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# Setting up micro-enterprises to promote soybean utilization at household level in Ethiopia

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**Abstract:** This project built on the previous work of the Centre for Development Innovation, Wageningen UR in the soy sector development in Ethiopia. As processors were linked more and more to producers in the soy sector, the need arose to explore options to enhance household nutrition security of producers in soy growing areas. One of such option was setting up a pilot microenterprise based on the VitaGoat system at the most successful soy growing cooperative in Ethiopia. The VitaGoat system has been already proved an economically viable initiative in several African countries. The system can produce soy milk, tofu, yogurt, fruit and vegetable sauces, purees and juices, flour or meal from corn, wheat, soy, rice, etc. and ground roasted coffee. While the VitaGoat system has been very promising, the project encountered challenges, some of the was Ethiopia-specific, that only partly could be solved.

**Keywords:** soy, VitaGoat, microenterprise, Ethiopia, nutrition security

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# Summary

Soybean is the most prominent oilseed crop in the world; accounting for 55% of global oilseed production. The United States of America followed by Argentina, Brazil, China and India are the top five producers of soy. Despite Ethiopia's staggering potential of over 2 million tons and huge impact of soybean on household food security and nutrition, current annual production remains low at 67 thousand tons per year, which is already four times the production of 2010 according to Ministry of Agriculture and Central Statistical Agency. A sharp increase up to 200% in supply is expected for the 2012 planting season. A large number of small scale and commercial farmers are switching to soy because of improving economics, soil fertility and low fertilizer requirement.

The main end-users of soy beans in Ethiopia are agro-processing industries engaged in human and animal feed. The World Food Program (WFP) is the principal buyer of soy products, mostly in the form of Corn-Soy-Blended food, for emergency prone areas. Despite a huge potential for household utilization and therefore food/nutrition self-sufficiency, less than 5% of the produce is utilized at this level. Of the different factors that contributed to low household utilization are limited awareness about the value of soy food, lack of access to small scale processing technologies, and lack of knowledge about soy home-economics (cooking methods).

The aim of the proposed project was to:

- Contribute to alleviating malnutrition that occurs in almost half of the children Ethiopia.
- Develop a business approach towards sustainable development projects that will not need donor funding after full take-off within two/three years period.
- Support women entrepreneurship, and small and micro agro-processing with potential to change soy consumption behavior within Ethiopian households.

The developments in the sector offer fertile soil for technology transfer to set up micro-enterprises for the processing of soy products thereby contributing to increased food security. The VitaGoat system, proposed within this concept note for technology transfer, can process soy into different products such as milk, tofu, yoghurt, and fruits into jams, grind coffee and nuts, therefore offers the possibility for product diversification for the micro-enterprise.

The VitaGoat system has been already tried successfully in Central-America and in Asia, and somewhat less successfully in African countries. The lack of success was due to the following main bottlenecks:

- Lack of clarity regarding the objectives of the operations of the enterprise: social or business.
- VitaGoat system was place in areas where market was not sufficient.
- People leading the micro-enterprise lacked business and managerial skills.
- There was no established technical support for repairs, parts and troubleshooting.
- Lack of proper M&E systems to track changes for the business venture as well as in food security.

This project proposed to set up a microenterprise based on the VitaGoat system at the most successful soy producing union in Ethiopia.

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# 1 Benefits of soy

## 1.1 Health benefits

Soybean, often referred to as the miracle crop, is one of the most nutritionally rich crops and highest utilized oil seeds both the human and animal feed industry. It has also a wide range of industrial applications. The dry bean contains the highest protein and oil content among grain legumes. Soy protein level ranges from 40-42% and has 20-22% oil content. Soy is one of the few plants that provide a complete protein as it contains all eight amino acids essential for human health.

Soy is a strategic crop in the fight against world hunger and malnutrition as it provides a nutritious combination of both calorie and protein intake. Soy products are the cheapest and rich source of protein for poor farmers, who have less access to animal source protein. They provide a high quality source of protein comparable to meat, poultry and eggs. Soy edible oil is one of the leading cooking vegetable oils.

A number of scientific evidences have proved that soy foods has health advantages related to preventing cardiovascular disease, cancer, osteoporosis and menopause. Other studies suggest that soy food provides an affordable balanced diet for HIV/AIDS patients.

## 1.2 Fighting malnutrition

Much of Ethiopia's rural population lives in a state of chronic food insecurity and malnutrition. Average daily energy intake is estimated at 16 to 20% below the accepted minimum, while diseases due to nutrient deficiencies are widespread. Malnutrition in children is high with almost 1 out of every 2 children under the age of 5 years stunted, or too short for their age (chronically malnourished). Stunting is irreversible and has impacts on physical and mental development of the child, which later on translates into reduced labour productivity. 33% of the children and pregnant and lactating mothers are classified as underweight (too low weight for age).

Malnutrition has a huge social and economic impact. Over one-third of child deaths are due to under-nutrition, mostly from increased severity of disease. Children who are undernourished between conception and age two are at high risk for impaired cognitive development, which adversely affects the country's productivity and growth. The economic costs of under-nutrition include direct costs such as the increased burden on the health care system, and indirect costs of lost productivity. Childhood anaemia alone is associated with a 2.5% drop in adult wages.

