



Final Report, June, 2018

Fermented food for life

- **IDRC Project Number 108122.**
- **Primary partners:**
 - **Western University, Canada**
 - **JKUAT, Kenya**
 - **Heifer International**
- **Other Partners**
 - Yoba for Life foundation (The Netherlands, Uganda Tanzania)
 - TTC Mobile (The Netherlands, Uganda)
 - No Money No Cry Films (The Netherlands, Kenya)
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1. Executive Summary

The “*Fermented Food for Life*” project aimed to improve food security by increasing local production, distribution and consumption of health-promoting probiotic fermented foods using a **pro-poor business model** in *Uganda, Kenya and Tanzania*, targeting to reach 250,000¹ people in the three countries (i.e. reaching 50,000 consumers of Yoba yoghurt in Tanzania, 100,000 consumers for Uganda and Kenya respectively) by its end in June 2018. The general **project objective was to improve food and nutrition security** by increasing local production, distribution, and consumption of probiotic fermented foods. The project had two phases: the **pilot phase** implemented for 6 months to research and test the pro-poor business models; and the **scale-up phase** focused on adoption using a robust communication strategy in order to stimulate demand for the probiotic yoghurt.

Major achievements:

1. A **pro-poor value chain-based business model** was adopted as a common approach to achieve the project’s main objective. This was applied to different nodes of the value chain of probiotic fermented yoghurt and through scale-up. This boosted the market for milk and increased profits for farmers, provided fermented foods to communities with diverse health benefits at an affordable price, empowered women and youth and enabled a platform for decision makers to support project endeavors.
2. Important elements of the scaling up strategy were (i) Awareness campaigns; (ii) A case study brochure; (iii) Partnerships, especially with DDA, UIRC, SNV, Mikono Yetu and various donors; (iv) Confirmation of health impact through school studies in Uganda, Tanzania and Kenya.
3. Based on field surveys it is estimated that the 234 production units (kitchens)(PUs) are reaching around **258,000 people** in Kenya, Tanzania and Uganda per month. This included 116 PUs in Uganda, 38 in Kenya including early development centres, and 85 in Tanzania (total 239).
4. In terms of our emphasis on **gender and empowerment of females**, the PUs are owned and run mostly by women (>60%), but males and youth are an integral part of the value chain.
5. **New product options** based upon cereals and fruits developed by Western University, Yoba and Makerere scientists, expanded the resource base and product lines.
6. The program shows great strength in **sustainability** based upon the main scaling up pathways in Tanzania and Uganda being donor-led through the SNV preprimary probiotic program, the Lutheran World Federation’s and Finn Church Aid’s initiative in refugees’ camps and Heifer international’s EAYIP project and focusing on mainstreaming fermented porridge in the Early Childhood Development led by JKUAT and public authorities in Kenya.

Overall, the project created a sustainable pro-poor model by which people of different nationalities could utilize local resources to create an extensive value-chain that produced and distributed health-promoting probiotic fermented foods.

¹ Please note that the targets were reviewed by the donor from the original target based on the findings and discussions of the August 2017 Mbeya meeting (Refer the August aide memo by Marwan Owaygen; IDRC program officer)

2. The research problem

The main research problem addressed was how to introduce a new concept of health-promoting probiotics to poor east African communities, and empower them to produce affordable, tasty fermented food that creates a dynamic value chain?

- This was tackled using a variety of educational tools, including radio, television, cell phones, a feature film, workshops, personal and group meetings, and a diverse group of partners already with a respected presence in the countries.

Such a project has to cut across languages and dialects, gender and age, customs and religions, and existing food production, and reach many people who have minimal education. In total, it has to reach 250,000 consumers in three countries covering 1,263,310 square miles.

- This was achieved by a simple methodology of production, having teams of trainers, text and graphics, advertising at community gatherings, recruiting producers from the dairy sector and women's groups, using simple but effective book-keeping and management practices.

It has to use low cost technology, while ensuring substantive empowerment, participation, and local capacity building in a scalable project that is sustainable over time.

- The success was achieved by a bottom-up approach where local people used local resources that embraced the whole value chain from farming to consumers.

