernity, Postmodernity, and Development*. Sterling, VA: Pluto Press.

Pieterse, J. (2001). *Development as Reflexive Practice in Pietierse*, J. (ed) Deveolpment Theory: Deconstructions/ Reconstructions. London: Sage.

Ruel, M.T. (2003). *Is dietary diversity an indicator of dietary quality or food insecurity?* Food Consumption and Nutrition Division Discussion Paper No. 140.

Schreinemachers, P. (2006) *The (ir)relevance of the crop yield gap to food security in developing countries: With an application to multi agent modeling of farming systems in Uganda*. Doctoral Dissertation, The University of Bonn, Netherlands.

Scott, J.C. (1998). *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.

Shrum, W. (2001). *Science and story in development: The emergence of non-governmental organizations in agricultural research*. Social Studies of Science 30(1).

World Food Program. (2006). *Food Procurement in Developing Countries*. Policy Issues for Consideration: Agenda Item 5. Available at: www.wfp.org/eb

---. (1996). *Food Procurement Policy*, Executive Director Circular ED96/009, 11 April 1996 Available at: www.wfp.org/eb

Endnotes

[i] Throughout this text smallholders will be used to refer to small, semi-commercialized farmers who hold back some of their production for subsistence.

[ii] Common metrics to address macronutrient malnutrition include Body Mass Index, upper arm circumference and height and weight measurements. Measures of micronutrient malnutrition often look for physical manifestations of micronutrient deficiency, such as Vitamin A related blindness or goiter.

[iii] For triangulation, access based measures are also often paired with biometric measures of food security such as the presence of a stunted child in the household, upper arm circumference, Body Mass Index, and weight to height ratios.

[iv] Like all legumes, soya bean leaves take nitrogen out of the atmosphere and draw it down to the root structure to be used as energy for plant growth.

[v] In terms of protein availability for digestion.

[vi] While soya beans originated in mainland China, today they are grown on all six inhabited continents and are available in a broad range of varieties bred to meet particularized climatic, nutritional, and agricultural needs.

[vii] These mills are ill adapted to oil processing, and the oil can break down the blades over time. Moreover, many mill owners do not want to take the time to clean the machine, allow for soya processing, and then re-clean the machine before moving back to grinding another grain.

[viii]A headline program of the food aid reauthorization in the 2008 Farm Bill is the inclusion of a 60 million dollar local purchase program (Title III, Farm Bill). The local purchase program is a pilot designed to build the case for a larger restructuring of US food aid. In an idealized sense, the turn to local purchase seems a key opportunity for the potential complementary nature of nutrition and agriculture to be realized in the development context. Functioning local purchase programs may have the opportunity to raise the exchange entitlement for participating farmers, providing them the opportunity to pursue a more sustainable livelihood.

[ix] Not surprisingly the largest supplier of food through local procurement programs is South Africa.

[x] Ugali is commonly considered the staple of the Kenyan diet. It is a pan-baked, mostly solid corn meal usually paired with vegetables such as kale or with boiled meat

[xi] SPSS was used to conduct basic statistical analyses on the various surveys.

[xii] This goal uses the phrasing of most likely to be food insecure as insufficient data was collected to obtain a more confident estimate of individual food security.

[xiii] Posho mills are Kenyan corn mills, and are often managed by successful small-scale entrepreneurs.