The main manifestations of malnutrition in Ethiopia are protein-energy, vitamin A deficiency, iron and iodine deficiency. The immediate causes of malnutrition and child death are the mutually reinforcing conditions of inadequate quality and quantity of dietary intake and infectious disease; the underlying causes are household food insecurity (availability and affordability), inadequate maternal and child care, and inadequate health services and health environment.

- Overall, only 4 percent of children age 6-23 months are fed appropriately, based on the recommended infant and young child feeding (IYCF) practices.
- Forty-four percent of children age 6-59 months are anaemic, with 21 percent mildly anaemic, 20 percent moderately anaemic, and 3 percent severely anaemic.
- Overall, 17 percent of women age 15-49 are anaemic; 13 percent are mildly anaemic, 3 percent are moderately anaemic, and less than 1 percent are severely anaemic.
- Twenty-seven percent of women age 15-49 are thin, that is, they fall below the cut-off of 18.5 for the body mass index (BMI), and 9 percent are moderately or severely thin.

### 1.2.1 Nutritional status of children

#### Height-for-age

Nationally, 44 percent of children under age five are stunted, and 21 percent of children are severely stunted. In general, the prevalence of stunting increases as the age of a child increases, with the highest prevalence of chronic malnutrition found in children age 24-35 months (57 percent) and lowest in children under age six months (10 percent). Male children are slightly more likely to be stunted than female children (46 percent and 43 percent, respectively).

Children in rural areas are one and a half times more likely to be stunted (46 percent) than those in urban areas (32 percent). Regional variation in the prevalence of stunting in children is substantial. Stunting levels are somewhat above the national average in the Amhara (52 percent), Tigray (51 percent), Affar (50 percent), and Benishangul-Gumuz (49 percent) regions and are lowest in Addis Ababa and the Gambela region (22 and 27 percent, respectively).

#### Weight-for-height

Overall, 10 percent of Ethiopian children are wasted, and 3 percent are severely wasted. Wasting, or acute malnutrition, is highest in children age 9-11 months (19 percent) and lowest in children age 36-47 months (6 percent). Male children are slightly more likely to be wasted (11 percent) than female children (8 percent). Ten percent of children in rural areas are wasted, compared with 6 percent in urban areas.

Wasting is most common in the children of thin mothers (whose BMI is less than 18.5) (15 percent), in those residing in the Somali region (22 percent), in children whose mothers have no education (11 percent), and in those in the lowest two wealth quintiles (12 percent).

#### Weight-for-age

29 percent of children under age five are underweight (have low weight-for-age), and 9 percent are severely underweight. The proportion of underweight children generally increases with each age cohort. The proportion of underweight children is highest in the age groups 24-35 months (34 percent) and lowest among those under six months (10 percent).

Rural children are more likely to be underweight (30 percent) than urban children (16 percent). The proportion of underweight children varies by region. Addis Ababa has the lowest proportion of underweight children, at 6 percent, while Affar has the highest prevalence of underweight children, at 40 percent.

| Table 1           | Proportion of underweight children* by region |
|-------------------|---|
| Region            |   |
| Tigray            | 35.1%   |
| Affar             | 40.2%   |
| Amhara            | 33.4%   |
| Oromiya           | 26%   |
| Somali            | 33.5%   |
| Benishangul-Gumuz | 31.9%   |
| SNNP              | 28.3%   |
| Gambela           | 20.7%   |
| Harari            | 21.5%   |
| Addis Ababa       | 6.4%  |
| Dire Dawa         | 27.6  |

### 1.2.2 Nutritional status of men and women

The mean BMI for Ethiopian women age 15-49 is 20 kg/m<sup>2</sup>. There are no major differences in mean BMI by women's age, urban or rural residence, region, or education level. The mean BMI increases slightly with wealth, from 20 kg/m<sup>2</sup> for women in the lowest wealth quintile to 22 kg/m<sup>2</sup> in the highest quintile. Sixty-seven percent of Ethiopian women have a normal BMI (between 18.5 and 24.9 kg/m<sup>2</sup>),

while 27 percent of women are thin or undernourished (BMI less than 18.5 kg/m<sup>2</sup>) and 6 percent are overweight or obese (BMI 25 kg/m<sup>2</sup> or above).

### The mean BMI for Ethiopian men

age 15-49 is 19 kg/m<sup>2</sup>. There is little difference in the mean BMI by background characteristics. Sixty percent of Ethiopian men age 15-49 have a normal BMI (between 18.5-24.9 kg/m<sup>2</sup>), whereas 37 percent are thin or undernourished (BMI less than 18.5 kg/m<sup>2</sup>), and 2 percent are overweight or obese (BMI 25 kg/m<sup>2</sup> or above).

Young men, age 15-19, are more likely to be thin (66 percent) than their older counterparts. Rural men are slightly more likely to be thin (39 percent) than urban men (32 percent). Among regions, those residing in the Somali region are most likely to be thin (62 percent), and those living in

Addis Ababa are least likely (22 percent).

