SoyCow, VitaGoat, and SoyaKit: Small-Size Soy Milk Processing Systems to Reduce Malnutrition and Generate Income

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SoyCow processing systems at the First Steps center in Wonson, Democratic People's Republic (DPR) of Korea.

Photo: Malnutrition Matters (2014)

Food Science in Action:

- ✓ Food Engineering
- ✓ Food Processing
- ✓ Food Microbiology
- ✓ Sensory Science
- ✓ Food Chemistry

The SoyCow, VitaGoat, and SoyaKit systems are three sizes of simple, small-scale, soybean processing equipment designed mainly to convert soybeans into soy milk, but they can be used to make other food products from grains, fruits, and vegetables. The systems were designed, developed, tested, fabricated, and deployed by Malnutrition Matters, a Canadian non-profit organization. Since their launch in 2004, partnering with numerous governmental and private organizations, hundreds of SoyCows and VitaGoats, and thousands of SoyaKits have been deployed worldwide. These systems present opportunities for the creation of micro-enterprises and to provide locally manufactured, nutritious foods to reduce food insecurity and health issues.

Introduction

Carbohydrates, proteins, and fats are our major sources of dietary energy and their ingestion in the right amounts and proportions along with consumption of essential micronutrients (i.e., a healthy diet) allow for adequate body growth, development, and good health.

On the other hand, it is estimated that approximately 3.1 billion people worldwide (39% of world's population) cannot afford a healthy diet.[1]

Estimates for 2021 indicate that around 768 million people went hungry worldwide with approximately 425 million (55%) in Asia and about 278 million (36%) in Africa. Unfortunately,

despite all current efforts and initiatives by multiple international organizations and governments, it is foreseen that by 2030 more than 670 million people could be undernourished worldwide (8% of the world's population).[1]

One of the reasons for this disproportionate prevalence of hunger in Asia and Africa may be the relatively high cost of a healthy diet containing fruits, vegetables, and animal proteins when compared to staple foods such as cereals and starchy roots.[2]

The agro-systems in Africa are not able to produce food at a cost that makes a healthy diet affordable for a majority of its population. As a result, nearly 75% of the African population cannot afford a nutritious diet of fruits, vegetables, and animal proteins with dairy products being the most expensive food group in all sub-regions of Africa.[2]

Because of its high levels of both oil (20%) and high-quality protein (approximately 40%),[3] potential environmental advantages (e.g., cultivation with lower greenhouse gas emissions),[4] versatility as a dairy substitute (e.g., soy milk and yogurt), and adaptability to grow in tropical environments, soybean (*Glycine max* (L.) Merr.) is a crop of interest to reduce malnutrition in the developing world as an alternative to dairy products and as a dietary source of high-quality protein.

Response

The SoyCow, VitaGoat, and SoyaKit systems are three similar processing equipment that differ in their size from largest to smallest. They are simple, small-scale, food processing systems designed mainly to convert soybeans into soy milk and its derivative products (e.g., soy yogurt, soy ice cream, tofu, and soy sour milk). However, they also can be used to make other food products from grains, fruits, and vegetables (e.g., peanut butter, maize flour, mango puree, jams, and jellies).

The SoyCow system has the largest production capacity, the SoyaKit has the smallest, and the VitaGoat is in between. During the design and development of the VitaGoat system, the name was selected to reflect both a smaller production capacity as compared to SoyCow (i.e., goats produce less milk than cows) as well as its ability to process legumes, grains, cereals, nuts, fruits, and vegetables.[6]

The three systems were designed, developed, tested, fabricated, and deployed by Malnutrition Matters, a Canadian non-profit organization, currently led by Hart Jansson — a former 25-year telecommunications software executive — as President and daily operations manager.

