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Lessons Learned from Pilot Testing VitaGoat Technology in Guinea

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Objective

One objective of Africare's Title II Institutional Capacity Building (ICB) grant (FY04-08) from the United States Agency for International Development (USAID) was to pilot test the introduction of community-based soybean processing equipment as a component of its existing and new Title II programs.[iv] This paper provides a brief overview of the results of one of these pilot programs, which was introduced in connection with the Guinea Food Security Initiative (GnFSI) in the region of Dinguiraye in 2004 and later in Dabola region in 2005.

Background

Any broad-based initiative to address the special needs and concerns of vulnerable people must also examine ways for poor and vulnerable populations to have access to good quality and less expensive (than animal food) protein sources, especially in a context marked by increases in oil and food prices and the financial crisis.

Although there is no evidence of a need for increased protein intake for people living with human immuno-deficiency virus **(**HIV), the need for high calorie, nutrient dense foods that are easily digested—such as soy milk—is not contested (WHO 2003, Africare and Malnutrition Matters 2004, Module 1). Furthermore, it is recognized that those living with HIV in resource poor areas are likely to have underlying protein-energy and micronutrient deficiencies (FANTA 2004). For these reasons, a growing number of African governments and international donors are re-examining various ways to use soy foods imported from the United States as well as locally grown soy to produce soy milk and other soy products. Both types of programs have received support from the American soybean industry and, especially, the World Initiative for Soy in Human Health (WISHH) of the American Soybean Association (ASA).

The Development of the Soy Processing Systems

The World Initiative for Soy in Human Health (WISHH), an NGO created in 2000—in partnership with Malnutrition Matters (a Canadian non-profit contracted by WISHH to provide technical support on these outreach activities)—has helped fund and facilitate funding of the basic equipment of small-scale soybean processing technologies in various parts of the world. The initial focus of these programs was on the SoyCow, later referred to as VitaCow—a processing system that could produce 40 liters of soy milk per hour. The soy milk can then be further processed into value added products such as tofu and yogurt, as well as local food blends. By comparison, live cows in developing countries generally produce between 3.8 and 7.6 liters of milk per day. The VitaCow can also process legumes, grains, cereals, fruits, and vegetables.

Based on lessons learned from the initial pilots by Africare as well as other organizations that pilot-tested the first generation VitaCows—most

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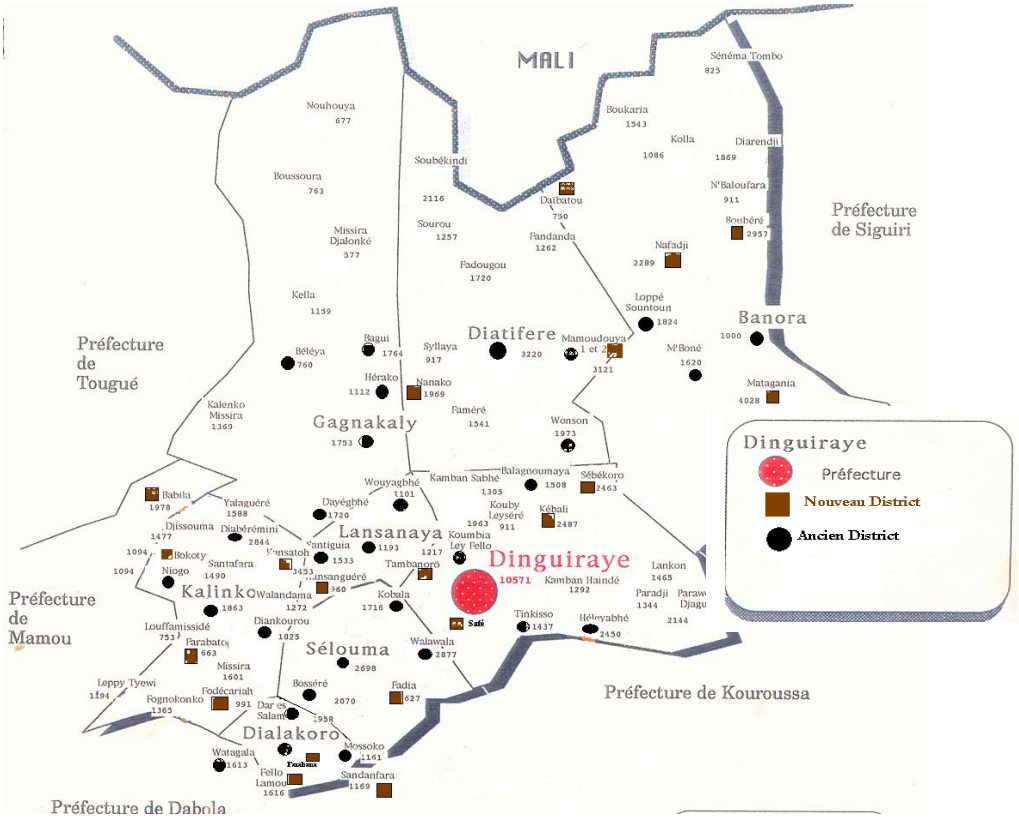