|                   | <b>Women</b> |                             |                           | <b>Men</b>               |             |                           |
|-------------------|--------------|-----------------------------|---------------------------|--------------------------|-------------|---------------------------|
| <b>Region</b>     | Mean BMI     | % of normal (BMI 18.5-24.9) | % of very thin ( <17 BMI) | Mean BMI (BMI 18.5-24.9) | % of normal | % of very thin (BMI < 17) |
| Tigray            | 19.3         | 56.8                        | 16.3                      | 18.8                     | 49.9        | 20.8                      |
| Affar             | 19.4         | 52.2                        | 21.8                      | 18.5                     | 40.8        | 28.4                      |
| Amhara            | 19.9         | 66.6                        | 11.8                      | 18.9                     | 56.2        | 17.0                      |
| Oromiya           | 20.2         | 68.4                        | 7.5                       | 19.3                     | 62.5        | 12.2                      |
| Somali            | 20.9         | 51.4                        | 13.8                      | 18.2                     | 36.1        | 33.7                      |
| Benishangul-Gumuz | 20.0         | 69.3                        | 8.2                       | 19.3                     | 60.4        | 12.5                      |
| SNNP              | 20.5         | 73.6                        | 6.0                       | 19.7                     | 68.1        | 10.4                      |
| Gambela           | 20.3         | 62.1                        | 13.9                      | 19.7                     | 64.9        | 9.5                       |
| Harari            | 21.4         | 63.5                        | 6.2                       | 19.9                     | 58.8        | 12.6                      |
| Addis Ababa       | 22.2         | 65.7                        | 4.9                       | 21.1                     | 65.6        | 7.0                       |
| Dire Dawa         | 21.5         | 56.6                        | 8.0                       | 20.3                     | 53.4        | 11.00                     |

Soybean and derived products can play a good role in adding to the dietary pattern of hungry and malnourished people by providing energy (due to the high oil content) and protein of adequate quality. Protein-energy malnutrition, with enhanced protein requirements is especially an issue in specific 'vulnerable groups'. For example:

### 1.2.3 People living with HIV/AIDS (PLWHA)

According to the Report "HIV/AIDS: A Guide for Nutrition, Care and Support", published by USAID in September 2001: "A deficiency in macronutrients, also known as "protein-energy malnutrition", manifests itself in the weight loss and wasting that is typical of AIDS patients. These symptoms occur as a result of reduced food intake, poor absorption of nutrients and changes in metabolism that affect cell grow, enzymatic processes and immune system reactions. Because of these effects, an HIV-infected person has increased nutritional requirements: 10- 15% additional energy intake and 50-100% increase in protein intake as compared to a non-HIV infected person".

### 1.2.4 Pregnant and lactating women

A pregnant woman requires approx. 15% more protein than the general woman population and a lactating woman requires approx. 40% more protein than the general population. As a special case, one thus sees the tremendous increase in the need for protein that an HIV-positive woman, who is pregnant or lactating, will need.



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### 1.2.5 Babies and young children

The WHO and almost all development organizations recommend that babies be only breastfed for the first 6 months. Afterwards, other foods such as rice and grains can be integrated into the baby's diet. This is referred to as the weaning period. Babies and young children require much more protein per kg of body weight than an adult, or even an adolescent. A lack of protein at this age will stunt the physical and mental development of the child, thus affecting their adult lives directly, while recent studies have also shown that malnutrition in children makes them predisposed to developing chronic illnesses (diabetes and heart disease for example) later in life.

## 1.3 Soil nutrient replenishment

The ability to fix atmospheric nitrogen makes soy excellent component within the various farming systems because it provides residual nitrogen and reduce the needs for mineral nitrogen fertilizers by associated non-legumes. This is a major benefit in farming systems, where soils have become exhausted by the need to produce more food for increasing populations, and where fertilizers are hardly available and are expensive for farmers.

## 1.4 Animal feed

A by-product from the oil production (soybean cake) is used as a high-protein animal feed in many countries. In case of household level production, whatever is not consumed by the family, can be fed to the animals as feed.

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## 2 Soy food - household use

Soybean provides a wide range of opportunities to improve household food security/nutrition and income generation (both from selling the beans and investing in small scale business activities). The majority of the population in Ethiopia don't have access to expensive animal protein sources such as egg, milk and meat. Child and maternal malnutrition are among the highest in the world. These added to the fact that more 32 million people are fasting from animal food sources for nearly 200 days/year; means that household utilization of soybeans has an immense potential. A number of soy food products can be integrated in Ethiopian household dietary system. There is limited experience in Jimma area with the enhanced utilization of soy-derived food products at the household level that show that there is acceptability of soy-based food products at the household level, especially in the form of soy flour and tofu.

### 2.1 Soy milk

Soy milk is produced by soaking dry soybeans and grinding them with water. It contains about the same proportion of protein as cow's milk: around 3.5%; also 2% fat, 2.9% carbohydrate, and 0.5% ash. Soy milk can be made at home with simple traditional tools or with a soy milk machine or juice maker. Large scale commercial processing is also possible; in Ethiopia FAFA is distributing imported soy powder milk. Soy milk can be used a substitute for cow milk but with different aroma and flavour. Soy-based infant formula (SBIF) is used for infants who are allergic to pasteurized cow milk proteins.

### 2.2 Soy tofu

Tofu is a well-known soy product, and comes in a variety of forms. Silken tofu has a creamy consistency and can be used with salad dressings and as a replacement for sour cream; firm tofu is solid and can be cubed or cut up; and soft tofu is softer than firm tofu but is not a liquid like silken tofu. Tofu is also called soybean curd, and it absorbs the flavor of the food with which it is cooked. Nutritionally, tofu is high in protein and B vitamins, with firm tofu containing the most nutrients.