Malnutrition Matters was formed in 2000 to produce and distribute commercial soybean processing units to facilitate adoption of soybean at the micro-enterprise level to promote rural economic development and tackle malnutrition.[5] Malnutrition Matters partners with numerous governmental, private, and international organizations (e.g., Alpro NV, African Development Bank, First Steps Canada, and The Soybean Innovation Lab)[9] to deploy their soy processing systems. In 2004, their first soy-processing system was implemented in Guinea in a joint collaboration project between Malnutrition Matters and Africare.[6,7,8] Alpro NV of Belgium (recently acquired by Danone of France) has been a corporate sponsor for the last 15 years and has given cumulative funds in excess of US$500,000. A Well-Fed World (USA) has recently become a new sponsor for Malnutrition Matters on a project-specific basis.[31]

Additionally, Malnutrition Matters engages with its key partners to find funding, financing, and grants, provide technical assistance and training, and support entrepreneurs with business plans, evaluation, and monitoring.

Since their launch in 2004, partnering with numerous governmental and private organizations, hundreds of SoyCows and VitaGoats, and thousands of SoyaKits have been deployed worldwide (Figure 1). The majority of systems have been deployed in Africa and Asia, but they have also been deployed in North America, Central America, South America and Europe.[32] The soy processing systems can be operated under income generation, social humanitarian or mixed models.[12]

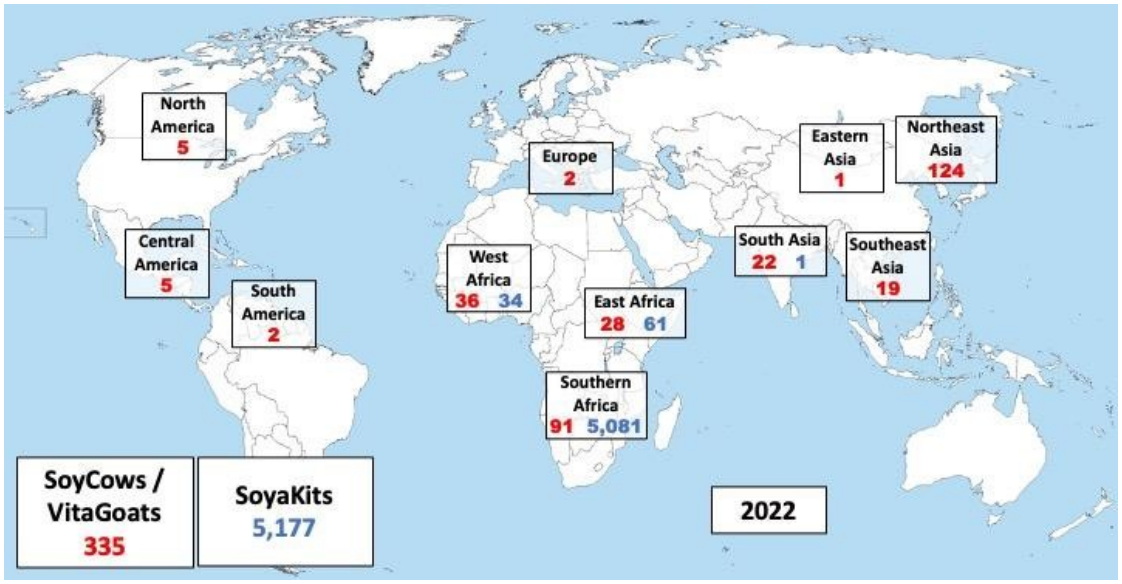

Figure 1. *SoyCow, VitaGoat, and SoyaKit installations by region.*[32]

Under the income generation model, these systems present opportunities for the creation of micro-enterprises to enable a sustainable approach to provide nutritious foods locally manufactured. In this model, the systems are expected to be self-sustaining after an initial investment through financing or donations by sponsors, training, and technical and business assistance for a limited period of time.[5]

With proper management, the soy processing systems can be very profitable creating significant income increase and creation of full-time jobs.[30] Examples of successful implementations operating under the income generation model are the SoyCow systems operated by SESACO Limited in Kyengera, Uganda[13] and Bungoma Farmers Group in Bungoma district, western Kenya,[30,33] and the multiple SoyaKits at Burundi,[15] Ghana,[15] Malawi,[13,16,33] and Kenya.[17]