Map 1: Prefecture of Dinguiraye, Guinea

notably the difficulty of growing enough soybeans to keep the machines fully deployed – Malnutrition Matters has switched its emphasis from SoyCow to VitaGoat in the last five years. A VitaGoat system can process 30 liters of soy milk per hour, using fuelwood or petrol (not electricity) (Malnutrition Matters 2007). The name changed away from a focus on soy in the development of VitaGoat systems (i.e., they are not called SoyGoats) to reflect the wider range of food stuffs that can be processed with the systems. Like VitaCow systems, VitaGoat systems can also be used to process other legumes, grains, cereals, nuts, fruits, and vegetables.

Africare's ICB Grant

Under the ICB Grant, Africare proposed to pilot test the introduction of the new VitaCow technology and eventually scale up the experience by adding it as a component in all of its existing and new Title II food security programs. It was anticipated that WISHH would provide the basic equipment for the projects and that the project would use its own resources to fund training and other inputs—such as improved seeds and crop extension—that local crop extension groups (or *groupements*) would need to make the VitaGoat technology profitable. After the initial subsidy from Africare for purchasing the equipment and transporting it to the site,[v] the community was expected to cover the costs of routine operation through the sale of the soymilk and related products, as well as other products that they could produce from the equipment. Through its ICB grant, Africare committed to providing some basic technical assistance (through its headquarters office) that would link its Title II programs with Malnutrition Matters, as well as a VitaCow business manual. The business manual, which was produced in English during the first year of the ICB, includes information on setting up a community-based soy processing activity including information on different products that can be made using soy beans, marketing, and a cost-benefit analysis Excel tool (Africare and Malnutrition Matters 2004). The manual also includes three more focused modules:

- Module 1. Health and Nutrition Instructions for People Living with HIV/AIDS
- Module 2. Weaning Foods using the VitaCow

- Module 3. Fruit & Vegetable Processing using the VitaCow (with a particular emphasis on mango and tomato processing)

The GnFSI Project

One of the first pilot tests was organized through the Africare Guinea Food Security Initiative (GnFSI, 2001-2007[vi]) in the Dinguiraye region of middle Guinea. Despite relatively high rainfall and abundant resources, historically, the Dinguiraye region has had some of the highest rates of malnutrition in Guinea. The Guinea Food Security Initiative and its preceding project the Dinguiraye Food Security Initiative (DFSI, 1997-2000) were designed to reduce these high malnutrition rates.

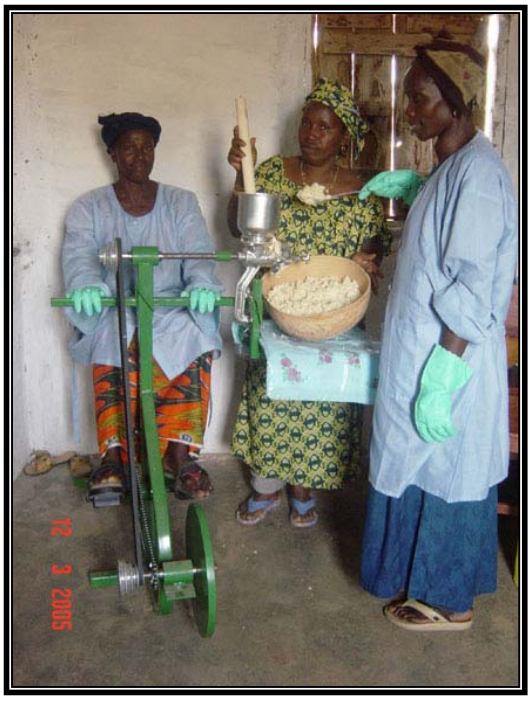
The GnFSI was a classic three-pronged food security project to address food availability, access, and utilization. The project activities were conceptualized as following two strategic objectives:

- Strategic Objective One: Improving the nutrition and health status of women and children under five and
- Strategic Objective Two: Increasing agricultural productivity.

Based on the results of the final evaluation of the previous DFSI project, the new project included post-harvest management (i.e., reducing post harvest losses, increasing revenues by value-added food processing) as one of the three sub-foci of the second strategic objective. The other two were agricultural production and community capacity building (see McMillan et al. 2006; Pogba et al. 2007 [AFSR No. 7], and Sidibé, et al. 2007 [AFSR No. 8]).