The food production has to be done in a hygienic manner and certification acquired from local health authorities.

- An advantage is that fermentation increases longevity of food, reduces pathogen counts, and helps treat diarrhea. Repetitive monitoring of PUs and assessment by health inspectors ensured compliance.

There should be no perception that the probiotic strains were being 'tested' on Africans.

- The messaging conveyed the extensive research already performed on the Yoba and Fiti strains, including studies in Africa, plus a school study of 5.5 weeks showed benefit to skin health.
- PUs were encouraged to develop their own brand and flavours.

The project has to be sustainable.

- Partners were brought on board, such as SNV, to add value to school feeding programs, whereby parents agreed to slightly increase the school fees to allow their child to consume small portions of probiotic yoghurt twice per week.
- Marketing skills were taught to balance costs with revenue, account for sachets purchased and volumes produced and sold, noting regular and random consumer numbers, increasing and diversifying production so that profits can be made even during dry season.

3. Milestones

The Fermented Foods for Life Project has completed its implementation.

Milestone 1 – Wide-scale distribution the probiotic bacteria sachets

During the entire project period, the project received 145,856 sachets (37,200 in Mbeya and 5000 in Mwanza, Tanzania, 63,000 in Uganda, 20,000 in Kenya), with 20,656 sachets of Yoba sold or used for training demonstrations. The sachets find their way to all corners of the countries: in Uganda through 12 local distributors in a market driven approach. The distributors come to Kampala to buy the sachets for 1.500 UGX, and retail them upcountry for 2.500 UGX.

The sachets are now distributed through centralized sites (SAUT and Mikono Yetu in Mwanza; JKUAT in Kenya). Of note, the PUs cover large areas of Uganda, except the north and east. But, initiatives are ongoing to reach the former through refugee camp initiatives and the latter through a proposal submitted with Australian colleagues to IDRC. In Kenya, the sites are located in Nairobi and districts to the south west, while in Tanzania there are multiple PUs in Mwanza and Mbeya with others scattered across the country.

Interestingly, 28 of the PUs were dairy cooperatives in Uganda, but only 1 of 85 in Tanzania and 7 in Kenya. This reflects the tremendous success of individual owners and means they can further target these cooperatives moving forward.

Milestone 2: Assessing impact on women and youth

The project has shown substantial impact on women. In Mwanza, all but 2 of the PUs are owned and run by women, in for Mbeya and all of Uganda, 74% are female owned. In Kenya, five PUs are wholly owned by women, while the 38 production units employ 74 people, of whom 47% are female. About 4000 individuals supply milk to the various production units for yoghurt production, and 60% of these are women. This means women are major drivers in production, distribution, marketing, and key parts of the value chain.

Interestingly, Uganda data show female owned PUs produce 196 litres per week while in Tanzania it stands at 144 litres; whereas the male owned production units produce on average 256 litres per week in both countries. Production volumes can be seen as a proxy for success and profitability, and therefore females are very successful in business but slightly less successful than their male counterparts. Possible explanations are conflict with duties at home, less (financial) resources and lower education levels. The project has therefore successfully labored to create a conducive environment for women in scheduling trainings and workshops, frequent follow-up and support visits, and supporting them in applying for other financial schemes for their business expansion ie the SNV grant scheme to boost yoghurt producers.

Youth (defined in the region as <35 years) have also substantially benefitted from the project, representing 45% of the people (over 500) involved in the business under Heifer. Youth ownership of production units is around 21%, likely because they are still mobile and less likely to settle and invest in a business, as well as being held back by limited access to financial capital. The youth who did have the zeal and ambition to start the business are proving to be highly successful, as the 22% youth-owned production units on average produce 271 litres per week. A short documentary developed by the project in Uganda shows some impressive success stories of youth entrepreneurs².



Milestone 3: Creating conditions of sustainability

As it is a business-led approach, producers benefit only when they make an effort themselves. And they will keep on benefitting after project closure, not because of the project, but because of their own efforts, driven by economic incentive. During the course of the project, a few production units have dropped out (a very low attrition rate of 5%), which further illustrates success.