Under the social humanitarian model, the soy processing systems are used primarily to improve quality of life through better nutrition and health. The systems under this model are not self-sustaining in the short or long term but are intended to be sponsored and supported by government, private, or religious organizations.[12] Examples of processing systems operating under the social humanitarian model are the SoyCow and VitaGoat systems operating at daycares (Figure 2), kindergartens, and collective farms in DPR Korea under the First Steps Program,[19] and the SoyCow systems operating in homes for children and destitute women sponsored by Child Haven International in India, Nepal, and Bangladesh.[20]

Figure 2*. Children getting their daily serving of soy milk and a nutritional biscuit at Samjiyon Potae Daycare in DPR Korea.*

Photo: Malnutrition Matters (2019)

Figure 3. *SoyCow processing system at Winnua LDA Mocuba, Mozambique* ***(left).*** *Masha Chiposyo, new entrepreneur in rural Malawi, with a manual grinder from the SoyaKit* ***(right).*** *Photo: Malnutrition Matters (2020)*

The processing systems can also be operated under a mixed model that combines both social humanitarian goals and income generation opportunities such as Winnua LDA in Mozambique (Figure 3), a private company which provides daily servings of soy milk to primary school students while also managing a commercial soy yogurt business.[14,16]

Additional to income generation and nutritional benefits produced by the soy processing systems, they also generate environmental benefits since the use of locally grown crops and produced plant-based protein products enable lower use of energy, land and water as compared to animal-based proteins.[4,5]

General Soy Milk Production Process

Soy milk making starts by the overnight soaking of soybeans in water. After soaking, the beans are drained and rinsed, and the soaking water is discarded. The soaked beans are then ground adding fresh water until a smooth slurry is obtained.[10,11]

After grinding, the resulting slurry is boiled and stirred for approximately 10-30 minutes depending on the cooking temperatures and pressure.[10,11] This heat treatment processing step is important since it improves nutrition, flavor, and microbial safety. Inactivation of trypsin inhibitors improves nutrition, while inactivation of lipoxygenases and volatizing of off-flavor compounds improve flavor and sensory. Additionally, heat treatment improves shelf-life and microbial safety by reducing microbial load.[3,10]

The heat-treated slurry is then filtered through a nylon-mesh sieve to separate the liquid (i.e., soy milk) from the insoluble fibrous residue (i.e., okara) which can be used in soups, bread, snacks, or animal feed.[25] The resulting soy milk is a white or cream emulsion which resembles cow milk in both appearance and consistency.[10,11]

Soybean may still be regarded as a relatively new crop in Africa. Thus, acceptability in some regions of soybean derived food products may have hurdles since they may not be known to many consumers. However, consumer research in Nigeria has indicated that great number of people have consumed soybean products (e.g., liquid and powdered soy milk, and soy flour) and they are accepted when educated about their nutritive value.[29] Malnutrition Matter's experience in over 20 countries in sub-Saharan Africa has been that the versatility of soy milk in producing derivative foods and the ability of these foods to be flavored with local and low-cost flavors or supplements, combined with the relatively lower cost of soy foods (as compared to animal-based proteins), enable one or more forms of these foods to be attractive to all local consumer groups.

SoyCow

The SoyCow "E" system (Figure 4), with a capacity of 45 L soy milk per hour (3 batches per hour)[21] includes a pressure cooker vessel (15 L soy milk capacity, 20 psig operating pressure), an electric grinder (0.37 kW), an electric (9-18 kW) steam boiler, a manual press, a refractometer, tofu boxes, spare parts, and an operating manual with numerous recipes. All components are made of stainless steel or food grade materials with safety relief valves to avoid boiler over-pressures. A water booster pump can also be provided if the available water pressure is less than 30 psig.[21]

For applications where electrical power is not abundant, the SoyCow "M" system uses a multi-fuel boiler able to burn wood, coal, gas, or other biomass such as corncobs, coconut shells, etc.[22] The fully electric SoyCow SC-30 processing system with a larger capacity of 80 L/h is also available.[23]

SoyCow equipment and parts are made at factories in India and Thailand. Depending on the model, processing equipment capital cost is between US$6,400 and US$14,900. Other items to be used with the processing equipment would be building, vehicles, furniture, and tools. Capital for site preparation would also need to be included.[5,7,8,23]