Methods

Although food processing was an important sub-focus under Strategic Objective Two, introducing VitaGoat technology was not in the original proposal. It was also introduced relatively late in the project cycle—one system was introduced in year four (2004/2005)[vii] and two in year five (2005/2006) of the original five year project period, which was later geographically expanded to cover the Dabola region and further extended by one year to include fiscal year 2007. This late introduction has had two important impacts on the data for this case study: there was no standardized monitoring and evaluation system set up specifically for the VitaGoat activities and limited data are only available for the final year or two of the grant. The lack of an M&E system for VitaGoat activities means that data on this sub-component is sparse and sometimes difficult to interpret. Records were kept based on the existing GnFSI model developed by GnFSI for community-based income generating activities that it facilitated. In addition, there was some attempt at tracking cash flow associated with the equipment. Although the initial installations included handing over the SoyCow/VitaCow Business Guide, which included a cost-benefit analysis template (Box 1 and Annex I), this guide was not translated into French and has not been sufficiently incorporated into the management structures in order to ensure its widespread use.[viii]



VitaGoat cycle grinder, Guinea.
Photo Credit: GnFSI II archive

This review of the experience with VitaGoat systems associated with the GnFSI project used project records and data and an initial review of Africare's VitaGoat Pilot projects in 2007 (Bryson 2007) to assess the success and impact of the VitaGoat systems and attempted to construct an ex-post facto analysis of the rate of return from the technology for the women's groups and individuals involved in the initial pilot tests. The VitaGoat machines were

Box 1. Cost-Benefit Analysis

The cost-benefit spreadsheet (prepared using Microsoft Excel) has 4 sections (see Annex I for example image of the spread sheet):

a) Capital Investment: This includes the cost of all equipment, site preparation, etc that is necessary to start the business.
b) Variable Costs: These are costs that are only incurred if there is production.
c) Fixed Costs: These costs are incurred regardless of whether there is production or not.
d) Revenue: This is the money that the business collects for products it sells.

In addition, there are 4 columns:

a) Unit cost: This is what the material or service costs on a "per unit" basis. For example, electricity is priced by kW-hours.
b) Hourly cost: This is what the material or service will cost per hour of production. For example, soybeans may cost $0.20/kg and the system may use an average of 6.15 kg per hour, so the hourly soybean cost is $ 1.23.
c) Cost per liter: This is what the business charges per liter of product. In the case of products that are not sold by the liter (or kilogram) – for example if yogurt is sold by 200 gram containers, then the total is prorated to a liter (in this example, the yogurt revenue per liter is the revenue per 200g times 5).
d) Profit per day: This is the difference between the revenue and cost for each item sold. Multiplied by the volume of product sold. For example, soymilk costs $0.16/liter to make and sells for $0.20/liter, so the per liter profit is $0.04/liter. Assuming that 60% of the day's sales are soymilk, and that the business produces for 5 hours per day, the total profit per day for soymilk is $0.04 x 0.6 x 40 (liters produced per hour) x 5 = $4.72.

The cost-benefit spreadsheet uses a number of mathematical formulas to arrive at the totals, but once these are known, it is simple to prepare this detailed spreadsheet for each location. It is simpler and much faster to prepare the spreadsheet on a computer, but it is of course possible to prepare it by hand as well. You will find enclosed in this section a computer diskette that includes the cost-benefit spreadsheet.

Source: Africare and Malnutrition Matters. 2004: 32-33.

provided to only women's groups, which were very active and efficient in food processing and marketing in major cities of Dinguiraye region (Dinguiraye and Kalinko) and Dabola Region (Dogomet). Although many staff associated with the GFSI project provided support to the VitaGoat extension activities through crop extension and farmer training, the VitaGoat exercise worked with only three of the 2003 *groupements* and eight unions of *groupement* supported by the project (see McMillan et al. 2006: 44 and 42-74). The authors communicated with the women's groups to gather information on the impacts of these systems.

The pilot test with these three *groupements* was truly a pilot both for Guinea and for Africare's Title II programs and provides valuable lessons learned from this initial experiment for Africare's future programs, as well as future attempts by WISHH to promote the technology though non-governmental organizations.

Results

The first VitaGoat technology was introduced through an established women's *groupement* in Dinguiraye in 2004. The entire women's group received a three to five day training from the Canadian consultant who delivered the equipment in November 2004. This training addressed basic operating issues, as well recipes for creating soymilk, soy coffee, and *soumbara* (the Guinean name for the spice more commonly referred to as s*oumbala* in many other parts of West Africa). Furthermore, a local artisan (a carpenter) was trained in maintenance and repair of the machines. Starting in 2005, the GnFSI health team charged with executing the activities under Strategic Objective One integrated information about the health benefits of soy

consumption into the public awareness campaigns and themes promoted during infant growth monitoring. The *groupement* also distributed a portion of its milk to a nearby kindergarten, which served as a marketing tool and increased awareness and demand for soymilk in the area.

Even in the first year, the soy milk and other products proved to be very popular. Despite high market demand (for milk purchases) the *groupement* was able to operate only seven out of 12 months in 2005. The chief problem was the difficulty in obtaining a sufficient supply of the raw product (soy beans). In response to this constraint:

- GnFSI began to promote soy production through its agricultural extension agents and by facilitating farmers' access to improved seeds from the Agricultural Research Center at Bordeau Kankan and
- GnFSI agents and *groupements* began to promote use of the technology to process other locally available products such as maize, millet, and peanuts.