So far, 75 major PUs in Uganda and Tanzania plus several in Kenya have obtained a certificate of microbial analysis, and others will follow. Full certification from the bureaus of food safety will also be obtained from the Uganda and Kenyan National Bureau of Standards and Tanzania Food and Drug Authority.

As a final activity not only towards sustainability but also towards expansion of the producers' base, 13 'Local Capacity Builders' (LCBs) were trained to satisfy the high demand for new PUs owners in Southwestern Uganda (the largest milk-shed in Uganda) and across Tanzania. These LCBs operate as individual consultants, who can provide training on *Yoba yoghurt production and sales* to clients, whereby the client meets the cost of this training. So far, three new PUs have been established as a result of the efforts of these LCBs.

Milestone 4: Disseminate results to authorities, policy makers and extensionists

A major achievement towards the milestone of disseminating project outcomes was the FFFL symposium held on the 27th of March in Uganda. The symposium was organized by all project partners and resulted in attendance of high-level stakeholders who took great interest and enthusiasm in the successes of the FFFL project and the potential of the concept for future application and expansion. Partners who showed particular interest were Sight & Life, Finn Church Aid and the Lutheran World Federation. . In partnership with the latter organization, two trainings in refugee camps were conducted specifically in Rwamwenje refugee camp. Two Production Units have been set up and thus producing an average of 200 litres of probiotic yoghurt per day and thus distributed and consumed in the camp. This is an exciting development given the number of refugee camps around the world that struggle for healthy food options.

² <https://www.youtube.com/watch?v=iYtzi4pkdsM&feature=youtu.be>

In preparation of the symposium, a 10-minute attractive documentary about the project in Uganda featuring 5 PUs was recorded by a professional TV-team¹. Secondly, a glossy Case Report was produced with success stories from the 3 countries³. This document was distributed to attendees of the symposium and other stakeholders who did not manage to attend the symposium. The event was featured on UBC tv (no link available), and the TV went back to one of the youth group yoghurt producers, Dovek, who featured on NTV on the 5th of May (no link available). FFFL also featured in the newspapers: In December an interview with project coordinator Nieke Westerik was published in the Daily Monitor⁴, and the same newspaper mentioned the project with regards to a roadshow conducted at Kalalangala Island⁵.

In the reporting period FFFL in Uganda alone, participated in 16 shows and exhibitions⁶ including an exhibition at the National Forum on Nutrition in the office of the Prime Minister and conducted one more roadshow⁷. FFFL and probiotic yoghurt was also featured at 27 schools (14 in Uganda and 27 in Tanzania), whereby 4,646 children received a sample of probiotic yoghurt, were sensitized on the importance of probiotics, played a football match with an FFFL ball and in FFFL branded T-shirts, and watched the FFFL movie 'The promised land'. As direct and spin-over effects of these promotions, 15 new schools stocked probiotic yoghurt in their school canteens.

Other Milestones achieved between October 2017 and June 2018

Scaling up pathways:

Uganda and Tanzania:

Grant program SNV

In March 2017, the Dutch SNV started with a grant program which provided a 50% contribution to investments in equipment and premises for PUs as supported by FFFL. To date, CA\$7,839.35 have been disbursed under this matching grant program. In 2018 the grant contribution was lowered to 25%, but the grant program will continue after the completion of the FFFL grant. By the time of the closure of the project, 27 production units in Uganda had benefited and the investment will go to improve the quality and safety of the product such as refrigerator, motor cycles to market the yoghurt, sealing machines among others.