Figure 4. *SoyCow "E" general components (left to right, top to bottom)[22]: Electric grinder, pressure cooker, manual filter press, electric boiler, and manual water pump.*

Photo: Malnutrition Matters (2018)

VitaGoat

The VitaGoat system (Figure 5) is a multi-purpose, non-electric food production system that, in addition to producing soy milk (30 L/h), can also process other foods such as cereals, grains, legumes, fruits, and vegetables. It has a pedal-driven grinder and a boiler that can use wood, coal, or gas to produce steam.[23] A manual water booster pump is available if water pressure supply is less than 30 psig.[21]

Equipment and parts are made at factories in India and Thailand with a capital cost for the processing equipment of approximately US$6,400.[8]

Figure 5. *VitaGoat general components (left to right, top to bottom)[8]: Pedal-driven grinder, steam boiler, manual water pump, pressure cooker, and manual filter press.*

Photo: Malnutrition Matters (2006)

SoyaKit

The SoyaKit is a small capacity soy processing system designed for household and small-scale enterprises, managed mainly by women food entrepreneurs (Figure 3). It does not require electricity, is manually operated, uses equipment common to kitchens, and an insulated heat-retention cooking bag is included to reduce fuel cost and smoke (Figure 6).[25]

Per 600 g of soybeans, the SoyaKit system produces 3.5 L of soy milk and 1 kg of okara (a fibrous slurry by-product rich in protein) for an hourly production capacity of 7 L soy milk or

yogurt, or 1 kg of tofu, or 10 L of soy porridge when combined with maize, rice, or sorghum flour or meal. This output capacity is sufficient for a small school or clinic, and three hours of work, by one or two people, can provide over 100 servings.[18,24,25]

The initial equipment investment for the SoyaKit system is US$80 if sourced locally (not certified to be complete or food-grade) or between US$180 and US$200 if imported.[24,26]

Figure 6. *SoyaKit components (top to bottom, left to right)* [24,26]*: Large plastic bin, heat-retention cooking bag, manual grinder, colander, tofu ladle, wooden spoon, food-grade plastic pail, lined rubber gloves, nylon filter bags, thermometer, 8-liter cook pot, cheese cloth. Not shown in the picture: Scale and users' manual.*
Photo: Malnutrition Matters (2020)

Results

Since 2004, Malnutrition Matters has partnered with numerous governmental, private, and international organizations to implement 320 SoyCow and VitaGoat systems worldwide. The majority of the larger systems have been implemented in sub-Saharan Africa (154) and Asia (150), but systems have also been implemented in North, Central, and South America, and Europe. DPR Korea is the country with most SoyCow and VitaGoat systems implemented (108), and, currently, it is planned to implement 8 more systems.[27]

Since its introduction in 2016, Malnutrition Matters has deployed 5,077 SoyaKit systems all in sub-Saharan Africa,[27] including 4,800 sourced locally in Malawi. [32]

Support for location selection, installation, commissioning, technical and safety training, sharing of food safety and hygiene practices, detailed operations and maintenance manuals and videos, recipes, identification of target markets (i.e., individuals or organizations), monitoring and evaluation are provided by Malnutrition Matters through local partners and sponsors and certified contract technical personnel in Ghana, Kenya, South Africa, India, and Thailand.[27]

Malnutrition Matters estimates that their soy program has more than 300,000 continuous beneficiaries, i.e., consumers, 5,000 local entrepreneurs, and employees.[27]

The soy program by Malnutrition Matters has received wide recognition and awards by different organizations, such as the Tech Award for Economic Development - Laureate in 2005 and the World Bank Development Marketplace Winner in 2007.[27]

Field research supported by USAID have concluded that the SoyaKit has many advantages, and financial indicators show that it is an appropriate food technology in small-scale household settings.[24]

Products made with the SoyaKit system are of low cost and healthy, raw materials and equipment are storable at household level, products can be made in a home kitchen, batch size is small, and it takes only 30 minutes for one person to process a batch. Capital and fixed costs are low, production inputs are readily available (i.e., labor, fuel, soybeans, and water), technology is simple, and short training is required since African women entrepreneurs are usually familiar with kitchen tasks.[24]

The SoyaKit system has a payback period of less than a year.[24] Nevertheless, in many locations credit may not be readily available to take the debt necessary to acquire a SoyaKit. Still, donors and non-governmental organizations (NGOs) could be an option to provide the necessary financial bridge for the US$80 needed to purchase a SoyaKit.[24]

Testimonials from local entrepreneurs:

"I started making soy milk on 3rd March 2019. We were invited to a two-day training where we were given entrepreneurial skills and given instructions on how to operate the SoyaKit to produce soy milk.