### 2.3 Soy flour

Soy flour is versatile ingredient that improves nutritional content, taste and texture of many common foods. It boosts protein, brings moisture to baked foods, and often reduces the fat absorbed in fried foods. The taste of soy flour varies from a "beany" flavour to a sweet and mild flavour, depending on how it is processed. In Ethiopia soy flour has a wide potential to make bread, biscuits, cakes, porridge and sauce when roasted and milled.

### 2.4 Soy edible oil

Soybeans have 20-22% oil content that can be extracted through solvent-extraction with hexane or expeller. Soy edible is one of the most widely consumed cooking oils. Per 100g of soy edible oil there is 16g of saturated fat, 23g of mono unsaturated fat, and 58g of poly unsaturated fat. The major unsaturated fatty acids in soybean oil triglycerides are 7-10% alpha-Linolenic acid (C-18:3); 51% linoleic acid (C-18:2); and 23% oleic acid (C-18:1). It also contains the saturated fatty acids 4% stearic acid and 10% palmitic acid. Health Care Food PLC is the only specialized producer of soy edible oil in Ethiopia.

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## 2.5 Soy meat alternatives

Soy meat alternatives, also called “meat analogs,” are made primarily from soy proteins, wheat gluten and may contain carbohydrates. A few meat alternatives are derived from tofu. Flavours and spices are typically added to enhance sensory qualities. Some of these soy products also contain egg and/or dairy ingredients. Soy meat alternatives are made specifically to resemble meats, poultry or fish products in taste, texture, colour and form. Sheba Food PLC just started processing these kinds of products in Ethiopia at Deberezeit.

## 2.6 Soy meals/cakes

Soybean Meal or soy cake is a by-product of soybean edible oil extraction. The high-protein fibre (that remains after processing has removed the oil) is toasted and prepared into animal feed for poultry, pork, cattle, other farm animals and pets. The poultry industry is the major consumers of soybean meal in the world. Soy meal has over 40% protein.

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### 3 Status and development of soy sector in Ethiopia

Embassy of Kingdom of the Netherlands (EKN) in Addis Ababa has been supporting soy sub-sector in Ethiopia through its Agricultural Development Program. The primary focus of EKN's intervention was value chain development and market linkage of soy for agro-processors engaged in human and animal food sectors. This program has been implemented since 2009 by Wageningen University-Centre for Development Innovation, Ethiopian Institute of Agriculture, and Shayashone Consultancy PLC. Over three years, the following key milestones are achieved:

- A national soy business platform that created sector dialogue forum between farmers (unions and large scale commercial farms), traders, agro-processors, Government of Ethiopia and Ethiopian Institute of Agriculture was set-up and functioning very well.
- National soy production increased from less 10 tons in 2009 to 67,000 tons in 2011 and fully substituted import via market link facilitation and strong desensitization of upstream and downstream actors. During the same time, demand increased by threefold.
- Series of business opportunity studies were done and presented to local and international business interested to invest in the soy sector.
- Critical review of sector challenges and strategies to overcome was developed in consultation with the private and public sector actors. Limited household use, market fluctuation, and transport and logistics are found to be the principal bottlenecks of the sector.
- Soy Market Information System-[www.ethiosoy.com](http://www.ethiosoy.com)-where producers, processors, traders and professional exchange information has been developed and will be officially launched in November 2012.
- A national sector task force constituting representatives of farmer organization, commercial farmers, agro-processors, Ministry of Industry and Ethiopian Institute of Agricultural Research is formed and studying possibility for the formation of National Soy Sector Association.
- A pilot rural/semi-rural small scale soy processing technology package (VitaGoat) is being imported from Canada; Chewaqa Union will own the technology; plans for domestic manufacturing of the machine is in place in agreement with the provider of the VitaGoat.
- There is clear interest from processing companies to buy more soy from small holders. As result, small holders are more and more motivated to produce soy for the market as well as for own consumption. The recently launched N2Africa project in Ethiopia with support of the Bill and Melinda Gates Foundation will focus on enhancing production technology of soy and increasing yield.

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## 4 The VitaGoat food processing system

The VitaGoat is a food processing system that can be used to create value-added products from cereals, grains, nuts, fruits and vegetables, enabling local groups to increase food security, improve health and create micro-usinesses and employment. Primary foods can be processed into flours, pastes or wet slurries and used "as is" or further cooked with steam, as for soymilk and its various derivatives. Cooked foods can also be used "as is" or pressed in a manual filter press to make juices and energy-dense beverages. The key feature of the VitaGoat is that it can make all of these foods without the need for electricity; grinding is provided through "pedal power" while cooking energy is provided via an innovative and fuel-efficient steam boiler. VitaGoat is specifically designed for conditions in rural Africa. The technology is developed by a Canadian based NGO-Malnutrition Matters- and sponsored by number of organizations namely, Africare, Alpro, Child Haven, First Steps, Rotary, WISHH, World Bank. VitaGoat is a versatile technology that can process multiple crops, fruits and vegetables; though it is popularized as soy food processor.

### **How do "VitaGoats" work?**

South African Member of Parliament Mrs. A. Mchunu participated in a demonstration of new VitaGoat. The full system includes four components: A pedal-operated grinding / blending system, a steam boiler, a pressure-cooking vessel and a filter press. The use of steam-injected pressure-cooking is up to 10 times more energy-efficient than traditional open stove cooking. Some foods can also be prepared using only the pedal-operated grinder/blender, and do not require the boiler and pressure-cooker.