Uptake by East African Youth Inclusion Project (EAYIP) of Heifer International

EAYIP is a project of Heifer International and its partners and is sponsored by the Master Card Foundation. The main objective of the project is to teach skills to youth and create employment for them in agricultural value chains. Hence the production of yoghurt fits perfectly into the

⁴ <http://www.monitor.co.ug/Magazines/Farming/Earn-more-from-making-yoghurt/689860-4221726-qb8edi/index.html>

⁵ <http://www.monitor.co.ug/News/National/46-per-cent-of-Kalangala-children-malnourished--says-new-report/688334-4151124-ron559/index.html>

⁶ Igongo Kids Festival, Igongo End of Year Festival, Wandegeya Farmers Market Expo (2x), UMA international trade fair, Africa Renewal University expo, Farm Clinic Serere, Ibanda swift business expo, Igongo Kids Festival, Mukono Arch-Diocese Family day and exhibition, Annual Passover festival Nambole, Toto Kids Festival, Castle Kids Festival, Pork Festival, Harvest Money Show Kampala, Forum on Nutrition in office of the Prime Minister,

⁷ At Kalangala Island in collaboration with Island Dairies

objectives of this project. In May 2018, the first two youth groups under the EAYIP project were trained by FFFL staff, and immediately kicked-off production. By the close of the FFFL Project, 33 youth groups (15 in Uganda and 18 in Tanzania) with a total of 663 youth had been trained in probiotic yoghurt making. Out of the trained groups, already 21 groups are in production (15 groups from Uganda and 6 in Tanzania). Further, the EAYIP project has set aside a budget of US\$200,000 with a plan to train and support more 60 youth groups to produce and market probiotic yoghurt. This is an incredible commitment to sustainability and growth.

Replication in refugee setting;

The Lutheran world Federation an NGO has replicated the model in a refugee camp called Rwamanja. Two PUs (one group with 13 women and 7 males while the youth are 5 in total, and an entrepreneur) were set up to enable refugees access nutritious foods but also have an income source. It is expected that the same organisation will replicate the model in more refugee camps. Similarly, Fin Church Aid has taken the initiative to replicate it with women and youth in refugees' settings as an alternative income source but also to enable refugees' access affordable nutritious foods. The scale-up activities are expected to continue given the benefits of the approach.

Pre-primary probiotic program

A pilot was conducted in collaboration between fermented food for life project and SNV whereby school management and parents of 48 pre-primary institutions in Mbarara and Bushenyi districts were sensitized on the importance of probiotics. Subsequently parents were convinced to slightly increase the school fees to allow their child to consume small portions of probiotic yoghurt twice per week. As a result, 2206 children started consuming probiotic yoghurt on weekly basis in the first term of 2019. The successes of this pilot resulted in a full-fledged program in South-West Uganda of which the costs are carried by SNV: the pre-primary probiotic program. SNV is implementing this program in order to enhance the consumption of probiotic yoghurt among young children. Thereto, six field staff were hired full time and tasked with visiting schools, talking to school management, and looking for opportunities to directly talk to the parents. The proposition is that children should take probiotic yoghurt in pouches of 125ml twice per week for their health. Thereto, parents should increase school fees by CA\$4.14 per period (3 months). The program started in February 2018, and so far, 1,921 pre-primary children and 530 primary children are taking yoghurt on weekly basis. As the model is parent-led, consumption will be sustained after intervention closure.

Kenya:

Two broad approaches for mainstreaming the production and consumption of products containing the target probiotic bacteria, *Lactobacillus rhamnosus* GR-1, were tested in this project. The first approach involved commercial yoghurt production by individuals, farmers' cooperatives, youth self-help groups or women self-help groups. The second approach involved non-commercial production and consumption of fermented porridge in pre-primary schools (ECDs).

The first approach has the advantage of being able to economically empower the producers, while affording nutrition and health benefit to the consumers. Most of the major production units established by individuals were owned by women, indicating the potential for women empowerment. On the other hand, commercial yoghurt production is under strict regulation by

the government, which requires the production units to be certified by the Kenya Bureau of Standards. Even though the certification process looks straightforward, it is intimidating and challenging to many small-scale producers. Therefore, many of the groups and individuals who received training on probiotic yoghurt production did not establish successful production units.

Because of the above challenge with commercial yoghurt production, the second approach involving production of probiotic fermented porridge in pre-primary schools was introduced in Vihiga county, with permission from the County government. Authority to introduce such a program in primary or secondary schools requires permission from the national government and would take a longer time.