The production of soy milk has made a difference in our village. Some people used to have fat bellies, but they are now coming to shape. Since March, we have had people who had asthma and others with fat bellies [coming] to a realization of how beneficial soy milk is to their well-being. The milk production business is helping me a great deal. I am not married, and I am able to support a family of 6. I am the sole bread winner. I am now able to support the school-going children. In the past, I could not even afford a notebook for a child to use in class. Since I started making soy milk, I am able to make enough money and set aside some for my children's school expenses. I could say that I was poor because sometimes my family could go without meals, but now things have changed a lot.

There has been a big transformation. Before I started making and selling milk life was so hard. I am making profits; I am able to calculate what goes into production and record. I then compare that to the sales and realize I am making profits. Life was hard in my house - I had no means of earning money. Even the village chief can bear witness. I used to lack food and school fees. Two of my elderly children dropped out of school, as it was hard for me to provide for them. However, with [the] last two small [children], I am able to send them into school.

Let me encourage my friends to give it their best shot. It is hard at first; however, if you are hardworking, it is good and precious. It is life changing."

Zione Charles, SoyaKit Entrepreneur (Chombakata village, Malawi)

"Our school program is going fine, now 2,000 students are receiving a daily serving of 250 ml of soy milk made from our SoyCow. After more than a year now the monitoring shows three good results:

First, more children enter school. Second, a higher percentage of the children that enter remain, less dropouts in other words. The last and, I think, best result, is that the children learn more than before. Their pedagogical performance has improved. The health post also confirms that the level of malnutrition has gone down in the villages that receive the milk."

Asa Maria Tham, co-owner of Winnua LDA (Mozambique)

Most SoyCow and VitaGoat systems are operating under the social humanitarian model in which systems are not self-sustaining in the short or long term but are intended to be sponsored and supported by government, private, or religious organizations.[12,19,20]

While the larger size SoyCow and VitaGoat systems do well converting soybeans into soy milk, they are expensive pieces of equipment that produce large quantities of soy milk, requiring dedicated space, electricity, and access to refrigeration.[28] Thus, implementation of the larger size systems requires careful assessment of market size (i.e., number of potential consumers) and proximity.[7]

While some SoyCow and VitaGoat systems set up as enterprises to generate income are successfully operating (e.g., SESACO Limited Uganda[13] and Winnua LDA in Mozambique),[14,16] field research supported by USAID on SoyCow and VitaGoat systems in Malawi working under the income generation model were operating only at 9% of capacity, which limits their ability to cover normal fixed costs (i.e., depreciation, amortization of equipment and infrastructure, working capital, marketing and promotion, and regulatory compliance).[7] Nevertheless, with proper

management the larger size SoyCow and VitaGoat system implementations can be very profitable creating significant income increase and creation of full-time jobs.[30]

Testimonials from local entrepreneurs indicate that economical, health, personal, and community benefits have been produced as a result of the commercialization and consumption of the different soy products made with these systems.[33]

Lessons Learned

- Key equipment (grinder and boiler) in the SoyCow system launched in 2004 require electrical power which limits its deployment to areas with sufficient and reliable electricity. The VitaGoat system, a fully non-electrical system with a multi-fuel boiler and a pedal-driven grinder was later developed and implemented for remote rural areas where electricity is not available.
- Because of their higher capital, fixed, and operational costs, the larger capacity SoyCow and VitaGoat systems present adoption challenges for small-scale enterprises in developing countries. The lower capacity manually operated SoyaKit was later developed and implemented, and it has received wide acceptance by small entrepreneurs in developing countries because of its low initial capital cost and simple operation.
- The SoyCow system was initially developed to convert soybeans into soy milk and its derivative products (e.g., soy yogurt, soy ice cream, tofu, and soy sour milk). Small design changes have allowed the systems to also process other food products from grains, fruits, and vegetables (e.g., peanut butter, mango puree, jams, and jellies).
- Not all earlier installed larger capacity SoyCow and VitaGoat systems operating under the income generation model have been successful. To increase chances of