### **Where are VitaGoats used?**

Between 2004 and 2007, 44 VitaGoats were installed in Africa, India and North Korea with over 40 more committed during the next two years. Many of the units installed in North Korea are used in social feeding programs in schools, orphanages and collective farms. In India, a women's self-help group in Orissa uses the VitaGoat for a mid-day meal program. A training and support center is located in KwaZulu Natal in South Africa, and another one is in progress in Lusaka, Zambia.

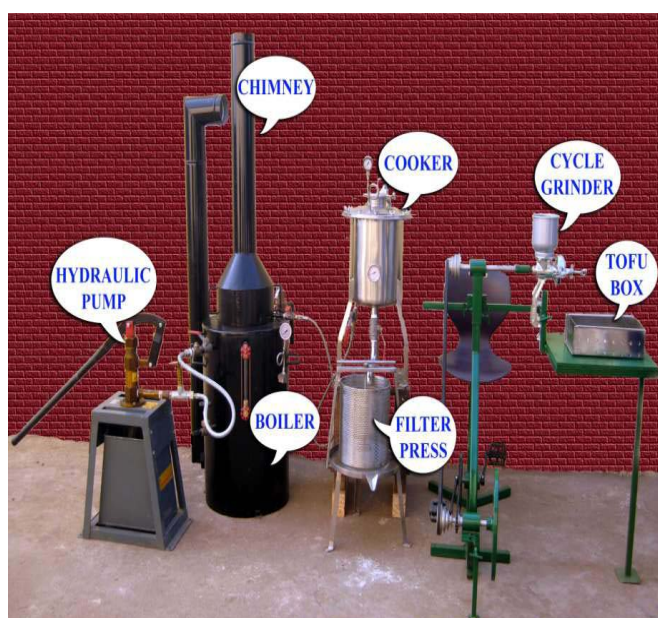
### **How does VitaGoat complement the dairy industry?**

VitaGoats can provide protein rich-nutrition for people in developing countries where lactose-intolerance is common or where traditional dairy products are unavailable or expensive. Processing temperatures used in SoyCows and VitaGoats effectively sterilize the soy foods, while providing safe drinking water, which is always a concern in developing countries. Traditional dairies are finding a demand for these soy products that can be marketed alongside milk products.





| Table 3 The Vita Goat food production chart   |                               |             |                    |
|---|-------------------------------|-------------|--------------------|
| Food items  | Production capacity           | Full System | Cycle grinder only |
| <b>Soymilk</b> from whole soybeans and soymilk-derived foods such as tofu, soy yogurt and sour soymilk. The fibrous by-product " <b>okara</b> " has many baking applications. | 30 liters/hour (8 USG/hr)     | ✓           |                    |
| <b>Fruit or vegetable</b> sauces, purees and juices   | 30 liters/hour (8 USG/hr)     | ✓           |                    |
| <b>Flour or meal</b> from corn, sorghum, wheat, soya, rice, millet, etc.  | 8 – 12 kg/hour (20-30 lbs/hr) |             | ✓                  |
| <b>Peanut or other nut</b> butter or paste  | 8 – 12 kg/hour (20-30 lbs/hr) |             | ✓                  |
| Ground roasted <b>coffee</b>  | 6 – 8 kg/hour (12-20 lbs/hr)  |             | ✓                  |



To make soy milk using VitaGoat, soaked soybeans first are ground using a grinder powered by a stationary bicycle. The beans then are mixed with water and put in a stainless-steel pressure cooker heated by a wood-fired steam boiler. Finally, the product is filtered using a manual press. VitaGoat gives small-scale producers with limited resources the opportunity to make eight gallons (30 liters) of soy milk and yogurt an hour, as well as other value-added products including peanut butter, tomato juice and ground coffee.

Over 100 VitaGoats have been installed in 13 African countries, India, Thailand, Bangladesh and North Korea in the past four years. In India, a women's self-help group in Orissa uses the VitaGoat for a mid-day meal program. A training and support center is located in KwaZulu Natal in South Africa, and another one is in progress in Lusaka, Zambia. The World Bank awarded 20-VitaGoat projects for providing midday meal for 15,000 students.

#### Economics:

- Daily serving of soy food for 500 to 1000 people
- Variety of local foods can be processed (VitaGoat)
- Minimal infrastructure and set-up costs

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The major investment cost of setting up a VitaGoat system is the cost of the equipment itself (6000 USD for equipment manufactured in India, 4000 USD for expert providing training, transport and import taxes), along with a suitable production space. There are no costs associated with installing or consuming electricity or running water. The water source for the system can be as simple as a bucket. It is expected that the investment will pay for itself within 2-3 years, assuming at least 3-4 hours daily production. The VitaGoat can be used in a number of settings, such as: direct feeding in humanitarian projects, use in social institutions (hospitals, schools, etc.) and, perhaps most importantly, as the principal vehicle for a food production micro-enterprise which could employ 5 to 10 people. This could be like a “restaurant”, food processing “mini-plant”, retail outlet, or any combination of these.

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## 5 Implementation of the project

### 5.1 Interest from the union

In Ethiopia, VitaGoat had not yet been tried, however; the Centre for Development Innovation, Wageningen UR, SS Consultancy and Chewaqa Union with support of Embassy of Kingdom of the Netherlands imported one full package as prototype. As the union had been involved in soy production and was supplying to the soy processing industry in Addis Ababa, the president of the union was keen on piloting the machine at his union.

As it has been agreed, the union would have the ownership over the VitaGoat system.