Parallel to the new emphasis on promoting soy through crop extension and diversification of food stuffs produced, GnFSI acquired two more machines in 2005. One went to Kalinko in the Dinguiraye region (Map 1) and the other to Dagomet in Dabola (Map 2). The new *groupement*s in those areas were trained by women trained during the first training workshop in Dinguiraye. In addition, GFSI worked through the GnFSI extension agents to organize exchange visits between the sites in order for the *groupement* members to exchange information about the difficulties they were encountering and routine maintenance.

GnFSI continued to facilitate farmers' access to improved seed from the Agricultural Research Center at Bordeau Kankan under the Ministry of Agriculture and Scientific Research (179 km from Dinguiraye, 267 km from Dagomet in Dabola, and 259 km from Kalinko in Dinguiraye). On-farm demonstrations of the new technologies were conducted on *groupement* fields near the project site. Individual women were also encouraged to have small 0.50 ha fields and were supplied seed. One of the best indicators of active interest in the program was that many farmers self-funded an expansion of the area planted in soy in the second year of the extension program and encouraged other groups (through the distribution of improved seed) to produce soy and sell it back to them. Project records show that 7.35 hectares were grown by women's groups in the two sites in 2007. Even with the increased area planted for soy all three machines were never able to acquire enough soy to satisfy the local market demand. In 2006, the women's groups in Dinguiraye and Dogomet, with the assistance of Africare assistant supervisor for agricultural productivity, undertook a field trip to Kankan to buy more soy from local farmers. Despite this effort very little quantity was delivered by those farmers and the supply of soy beans could never match the grinding capacity of the three machines, nor to the demand for soy milk in the market. The demand for soy milk was primarily from children, particularly school children in all three production centers. Additional demands arose from the small traders and few civil servants who found the soy milk to be a good replacement for cow's milk, which was considered more expensive and not readily available.

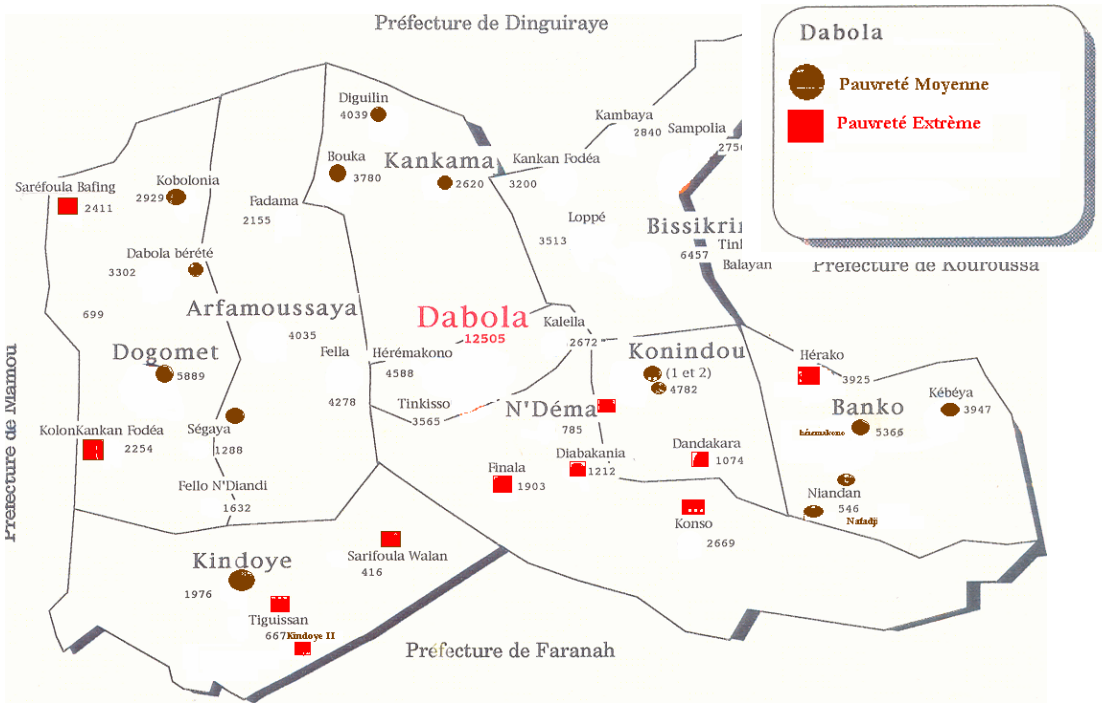
Since many *groupements* had experience with other types of food processing, minimal extension and special training was required to stimulate their use of the material for a wider range of non-soy based materials as well—especially peanut butter and jams. The short term impact of these was a fairly immediate and direct increase in soy milk production in year one, followed by greater diversification to other products during the second year (Table 3). A sharp drop off in production of all sorts occurred in the third year (2006) due to a malfunction of the nanometer for the boiler of the Dogomet and Kalinko machines. The Africare office in Conakry initiated contacts and discussions with Malnutrition Matters in Canada and realized that

A variety of food stuffs were produced by women's groups under the GnFSI activities.
Photo Credit: GnFSI archive.