The Second approach has a higher potential than the first for mainstreaming the production and consumption of the probiotic products because of its simplicity, low cost and observable benefits. It is simple in that many pre-primary schools already provide porridge to children daily, and they only require the starter culture, low cost improvised incubators and training on the fermentation process. In the participating pre-primary schools, the product is popular with the children, parents and teachers. The children prefer the fermented porridge to the unfermented porridge, and there is anecdotal evidence from the teachers and parents to the effect that the children are healthier and happier. Neighbouring ECDs that were not in the program have continued to ask to be included in the program. With this kind of reception, the program has a high potential to be upscaled from the 20 pilot ECDs with a student population of 1200 to over 800 ECDs in Vihiga County, with a population of over 400,000 children. Nationally, there are approximately 50,000 ECD centers, with a population of 3 million children, who could be reached by this intervention.

To facilitate wide-scale adoption, ECDs that are already in the program are encouraged to share the technology with other ECDs in Vihiga County, and to discuss with JKUAT any technical difficulties. JKUAT has signed memorandums of understanding for development with five Counties, and the JKUAT project leader will pursue specific memoranda of agreement for adoption of this program by these counties. JKUAT will also apply for a small grant to sell the program to all the 47 counties.

4. Synthesis of research results and development outcomes

4.1 Estimating the number of consumers reached

It is impossible to state the number of consumers of the probiotic fermented food, so estimations are needed.

In Uganda, 13 PUs were surveyed, whose monthly yoghurt output was measured and numbers of outlets supplied were known, plus regular customers (at least once per week) were assessed along with irregular consumers reached through all outlets. The PUs had 387 outlets and served 47,390 consumers per month.

Based on this survey, it is estimated that in Uganda with the current level of production, 215,000 consumers per month (**of whom, 49% are regular consumers while 51% are irregular**) are being reached. In Kenya, the number of regular weekly consumers of probiotic yoghurt is estimated at 13,713. The survey in Tanzania estimated the number of monthly consumers to be

29,289 (of whom 81% are regular and 19% irregular). The estimation for the three countries is that around 258,000 consumers of probiotic yoghurt are being reached per month.

The additional component is to state how many consumers potentially have access to the products, based upon location of PUs. The population of Uganda is 41 million, with 9 million living in the southwest region where most of the PUs are located. In Tanzania, the population of Mwanza is 2.8 million, and Mbeya 2.7 million. In Kenya, the population of Nairobi and south western counties is around 3 million, and there are 3 million children accessible through the early life schooling programs. This provides a total of 20 million people. This reflects a penetration of around 1% of the population we are already reaching with the probiotic foods.

4.2 Market studies

To further demonstrate interest in scaling up SNV conducted a market study on the potential interest of the Ugandan population in a health promoting probiotic yoghurt product. The study was conducted by Marketing Excellence Consults with collaborative efforts from the FFFL project. 634 questionnaires were successfully administered, of which 274 were administered in Kampala, 265 in Mbarara and 95 in Ntungamo.

The concept of probiotic yoghurt was explained to the respondents with the following explanation: *‘Probiotic Yoba yoghurt is a yoghurt that looks and tastes very similar to any other regular yoghurt, but the word ‘probiotic’ indicates that this yoghurt has special health benefits. The health benefits include helping digestion, balancing the digestive system, reducing bacterial infections and reducing ulcers’*. Subsequently, the respondents were subjected to a questionnaire, of which the outcomes are summarized in this report.

From the table below, it can be noted that consumers are very health conscious in their purchase behaviour, which likely explains interest and appreciation for the concept of probiotic yoghurt. However, especially in the more rural areas (Mbarara and Ntungamo), consumers are sceptical with regard to health claims on packaging material. Translating this to the FFFL project meant that there is high potential for reaching consumers, but that there is need for awareness creation and endorsement by persons or institutions that are perceived by the general public to have authority.