### 5.2 Challenges

The project encountered major challenges throughout its life-cycle.

#### 5.2.1 Producing the machine locally

While the first prototype was imported to Ethiopia, the project was working towards ways to replicate the technology within the country-two potential technology companies, Selam Technology Institute and Defence Engineering Enterprise were approached and showed willingness to produce the components as long as there is a business case to it. Also the Canadian based NGO who owns the patent has given a green light to franchise future production to the local manufacturers. However, producing certain parts of the machine turned out to be not feasible in Ethiopia due to lack of technology on the premises of the factories. Also the Canadian based NGO warned in advance that so far, in Africa, no company managed to produce the VitaGoat system. The above mentioned 2 companies were approached as they both have access to Western European technology, however even they could not produce the system.

If the VitaGoat system proves to be attractive enough, domestic (regional) production of VitaGoat must be set up.

#### 5.2.2 Import

The project had a 1 year duration and started the process of importing the VitaGoat system from Thailand when project commenced. It took 6 months to produce the machine and transport it to Ethiopia. Afterwards the machine was in the custody of the Ethiopian customs for 4 months. Luckily, SS Consultancy also has importing and logistics operations, and they were managing all requests from the customs. If they had not been part of the project, the machine would not have entered the country.

The Canadian NGO that supplies the VitaGoat system all over the world was extremely frustrated with the process as well. Apparently, they had never encountered such problems, never had to fill out so many paperwork, never had to get so many stamps during any of their other projects.

#### 5.2.3 Changes at Chewaqa Union

While the president of the union was eager to start with a pilot project with VitaGoat, the political situation changed at the union, and the president resigned. For a while, it was not clear who would take his place, and whether he would still be willing to work with the VitaGoat machine. That became a hurdle when the site had to be set up for installation; another couple of weeks went by waiting for approval of the new president.

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## 5.2.4 Installation

Finally the site was ready for installation in February 2013. Because of the change of presidency, the ownership over the VitaGoat project itself was not completely clear; no decisions were made, hardly any actions were taken. The Canadian NGO provided his assessment of the situation at the time of installation. (please, see exhibit).

## 5.2.5 Launch

The installation was followed by the launch of the system. Local government officials and members of the union were invited to taste the product of the machine. Women were trained on how to use the soy in household to increase the nutrition security of their families. Cookbooks with mostly pictures were distributed among the members of the union.

## 5.2.6 Conclusions and next steps

### 5.2.6.1 Sustainability and viability

In its current set up, the VitaGoat system is not viable for several reasons.

- A lack of an established technical support system for repairs, parts, and troubleshooting; As the technology is not available in the country to produce the system, if something breaks, it cannot be replaced. There are a few spare parts for the machine, but that might not be enough for the potential lifetime of machine.
- There is no clear business case to operate the micro-enterprise. While it is economically viable based on experiences from other countries, it is not clear how the union is going to make a business out of it. As the project officially ended way before the installation phase, there was no way to provide support to the union in this aspect.
- Lack of sufficient capacity building (technological and food preparation) due to end of project

### 5.2.6.2 Tracking nutritional intake on household level

Due to really short project cycle, this was not possible to implement.

### 5.2.6.3 Links to other initiatives

As it became clear that the sustainability of the project was at risk, CDI looked for other initiatives that could contribute to further developing the VitaGoat idea. The following linkages were made:

- N2AFRICA is a large scale, science-based “research-in-development” project focused on putting nitrogen fixation to work for smallholder farmers growing legume crops in Africa. Its vision of success is to build sustainable, long-term partnerships to enable African smallholder farmers to benefit from symbiotic N<sub>2</sub>-fixation by grain legumes through effective production technologies, including inoculants and fertilizers. With funding from the Bill & Melinda Gates Foundation, N2Africa began a second phase on the 1<sup>st</sup> of January 2014. The project will run for five years and is led by Wageningen University together with the International Institute of Tropical Agriculture (IITA) and the International Livestock Research Institute (ILRI). We have many partners in Ghana, Nigeria, Ethiopia, Tanzania and Uganda (Core countries), and in DR Congo, Rwanda, Kenya, Mozambique, Malawi and Zimbabwe (Tier 1 countries).
- In the first phase, N2Africa reached more than 230,000 farmers who evaluated and employed improved grain legume varieties, rhizobium inoculants and phosphate based fertilizers. In the second phase, we remain focused on research on and dissemination of major grain legumes in selected areas in the Core countries. In the Tier 1 countries we disseminate the outcomes from the first phase through co-funded dissemination activities. In all countries we work closely with national systems to institutionalize legume expertise
- IFDC is focusing not only on enhancing production of soy but also on linking smallholders to market. One of their areas of interest is to upscale the VitaGoat system.
- Bottom of the Pyramid (BoP, Utrecht, Netherlands) has been involved in developing low income markets. They also expressed interest in working with the VitaGoat system in Ethiopia.

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## Exhibit - Report on the Vitagoat project in Chewaqa

## Report on the Vitagoat project in Chewaqa

The Vitagoat project was executed in Chewaka district in Illubabor Zone. The area is located about 84 kms from Nekemt and a little over 70 km from Bedele. Although closer to Bedele, accessing the district from this side is highly challenging as the road has not been well maintained. Due to this reason, it takes approximately 3 and half hours to get to Chewaqa from Bedele. On the other hand, as the major part of the road from Nekemt (around 75%) is asphalt the trip takes an hour and a half.