Table 1. Number of Members in the Beneficiary *Groupements*

Location	Total Members	Female	Male
Dinguiraye	21	20	1
Kalinko	31	30	1
Dagomet	25	22	3

Source: GnFSI Project Records.



Prefecture of Dabola, Guinea

this technical problem was identified in other projects. Malnutrition Matters replace the defective parts free of charge.

In 2007, Africare facilitated supply of the spare parts from Canada to repair the machine of Dogomet and received additional spare parts for the two machines of Dinguiraye and Kalinko. The actual replacement and repair was done by the technician who had been trained at the beginning of the program and who has continued to repair the machines for a modest fee.

Although the GnFSI project closed in 2007, a group of former employees have created a local NGO in the region. They report that the three machines are still working. The chief concern expressed by those still associated with the machines is the lack of locally available spare parts.

Impacts

Assessing impact is difficult and not exhaustive with data that were recorded and are available. Records from the women's *groupement* show that 1.5 kilograms of soybeans (which cost 1554/kg in 2004/2005)[ix] produced 11 to 12 liters of soymilk. In 2004/2005 a liter of soymilk sold for 1000GNF. During the same time period one 300 gram box/bottle of fresh Gloria milk in the store cost between 1000GNF to 1300GNF (3333 to 4333GNF per liter). Thus the fresh box milk was more than three to four times as much as the VitaGoat soymilk.[x] Although the price of soymilk went up and down based on the shift in prices and currency,[xi] the price of a liter of soymilk remained substantially less than a liter of fresh box milk. By 2005/2006 the price of a 300 gram box of fresh milk had risen to 1500GNF to 2000GNF (4995 to 6660GNF per liter) compared to one liter of soymilk that was selling for 1300 GNF. A great deal of the product was sold by women entrepreneurs in smaller 200 gram units of soymilk and 300 gram units mixed with soy coffee through small restaurants. Another attractive quality of the soy milk was that it was available more consistently than local fresh milk, which was sold seasonally in area markets. In addition, the "fresh" milk

Table 2. Evolution of Soymilk Production from the Three VitaGoat Machines Introduced through GnFSI (March 13, 2005-August 28, 2007)

March 2005 to August 2007	Quantity of Soy Used in Production (kg)	Quantity of Milk Produced (liters)	Quantity of Milk Consumed by Women's Group or Given Away (liters)*	Quantity of Milk Sold (liters)	Gross Profit** from Milk Sales (GNF)	Price per Liter (average)
March 2005	22.5	247	27	220	220,000	1000
April, May June 2005	42	372	83	289	289,000	1000
July, August, September 2005	38.10	290.5	22	266.5	266,500	1000
October, November, December 2005	24	180	15	165	165,000	1000
Subtotal 2005	***126.6***	***1089.5***	***147***	***940.5***	***940,500***	***1000***
October, November, December 2006	42	373	35	338	439,400	1300
Subtotal 2006	***42***	***373***	***35***	***338***	***439,400***	***1300***
January, February, March 2007	18	145	35	110	165,000	1500
April, May, June 2007	7	71	16	54	82,050	1519
July, August 2007	38	295	80	215	322,500	1500
Subtotal 2007	***63***	***511***	***131***	***379***	***569,550***	***1503***
Total 2005-2007	**231.6**	**1,973.5**	**313**	**1,657.5**	**1,949,450**	1176

Source: GnFSI Project Records.
Note: The value of the Guinean Franc fluctuated considerably during the time in which these data were recorded. When necessary the project used the exchange rates reported in the official CSR2 reports for each year: (Africare. 2005; Africare 2006; and Africare 2007).
***** Includes free distribution of the milk at a nearby kindergarten.
****** Does not include cost of inputs, equipment or depreciation of equipment.

sold in markets was often powdered milk mixed with water of questionable quality and sanitation and was at times mixed with other products.

Although there is a great deal of qualitative evidence of the positive impact at the household and individual level of the VitaGoat systems, this impact is difficult to document quantitatively due to the lack of a standardized monitoring and evaluation system to monitor production for consumption and sale. Although the data is incomplete due to the lack of such a standardized method for tracking the details, there is a sense that specific constraints hindered production and profit making potential. These include the high costs of purchasing and maintaining the equipment and the small equipment that has to be purchased annually or every two years and the difficulty of obtaining spare parts, which resulted in delays and/or discontinuation in production.