Key perceptions with regards to yoghurt. The figures are an aggregate of the respondents who agreed, much agreed and very much agreed to the statement

	KAMPALA	MBARARA	NTUNGAMO
A healthy product	94%	88%	79%
An affordable product	75%	70%	68%
An appealing brand	90%	53%	45%
The produce features are built well	83%	54%	46%
Product is of value to life and health	100%	84%	89%
Product has health attributes	100%	89%	92%
Overall perception of the product	Very good	Good	Good
Interested in buying this product	88%	87%	87%
“I really need this product because nothing else can solve this problem” or “This is a minor improvement over what I currently use”	42% and 36%	37% and 34%	44% and 31%

Consumption choices (general) are influenced by health considerations	83%	88%	89%
Buying products specifically for its health benefits	76%	94%	96%
Trusting health claims on food labels	61%	37%	35%
Neither trust nor distrust health claims on food labels	31%	29%	27%

In March 2017, a survey was conducted on the distribution channels through which probiotic yoghurt was sold in Uganda. A summary of the outcomes is shown below.

Different distribution channels through which probiotic yoghurt is sold in Uganda, and the percentage of production units making use of this channel

TYPE OF MARKETING CHANNEL	PERCENTAGE OF PUS USING THIS CHANNEL
Own outlet	66%
Rural kiosk	33%
Urban shops	31%
School canteens	14%
Hawking	15%
Acquaintances and personal orders	9%

4.3 Health and socio-economic studies

In November 2017, a study on the effect of yoghurt consumption on the health status of pupils at Aparisa Primary School in Amuria District, Uganda was commissioned. Esther Anyimo was contracted as the lead nutritionist on this study. The probiotic strain used in Yoba, *Lactobacillus rhamnosus* GG (Yoba) and Fiti, *Lactobacillus rhamnosus* GR-1, are two of the most extensively studied in the world. In order to generate local data, an open-label study was performed. Four hundred and sixty-seven (467) children at Aparisa Primary School in Amuria District consumed probiotic yoghurt containing Yoba. Each child took 100 mls of yoghurt at 12pm daily, which translated to 2800mls in the 5.5 weeks of the study period. This was consumed along with the regular family meals consumed by children from their homes or school as packed lunch.

Measurements were conducted prior to, during and at the end of the study of children in the lower classes, nursery/kindergarten to primary four. During each of the surveys, children's weight, height and MUAC anthropometric measurements were taken and a structured questionnaire was administered to the parents'/care takers (household heads) of the children.

The primary objective was to monitor changes in the weight (kg) of children, and the secondary objective was to compare the incidence of diarrhea, respiratory tract infections, skin rashes and nutrition status indicators.

One hundred (100) household heads/parents/caretakers of the children were successfully interviewed in the baseline, 73 in the midline and 86 in the end line assessments. Household heads with more than one child in the study provided information of up to 3 children. From the interviewed household heads, information from 189 children in the baseline, 143 in the midline and 172 in the end line study was collected. 240, 200 and 214 children were measured and inspected for skin rashes in the baseline, midline and end line studies respectively. The interview of household heads and the measurement and skin inspection of children were all done within school premises and the children and households surveyed in the baseline were the same ones followed in the subsequent assessments. A summary of the outcomes can be found below.

Outcomes of the study at Aparisa Asamuk primary school. The incidence (in number of children) is given for different parameters for the baseline and the endline (at 5.5 weeks).

Condition	Baseline	End
Diarrhoea in last two weeks	4	2
Skin Rashes at time of measurement	101	15
Cough in last two weeks	15	22
Flu in last two weeks	16	19
Weight gain	-	0.3 kg \pm 1 kg
Absenteeism	40	23

Shortcomings in the study included 1) the diagnosis of the different diseases was not done by medically schooled personnel and 2) the study did not include a control group. The study can therefore only serve as a reference point.

A second study was performed in March 2018 with students in Zelezeta Primary School in Mbozi District, Songwe Region of Tanzania. The primary objective was to monitor changes in weight of children aged 4 – 15 years after consumption of Yoba yoghurt. The secondary objectives were to compare the incidence of diarrhoea, respiratory tract infections and skin rashes among the children before, during and after the intervention.