The Vitagoat project was specifically focused on Chewaqa Union which has around 1608 male and 184 female members within it. The exact location of the project site is an area known as Chewaqa 2.

### Field purpose

The purpose of the field trip was to install the vitagoat machine for the processing of Soymilk and the demonstration of the machine. Along with this, a short training of the operators .

### Field schedule

The schedule combined the installation of the machine at the same time training the operators.

#### *Schedule for the machine installation*

| DAY  | MORNING<br>8.00 – 10.00am                                       | 10.00 –<br>10.30am               | 11.00 – 1.00pm   | 1.00 –<br>2.00pm     | AFTERNOON<br>2.00 –<br>4.00pm                               |
|--|---|----------------------------------|--|----------------------|---|
| Monday<br>13 <sup>th</sup> Jan,<br>2014    | Introduction &<br>Expectation b/n<br>team members               | <b>T</b>                         | Trip to Jimma  | <b>L</b>             | Introduction to<br>Vita Goat                                |
| Tuesday<br>14 <sup>th</sup> Jan,<br>2014   | Opening the<br>Shipping Crate                                   | <b>E</b>                         | Identifying of<br>parts of vita Goat                           |                      | Installation of<br>Vita Goat System                         |
| Wednesday<br>15 <sup>th</sup> Jan,<br>2014 | Testing of the vita<br>Goat System                              | <b>A</b>                         | Demonstration of<br>Soya Milk<br>Production using<br>Vita Goat | <b>U</b>             | Demonstration of<br>SoyaYorghurt<br>Production              |
| Thursday<br>16 <sup>th</sup> Jan,<br>2014  | Practical on Soya<br>Milk and Soya<br>Yorghurt<br>Production    | <b>B</b><br><b>R</b>             | Practical on Soya<br>Milk and Soya<br>Yorghurt<br>Production   | <b>N</b>             | Cost and the<br>Benefit of Soya<br>Milk Vita Goat<br>System |
| Friday<br>17 <sup>th</sup> Jan,<br>2014    | Production of<br>other Soya<br>Products,<br>(Home<br>Economics) | <b>E</b><br><b>A</b><br><b>K</b> | Tasting of Soya<br>Products, (Home<br>Economics)               | <b>C</b><br><b>H</b> | Action Plan, way<br>Forward,<br>Training<br>Evaluation      |

|   |                        |
|---|------------------------|
| Saturday<br>18 <sup>th</sup> Jan,<br>2014 | <b>travel to Addis</b> |
|---|------------------------|

As per the schedule I arrived in Addis Ababa on Sunday, Jan 12, 2014 at 8:30PM. Monday morning I and the project facilitator from Shayashone went to Jimma, 350km from Addis Ababa arriving at 4:00PM. On the morning of Jan 14 we started the trip started to Chewaqa. On this day the team reached Chewaqa 2 at 1PM which was later than the scheduled time of 10AM. This was due to the unpredicted poor state of the road.

After reaching the project site the team collected the selected attendants of the trainings for a meeting. The attendance of the meeting was not high since some went back to their daily chores as the team was late and most did not come at all. Never the less the we assembled the trainees and the union management team to introduce the team members, their purpose of visit, their expectation from the Union management and trainees and their schedule. The team then gave the floor to the attendants for comments and questions. To this aspect attendants mentioned issues like

- They did not expect the training to be as intense as the team explained
- They have received a minor training on household use of soy about five years ago and wanted to know if there was a difference
- They wanted to know the issue of per diem

In response to the first issue the team responded by saying that the training is not so intense that they will not be able to grasp the points within the scheduled time and reassured the attendants that as they practice it during the training they will notice it is not too complicated. Regarding the per diem they were promised that the budget will be checked and they will be informed the next day. I then explained how soy could be used to produce a variety of food stuffs. In the end the attendants mentioned that they only produce soy as a cash crop and didn't know of all the uses it has when consumed as mentioned by the expert.

In clothing the management was informed on what to prepare for the next day, to select 5 people (3 men and 2 women) as regular operators of the site and to gather the attendants that were not around on the opening day and the team left for nekemt.

On Wednesday Jan 15, 2014 the team reached Chewaqa at 10AM to start with the trainings. When arriving at the Union office, some of the attendants were already taking out the packed machine from the store. However, there were some difficulties hindering the progress such as the lack of transportation access to take the machine from the

store to the project site which was about 1km away and the fact that many of the attendants, most of which were women, were not present.

### **Machine installation and Demonstration**

Even though most of the trainees did not arrive the team and the few attendants went on to dismantle the box holding the machine and separating parts of the machine to make it easy to transport and also install later.



After some time, the different parts of the machine were transported to the site using vehicle and lorry. Even though many of the attendants didn't arrive on time, it was decided to go ahead with the installation while waiting for the rest of the trainees to arrive. Accordingly, I gave instructions on how to install the machine while the attendants assembled it. It was thought best to let the trainees be highly involved in the installation with supervision of the expert so they would know the details of the machine.



The complete installation of the machine took the whole afternoon along with demonstration of the manual grinder and water pump. On this day it was highly challenging to train the selected people as the local people were interested to see what was happening and there were more than 30 people coming and going to and from the site. This being as it is, the Union management and the trainees were informed to soak 4kg of soybean in water with the proportion of 12lt for 2kg of water and the training was closed for the day.