Table 3. Other Products Transformed by the Bicycle (Cycle Grinder) from the Three VitaGoat Machines Introduced through GnFSI (March 13, 2005-August 28, 2007)

Period	Transformed Products	Quantity (kg)	Price per Unit (in GNF)	Cash Value of the Products/Gross Profits (in GNF)
March 2005	Peanut butter	20	3000	60, 000
	Ground maize	15	1500	22,500
Subtotal 2005				***82,500***
January, February, March 2006	Soy coffee	21	5000	105, 000
	Squash preserves	35.5	6000	213,000
April, May, June 2006	Soy coffee	15	3000	45,000
	Ground maize	50	2000	100,000
July, August, September 2006	Soy coffee	25	3000	75,000
	Peanut butter	35	3500	122,500
October, November, December 2006	Soy coffee	18	3500	63,000
	Squash preserves	16	5000	80,000
Subtotal 2006				***803,500***
April, May, June 2007	Soy coffee	10	3800	38,000
July, August 2007	Soy coffee	8	380	30,400
Subtotal 2007				***68,400***
Total				**954,400 GNF**

Source: GnFSI Project Records.

While it was not possible to demonstrate the long-term profitability and sustainability of the equipment, the project records show the following other results that need to be considered.

- A significant amount of soy milk has been supplied (free of charge) to the kindergarten located 10 kilometers from the VitaGoat installation at Dinguiraye and Dagomet since 2005, which has reportedly had a positive impact on the health of the children during the school year. This distribution to the school children has been a very effective marketing tool that increased local demand for purchased milk.
- The sale of products such as soy coffee by various extension group members has become an important income generating activity for the individuals. Unfortunately, only aggregate data were available and there is no documentation on how individual women benefited.
- The same problem with tracking household level impact emerges from the analysis of milk consumption. Though the project records show that a substantial proportion was consumed by the members of the sponsoring women's groups (Table 2), it is not clear what the household level impact was or how this was distributed.
- The use of soy bean husks for animal fed helped encourage intensive on-farm livestock production, but again, there is no information on how this was distributed within the *groupement* and/or sold to others in the area.
- There were several instances of *groupements* using the technology for other types of remunerative activities. One of the most successful was the Dogomet group that re-invested 300,000GNF of the money they earned from the sale of soymilk into equipment they needed to transform fresh cassava into "*attiéké*"—a type of cassava-based couscous that is one of the main food staples in southern *Cote d'Ivoire*.[xii] Therefore, it is possible that training and providing the groups with such complex food processing activities inspired them to think creatively about other options for income generation that would be feasible with established and effective collaboration between individuals.

- Several women groups in other urban areas had requested that Africare assist them with VitaGoat machines. However, due to the various constraints for raw materials and spare parts, Africare opted not to expand the program until there is clear evidence of their sustainability.

Factors that Contributed to or Detracted from Adoption and Economic Impact

Spare Parts and Maintenance. The chief constraint in relation to productivity of the technology—both for soy and other crops—is the need for a reliable and easily accessible network for spare parts. When the nanometer broke and replacement parts were not available in Guinea, Africare was required to order the replacement parts from Canada on behalf of the *groupements*. In the absence of this spare part, the machines completely shut down, which limited annual earnings. At least one female merchant in the region (who is heavily involved in importing mechanical parts and machines) is reported to have expressed and continues to express interest in importing the spare parts for VitaGoat machines. Based on local interviews with people remaining in the zone, the technician that the Canadian-sponsored consultant trained in 2004 is still available for parts repair and maintenance. These are opportunities to overcome this problem of availability of spare parts and reliable technical assistance.

Raw Material Supply and Seed Supply. After spare parts, the principal constraint to profitability of the VitaGoat systems was the insufficient supply of basic raw materials (i.e., soybeans). According to agricultural staff affiliated with the project, the Dinguiraye region is well adapted to soy production. They feel that had the soy processing technology and the GnFSI programs to promote soy production been introduced earlier on—it is possible that a more sustainable increase in the total area planted in soy could have occurred and/or been set in motion. Given the demonstrated demand, it is still plausible. For this type of technology uptake to be sustainable over the long-run, however, it needs to be supported by a steady reliable source of certified seed. Seed prices varied between 1000 and 1500 GNF in 2007. Since this price was sometimes 20 and 30 times greater than the average price per kilogram that *groupements* reported paying for soybeans, the private sector seed market seems to have potential to serve as a parallel livelihood activity.[xiii]

Member of the women's group selling mango jam processed with VitaGoat system.
Photo Credit: GnFSI II archive

To date, private sector seed supply in Guinea is very limited, if not non-existent for soy bean seed. In order to grow sufficient raw material, Africare purchased seed on behalf of the *groupments* from the Bordeau Kankan Agricultural Center—250 to 300 kilometers from the area where the three VitaGoat machines were located. Once the center closed its seed production activities, some of the students who had been working as interns on the Kankan farm with soy bean production started their own plots and continued to supply to the project. Another good indicator of strong demand is that the *groupements* are now purchasing the seed from the former students (emerging private sector seed suppliers) on their own. To date, the issue of seed remains unresolved due to the vast distances over which seed must travel and the lack of a solid national system in Guinea for certifying seed.