Testimonials from local entrepreneurs (cont'd):

"I am 35. I am a single mother of two children. There are five members in our household, my two sisters, my two children and myself. I am the breadwinner of the family since our mother died. I started the soy milk making business in March 2019. Since I started the soy milk making business till now, I have managed to do a couple of things that I never imagined I would be able to achieve.

I have made a profit of about MK 160 000 [US$200] from the month of March to this month of May (2019). The MK 160 000 is the profit that I have made so far when I deduct all the investments I have put [in it]. In March alone I made about MK 87 000 [US$109] and in the first two weeks of May I made an amount close to MK 80 000 [US$100] but the total was MK 160 000 [US$200].

When [the] SoyaKit came, I was already engaging in another business of selling plastic shoes. But these two businesses are different. The soy milk business is a daily cash enterprise, I make more money because people want milk on [a] daily basis. Shoes on the other hand are only bought based on need. Every morning I make door-to-door deliveries and in the evening, I go back to collect payment.

To make milk, we need to buy soy, charcoal, sugar and salt. I have several clients and I often run out of milk before I meet the demand [of] all my clients. I make on average 3 to 4 batches of milk per day and on rare occasions I manage 5. However, 3 - 4 is average, translating to 12 - 16 liters of milk. On average, I make a profit of MK 3 500 per day [US$4.40].

My clients love the milk. I have a lady client who used to have a fat tummy which has since returned to its normal shape since she started taking soy milk. She takes two 300-ml bottles of milk every day. Another woman had a malnourished child, she buys 2 bottles, and the child is healthy.

My household has equally been transformed.

Promise Sailesi – SoyaKit Entrepreneur (Malawi)

success, decision for deployment is now based on a detailed business plan which include analysis of market size and proximity, competing products, supplies, packaging, price, cost/benefit, maintenance needs, training needs, leadership, and team make-up and skills.

- To be successful, Malnutrition Matters must work with sizable government or private partners that already have local presence and involvement in areas with high undernourishment rates who purchase the equipment and finance costs for planning, implementation, project management, installation, and monitoring. It must also partner with local contractors to provide installation, equipment commissioning, training, recruitment, and technical and business support.

Next steps

More SoyaKit projects have been implemented since its launch as compared to SoyCow and VitaGoat, and this trend will continue in the near future. Nevertheless, SoyCow and VitaGoat systems are still of interest, and will continue to be deployed to selected communities through strategic evaluation and planning.

Current and upcoming undertakings include: [31]

- A project beginning early 2023 in DR Congo with the International Institute of Tropical Agriculture (IITA), likely in Kasai Centrale, which will involve 5 VitaGoats and 12 SoyaKits.
- A DR Congo project under discussion with Catholic Relief Services but of uncertain timeframe.
- A project in Kenya of 100 SoyaKits to the Bungoma province, funded primarily by Rotary International expected to begin in 2023.
- A dozen more SoyCow systems expected to be shipped in 2023 to DPR Korea in partnership with First Steps, but the timeframe is uncertain due to import restrictions by DPR Korea and United Nations sanctions.

Most importantly, Malnutrition Matters is always very keen to engage and is constantly looking for local and international partners to deploy these unique, small scale soy processing systems rapidly and efficiently.

References

1 FAO, IFAD, UNICEF, WFP and WHO. (2022). The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable. Rome, FAO. https://doi.org/10.4060/cc0639en. Accessed November 16, 2022.

2 FAO, ECA and AUC. (2021). Africa regional overview of food security and nutrition 2020: Transforming food systems for affordable healthy diets. Accra, FAO. https://doi.org/10.4060/cb4831en. Accessed November 16, 2022.