On Thursday Jan 15, 2014 the team arrived in Chewaqa at 10AM. Up on arrival the team gathered the union management team and the union board members for a short discussing. On the discussion the team pointed out some of the challenges it faced the previous day which might hinder the progression of the training going forward. These challenges were

- Lack of water on site
- Lack of facilities like pails, spoons, etc as mentioned in a list provided to the management few weeks prior to the visit
- Lack of proactivity within the attendants and management
- The incompleteness of the site (water, electricity, toilets, sanitation facilities etc)

To this end, the management promised to get things ready for the remaining days as much as possible and to finish the rest of the issues that will take longer time (completion of site) within the coming two months.



After the short meeting the management was asked to point out the five people it has selected to operate the site and as the two women were not yet selected the three men, the management and board were chosen to attend the training. Accordingly, I demonstrated how to use every part of the machine while explaining each step and answering the questions raised. Using the soaked soy from the previous day I demonstrated the usage of the cycle to grind manually. Then he demonstrated how to use the boiler and pressure cooker to produce milk.



I explained in detail the technical parts such as the readings on each gage and use of each valve. I emphasized on the safety issues in handling the machine and the precautions that needed to be taken. After this I gave the trainees the chance to try the steps themselves.



The milk produced during the exercise was tested then distributed among the people that came from the neighborhood to see. With this the training was concluded for the day at 5PM and the team left with another instruction to the trainees to soak 4kg of soy for a minimum of 8 hours for the next day's training and make the necessary facilities available.

Thursday Jan 16 the team arrived on site at 10AM and all the trainees were present with the necessary facilities. As discussed on the opening meeting the day was dedicated for the trainees to practice. Therefore, before using the actual soy they were instructed to exercise using water and on this day the two ladies who will be involved in the operation of the site also joined in.



The whole morning the selected 5 people, the union management and the board members practiced working with the boiler and the pressure cooker using water. As the use of the cycle to grind the soy was very basic the trainees did not take much time mastering it.

After several trials with water the group went to use the soaked soy, grinding it manually using the cycle and then heating the boiler and putting the soy paste in the cooker. They did all these with minimum supervision asking questions as they went along each step. Hence, at the end of the day they managed to make their first milk.



On this day the group also tested the electrical grinder. As representatives from the local administration office have come to see the demonstration they also saw how the machine operates. This gave the field team the chance to show the challenges the union is facing with regards to facilities like electricity and water. After seeing the demonstration the local administrators promised to assist the union with these aspects.



After tasting the milk grinded using the electric grinder using the same milk, I showed the group how to make tofu, and yogurt. With this the day's training was complete with another 4kg of soy to be soaked for the next day.

January 17, Friday was the final day of the training. This day, like the previous one, was dedicated for more practical exercise by the site operators and the union board and management. The group were given the chance to exercise using the soaked soy and more attention was given to the five people. On this day the group also got the chance to taste the yogurt it made the previous day mixing soymilk, canned yogurt for bacteria and some sugar.





After addressing any and all the questions raised with regards to spare parts for the machine and durability from the training group I gave a short closing speech remarking on issues that need to be addressed for the better function of the site and wishing the whole group a successful future. The group on the other hand thanked the field team for showing them a wide range of options and possibilities with regards to the use of soybean and the knowhow on the operation of the machine the field team said its farewells to everyone and left Chewaqa at 12:30 PM to Jimma.





After reaching Jimma at 6:45PM the team spent the night in SYF Hotel. The next day the team started its journey to Addis at 12:30AM and reached the capital at 2:30PM. I spent the night of Jan 18 at Desalegn Hotel and came back to Kenya on Jan 19 at 10:30AM.

### **Challenges**

- No access to water on site hence, throughout the training water was being transported from the wereda administration office in 20lt containers
- No electricity on site. The union has asked the permission of a government office close by to take power from their office but as the responsible parties were not around when electricity was needed for the training, the training had to be put on hold until the people were communicated by phone
- Lack of facilities. As some facilities were not ready improvising with what was around was necessary (making spoon out of wood). Other facilities for hygiene were not available such as slippers, gloves, washing area outside etc. which meant the quality of the produce from the site was in jeopardy
- The house for the machine was not complete. Due to various reasons the union has not yet completed the construction of the house. Hence, dust and other materials come inside through the woods which made it hard to keep the quality of the milk or other soy products made in the site.
- The surrounding area is also not cleaned up hence, whenever water was poured on the ground it turned into mud and people brought the mud into the milk house on their shoe
- No windows. The fact that there were no windows made it hard for ventilation. However, this was minimized due to the fact that the walls were open.

- No slop on the floor. The fact that the floor didn't have slop meant that water did not go the desired way. It was observed that water actually goes to the storage unit
- People especially the women did not show up for the training until information was given that they will be given per diems

### **Points of improvement**

Given the challenges faced as mentioned above there were some learning points and points of improvement include:

- Complete house
- Prepare raised washing sinks
- Have a good water source
- Make the floor tiles
- Make windows for good ventilation
- Dry storage unit
- Tables to do the mixing and placing utensils
- Spoons
- Stainless steel pails
- Stepping box
- Gloves, masks, slippers
- Outside toilet
- Clean surrounding
- Make drainage system

I wish to thank you for giving me the opportunity to visit Ethiopia and interact with the local people.

To explore  
the potential  
of nature to  
improve the  
quality of life



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