Training. One critical factor that contributed to the speed with which the three *groupements* were able to introduce the new technology was the initial training workshop that was organized the first year for the first *groupement* at Dinguiraye. This five-day training would have been insufficient, however, had the same *groupements* not already benefited from other project-sponsored workshops in basic literacy and business capacity building as part of the GFSI project. The women trained during the first workshop later trained the *groupement* members in the two new sites that were started in 2005.

Although the Africare and Malnutrition Matters Business Guide was produced in 2004 and informed the initial set-up of the equipment and training, the manual was not translated into French and no additional workshops were organized after the initial training of the local technician trained in repair.

Marketing. Not one of the three groups encountered any problems selling its products. The soy milk was popular and demand was high. It is important to emphasize however that:

- All three groups are located in urban and peri-urban areas where the demand for milk is high and the access to cow's milk is often limited and
- GnFSI promoted the virtues of soy products in its regular health promotion activities in connection with infant growth monitoring and other programs targeting children and mothers.

Diversification. Part of the genius of the VitaGoat technology is its utility for other types of food processing—especially of fruits, peanuts, and other nuts. Given the production constraints caused by inadequate supply of soybeans, this capacity to process other foods became extremely important to the participating *groupements*.

The rising demand of soy materials in the region has also contributed to encourage seeding of soy, thereby diversifying production options for farmers and encouraging young university graduates to invest into agriculture through soy bean production. This demand-driven private sector involvement is a trend to be encouraged by local decision makers in charge of agriculture extension.

Conclusions and Recommendations

In conclusion, there is clear evidence of adequate demand for VitaGoat technology and products. Not one of the groups encountered any problems with marketing the soy products. There was a strong local demand and no need to explore or create new market chains to the country's southern markets. This has been a major strength of VitaGoat installations in these areas. However, for the technology to realize its full economic potential it needs to be introduced as part of an integrated food security initiative that increases demand (through health education programs that publicize the potential health benefits of the milk) as well as programs that increase soy bean production. For the pilot testing of VitaGoat systems and similar food processing systems to be complete and to have maximum benefit, the agencies testing these technologies need to introduce simple systems for community-based monitoring and evaluation that help better capture impacts and detect and head off problems. This need for a simple M&E system is echoed by an assessment of VitaCow and VitaGoat systems in other Africare country programs (Harrigan and Cohen 2008).

Food Availability. Projects that use VitaGoat systems should anticipate the need for promoting soy production through on-farm demonstration trials and for securing a dependable supply of improved (i.e., certified) seed from a national agricultural research center or private sector supplier. Guinea is not alone in this experience. It was also a reported constraint in Namibia (Harrigan and Cohen 2008).

Access and Promotion. The Guinea case shows clear advantages to situating the technology in or near an urban area where the potential customer base will be sufficiently large.[xiv] To stimulate sales, future projects should anticipate the need to promote soy milk consumption as part of its routine health messages.

Utilization. Given the huge price difference between fresh milk and soy milk in Guinea and the seasonal nature and questionable quality of fresh milk in the market, local people were receptive to purchasing soy milk. The growing market for "street food" from urban people at work or living without their families also helped develop demand for the products. The cost and nature of cow's milk should be considered when selecting a site for soy processing. This and other factors to consider in site selection are outlined in the VitaCow Business Guide (Africare and Malnutrition Matters 2004: 14).

Capacity-Building. Basic training is critical. The Guinea case shows clearly how technical training of trainers can work if groups already have experience and basic training in business management, organization, and book-keeping. This training needs to be supplemented by developing private sector capacity to maintain the machines and supply parts.

Administration, Monitoring, and Evaluation. The Africare and Malnutrition Matters Vita Cow

Business Guide (2004) is excellent and includes highly relevant sections that can alert projects and *groupements* to the issues they are likely to face and need to consider. While the English manual can be read by country representatives in the capital, it is less useful to project coordinators and technical people in francophone countries such as Guinea. Translation of this guide and the three modules, including the cost-benefit analysis Excel tool, would increase the utility and impact of these resources. Part of the initial set up of these systems needs to be training and set up of simply and effective tracking systems so that the impact of these activities can be easily noted and reported on. Adding a module to provide some standardized guidelines for developing a community-based monitoring and evaluation system would also help projects better capture the indirect impacts of the projects and identify potential problems early on.

The VitaGoat technology was not, nor could ever be a "magic bullet" to solve food insecurity and malnutrition on its own. It is a valuable tool that Africare has been partially tested in some of its Title II and USDA food security programs. Given the emerging interest of many African governments in revitalizing soy production, it is a tool that deserves additional attention and consideration along with the factors that would be critical to success.