3 Omre, P.K., Akhtar, J., Kuldeep, and Singh, P. (2017). Influence of Processing Factors on Beany Flavor, Trypsin Inhibitor and Colour of Soy milk. Chemical Science Review and Letters 2017, 6(23): 1875-1885. https://chesci.com/wp-content/uploads/2017/08/V6i23_83_CS302048086_J_Pasha_1875-1885.pdf. Accessed November 16, 2022.

4 Gonzalez, A.D., Frostell, B., Carlsson-Kanyamac, A. (2011). Protein efficiency per unit energy and per unit greenhouse gas emissions: Potential contribution of diet choices to climate change mitigation. Food Policy 36(5):562-570. https://doi.org/10.1016/j.foodpol.2011.07.003. Accessed November 16, 2022.

5 Malnutrition Matters. (2020) Capabilities Statement – Malnutrition Matters – January 2020. https://www.dropbox.com/s/b30nj0pohvvex4c/MM%20Capabilities%20Statement%202021.pdf?dl=0. Accessed November 17, 2021).

6 Conté, M., Bonaventure, T. and McMillan, D.E. (2008). Lessons Learned from Pilot Testing VitaGoat Technology in Guinea. Africare Food Security Review No. 19, December 2008. https://pdf.usaid.gov/pdf_docs/PNAEB955.pdf. Accessed November 17, 2022.

7 Krause, J., Cornelius, M., Goldsmith, P., Mzungu, M., Kambani-Banda, C. and Tamimie, C. (2021). Soy Dairy Performance Metrics. Afr. J. Food Agric. Nutr. Dev. 2021; 21(10): 19016-19039. https://doi.org/10.18697/ajfand.105.21245. Accessed November 17, 2022.

8 Malnutrition Matters.(2022). VitaGoat & SoyCow 'M' Fact Sheet. https://www.dropbox.com/s/fedsde0m4vnfewj/Vitagoat%20_%20SoyCow%20M%20fact%20sheet%20

01-21.pdf. Undated. Accessed November 17, 2022.

[9] Malnutrition Matters. (n.d.). Partners. http://malnutrition.org/partners/. Undated. Accessed November 17, 2022.

[10] Snyder, H.E. and Wilson, L.A. (2003). SOY (SOYA) BEANS. Processing for the Food Industry. Encyclopedia of Food Sciences and Nutrition. Second Edition. Ed. B. Caballero. Academic Press.

[11] Ugwu D. S. and Nwoke U. M. (2011). Assessment of soybean products acceptability and consumption in Orumba South Local Government Area of Anambra State Nigeria. International Research Journal of Agricultural Science and Soil Science 1(8): 314-325. https://www.researchgate.net/publication/228446886_Assessment_of_soybean_products_acceptability_and_consumption_in_Orumba_South_Local_Government_Area_of_Anambra_State_Nigeria. Accessed November 17, 2022.

[12] Harrigan, B. and Cohen, L.A.J. (2008). Africare's Experience with VitaCow and VitaGoat Food Processing Systems. Africare Food Security Review No. 18, December 2008. https://pdf.usaid.gov/pdf_docs/PNAEB954.pdf. Accessed November 18, 2022.

[13] Malnutrition Matters. (2018). Newsletter - October 2018. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-Oct-2018.pdf. Accessed November 18, 2022.

[14] Malnutrition Matters. (2020). Newsletter – April 2020. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-April-2020.pdf. Accessed November 18, 2022.

[15] Malnutrition Matters. (2017). Newsletter – January 2017. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-Jan-2017.pdf. Accessed November 18, 2022.

[16] Malnutrition Matters. (2018). Newsletter – March 2018. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-March-2018.pdf. Accessed November 18, 2022.

[17] Malnutrition Matters. (2021). Newsletter – July 2021. https://malnutrition.org/wp-content/uploads/2021/09/Malnutrition-Matters-July-2021-Newsletter.pdf. Accessed November 18, 2022.

[18] Malnutrition Matters. (2017). Newsletter – January 2017. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-Jan-2017.pdf. Accessed November 18, 2022.

[19] Malnutrition Matters. (2019). Newsletter – June 2019. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-June-2018.pdf. Accessed November 18, 2022.

[20] Malnutrition Matters. (2019). Newsletter – February 2019. https://malnutrition.org/wp-content/uploads/2020/05/MM-Newsletter-Feb-2019.pdf. Accessed November 18, 2022.

[21] Malnutrition Matters. (2006). The SoyCow / VitaCow / VitaGoat Business Guide. http://legacy.soybeaninnovationlab.illinois.edu/files/MM%20Business%20Guide.pdf. Accessed November 18, 2022.

[22] Malnutrition Matters. (n.d.). SoyCow "E" Fact Sheet. http://legacy.soybeaninnovationlab.illinois.edu/files/SoyCow%20%27E%27%20fact%20sheet%2009-14.pdf. Undated. Accessed November 18, 2022.

[23] Malnutrition Matters. (n.d.). SoyCow 30 Fact Sheet. https://malnutrition.org/wp-content/uploads/2020/05/soycow_30_fact_sheet_08-16.pdf. Undated. Accessed November 18, 2022.

[24] Kim, C. and Goldsmith, P. (2021). The Economics of the Soy Kit as an Appropriate Household Technology for Food Entrepreneurs. Food and Nutrition Bulletin 2021, Vol. 42(1): 104-115. https://journals.sagepub.com/doi/epub/10.1177/0379572120981183. Accessed November 19, 2022.

[25] Malnutrition Matters. (n.d.). SoyaKit: Home Business in a Box. https://malnutrition.org/wp-content/uploads/2020/05/soya_kit_overview_27-11-161.pdf. Undated. Accessed November 19, 2022.

[26] SIL and USAID. (2020). Activities & Impact Report 2020. https://www.soybeaninnovationlab.illinois.edu/_files/ugd/7b7dcd_9df0ac8b893f4c2085ded10e8f79027d.pdf. Accessed November 19, 2022.

[27] Malnutrition Matters. (2022). Capabilities Statement – Malnutrition Matters – January 2022. https://www.dropbox.com/s/4tufpfs2kgtzu66/MM%20Capabilities%20Statement%202022.pdf?dl=0. Accessed November 20, 2022.

[28] Stein, M. (2021). Soy kits provide earning power for women entrepreneurs in Malawi. College of Agricultural, Consumer and Environmental Sciences News. University of Illinois. https://www.google.com/url?client=internal-element-cse&cx=002908087471986409756:oszptzt4clw&q=https://aces.illinois.edu/news/soy-kits-provide-earning-power-women-entrepreneurs-malawi&sa=U&ved=2ahUKEwik1Pyj6737AhU3jokEHewVD4sQFnoECAAQAg&usg=AOvVaw2C8O5AtAFS6qA6J7p_4sC0. Accessed November 20, 2022.

[29] Ugwu D. S. and Nwoke U. M. (2011). Assessment of soybean products acceptability and consumption in Orumba South Local Government Area of Anambra State Nigeria. International Research Journal of Agricultural Science and Soil Science Vol. 1(8): 314-325. https://www.interesjournals.org/articles/assessment-of-soybean-products-acceptability-and-consumption-in-orumba-south-local-government-area-of-anambra-state-nige.pdf. Accessed

November 21, 2022.

[30] Malnutrition Matters. (2014). Case Study – Bungoma, Kenya Farmer's Group. Malnutrition Matters – February 2014. https://www.dropbox.com/s/qvyhsv2hz0qiprt/CASE%20STUDY%20VITAGOAT%20IN%20BUNGOMA%2002-14.pdf?dl=0. Accessed January 30, 2023

[31] Johnson, H. (2023). Personal communication. January 30, 2023.

[32] Malnutrition Matters. (2022). Local Jobs for Women to Tackle Malnutrition [PowerPoint slides].

[33] Johnson, H. (2023). Reducing Chronic Malnutrition through Women Empowerment. Impact Entrepreneur. https://impactentrepreneur.com/reducing-chronic-malnutrition-through-women-empowerment/. Accessed March 9, 2023.