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Annex I: Example of Excel Spreadsheet for Cost-Benefit Analysis of VitaCow Systems (example values from Cote d'Ivoire example)[xv]

A) Capital Investment	Unit Cost	Hourly Cost (40 L)	Cost per liter (or kg)	Profit per day (5 hr production)
1- VitaCow system including freight	$5,500			
2- Tables, containers, sink, utensils	500			
3- Site Preparation	2,000			
4- Inventory (beans, sugar, etc)	2,000	Initial Start-up Investment=		$10,000

B) Variable Costs

1- Soybeans (per kg) 1	$0.20		$1.25
2- Labour (3 people) - per hour each	0.223		$0.67
3- Energy			
a) Electricity for electric boiler (per kW-hr)[2]	0.066		$0.53
b) Electricity for motor (per kW-hr)	0.066		$0.05
4- Water (per m3)	0.411		$0.04
5- Ingredients (sugar, salt, flavour) (per kg)	0.635		$0.76
6- Coagulant (for tofu) (per 30g)	0.34		$0.68
7- Cultures (for yogurt) (per 125 g)	0.34		$0.68
8- Packaging (plastic film) 250 g pouch	0.01		$1.60

C) Fixed Costs (per month)2

1- Rent (25 m2)	$27		$0.26
2- Maintenance and spare parts	$20		$0.19
3- Depreciation on Equipment (10 year life)	$50		$0.48
4- Promotion	$25		$0.23
5- Distribution	$25		$0.23
6- Cleaning chemicals	$15		$0.14

TOTAL COST3			
a) Soymilk Beverage (40 L)		$6.43	$0.16
b) Tofu (10 kg)		$6.34	$0.63
c) Soya Yogurt (40 L)		$7.11	$0.18

D) Revenue

1- Soymilk beverage (per liter) (cow's milk is $0.27/liter)		$0.20	$4.72
2- Tofu (per kg) (regular cheese is $10.81/kg)		$2.00	$13.66
3- Yogurt (per liter) (cow's milk yogurt is equivalent to approx. $2.50/liter)		$0.75	$22.89
4- Other foods (fruits and vegetables)			
5- Okara products (per kg)		$0.02	$1.00
TOTAL Profit per day4			**$42.27**
Total months for payback of start-up investment			**11.36**

NOTES:
1- Cost of soybeans bought in bulk
2- Daily operations of SoyCow assumed to be 5 hrs. Monthly hours based on 20.83 days/month (250 d/yr)
3- Hourly production rate is 40 liters of soymilk
4- Revenue based on 5 hours/day with 60% soymilk beverage; 20% tofu and 20% soy yogurt
5- The assumed exchange rate for Cote d'Ivoire is $ 1 US = 740 f cfa
6- The cost of cow's milk in Cote d'Ivoire is US$ 0.27/ liter
7- The cost of cheese in Cote d'Ivoire is US$ 10.81/kg
8- The cost of yogurt in Cote d'Ivoire is US$ 0.34/125 g container
8- The output is only assumed to be for soya dairy foods but the VitaCow can process other foods as well

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[i] Mamadou Conté was agricultural production supervisor of GnFSI from 2003 to 2007 and served as GnFSI project coordinator from February 2007 until March 2008.
[ii] Bonaventure Traoré was the Africare country representative in Guinea from March 2005 until July 2007.
[iii] Della McMillan is a consultant who has worked extensively with Africare's Title II programs over the last 10 years. Her role in this paper was to try to identify some of the old project records and individuals affiliated with the technology.
[iv] These activities fall under the ICB IR 1.3: Innovative models for using FFW and high protein nutrient dense products to address food insecurity and improve the quality of life of people living with HIV/AIDS pilot tested in Title II programs and shared with other Cooperating Sponsors**.**
[v] GnFSI paid $10,000 for the equipment, transportation and for fielding the trainer to Guinea.
[vi] The original project was for five years (2001-2005). Through a series of extensions the project covered the region of Dabola from 2004 and a final one-year extension continued some activities until September 2007.
[vii] Although the technology was introduced in Dinguiraye in 2004 it was not operational until 2005. The technology introduced in Dabola and Kalinko in 2005 was not fully operational until 2006.
[viii] At some point since then an official translation into French has been done of the VitaGoat Business Guide, which is still largely known by field and headquarters staff.
[ix] The other inputs for 1.5 kg of soy beans included 300 grams of sugar, 2 spoons of salt, and wood. A fagot of wood valued at 2000 GNF was sufficient for four preparations.
[x] This is based on assumption of 1000 grams per liter.
[xi] Over the period of the pilot projects the value of Guinean franc fluctuated considerably. One reason was a governmental reform of the currency system that occurred in 2005.
[xii] The processing of cassava into *attièkè* was initiated by Africare, who funded a local association to train women groups in both the Dinguiraye and Dabola regions in 2006-2007.
[xiii] The actual prices paid in 2006 and 2007, varied from 16 GNF/kg to 58 GNF/kg.
[xiv] Remote rural areas are reportedly inappropriate for this type of technology which is most efficient when it has the supply and demand to be producing at least three to four hours every day (Harrigan and Cohen 2008: 4).
[xv] This is an image of the Excel tool that is included with the Malnutrition Matters and Africare (2004) VitaCow Business Guide.