The study involved enrollment of 202 students from Nursery school to grade six (V1) aged 4-15 years. Each was provided with 125mls of probiotic yoghurt during the weekdays for a period of 8 weeks. The Yoba yoghurt was consumed during class break at 10.00 am. The nutritionist assessed the anthropometric measurements, physical examinations and indicators of malnutrition in children. A questionnaire was administered to gather quantitative and qualitative data on diarrhoea and skin rashes to the pupils. The study was designed as cross sectional. The number of students involved in the study decreases from 202 to 177 due to absenteeism and wrong perceptions of the parents who prohibited their pupils to consume yoghurt.

During the final assessment, 177 pupils were weighed using the digital SECA and 80 pupils gained some weight this is equal to 45% of total pupil in the study. Children who consumed probiotic yoghurt every day, gained weight quicker than those not consuming yoghurt. The study witnessed a decrease in sickness complaints from pupils in study group who consumed probiotic yoghurt.

Condition	Baseline	Midline	End line
Diarrhoea in last two weeks	80	2	-
Skin Rashes at time of measurement	-	-	-
Cough in last two weeks	99	-	20
Flu in last two weeks	99	2	20
Weight gain	-	55	80
Absenteeism	-	42	25

Shortcomings in the study included; 1) Absenteeism of some children and misperceptions of few parents resulted into drop-out of the enrolled pupil and hence reduce the sample size of study 2) The study did not include a control group therefore its results will only serve as a reference point for further studies.

Socio-economic impact assessment:

In the third Interim report we reported on a socio-economic impact assessment as conducted by Dr. Onesmo Shuma. In short, the assessment proved that all the three business models i.e. group, cooperative and individual for the project are scalable, profitably as well as socially viable. However, the success of any scaling up and replication efforts largely lies on the ability of the enterprises to reach a critical mass of consumers. The study further concluded that the achievement of the poverty and nutrition objectives of the project will come through “multiplier effects”. In addition to this, the project addresses income poverty through profits generated, while at the same time addressing non-income poverty, namely education, health, nutrition, safety nets, household food security e.t.c) through the increased household income. Lastly, the study has concluded that women and gender empowerment will come through promotion of “gender for efficiency” and not “gender for equity” approaches. Based on this study, the net profit in Uganda of selling one liter of probiotic yoghurt is at least 3 times the net profit of selling one liter of fresh milk.

The income gains of selling probiotic yoghurt instead of fresh milk is on average 95 US\$ per production unit per week in Uganda and 193 US\$ per production unit (run by individuals) per week in Tanzania.

4.4 Informing decision-making

During the entire project period, FFFL participated in 32 shows and exhibitions and conducted 9 road shows across Uganda. The details of these shows and exhibitions have been reported previously. As a direct result of these and other activities, FFFL UG has, to our knowledge, featured in 4 newspaper articles, 10 TV shows and 13 radio show (details previously reported of which 12 radio shows were in Tanzania).

There are many testimonies of positive effect of these different types of exposure (i.e. sharp increase in demand after a roadshow in the village of the PU, people asking for and looking for the product after a TV show, etc). However, quantifying the exact effects of marketing efforts in general, considering the prevailing circumstances, has not been possible.

As an important outcome of all these efforts there is strong awareness about probiotic yoghurt among the regulators of the dairy sector i.e. staff of the Dairy Development Authority (DDA) and Uganda Industrial Research Institute (UIRI) in Uganda, Tanzania Dairy Board and Tanzania Food and Drug Authority (TFDA). These agencies are already main-streaming adoption of the probiotic yoghurt processing in their work. For instance, DDA committed to mainstream training in probiotic yoghurt processing in the dairy school, URI and TFDA have committed to provide support in certification and nurturing probiotic yoghurt processors to move to scale. Prominent figures in the Ministry of Health and the Ministry of Education also committed to encourage consumption of probiotic yoghurt in primary schools.

4.5 Capacity building and empowerment

As a result of workshops on quality & safety and continuous mentoring and coaching on the same, 78 production units (75 in Uganda and 3 in Tanzania) have been able to obtain a positive certificate of analysis from the laboratory of the Ugandan Industrial Research Institute and TFDA, respectively.

FFFL introduced standardized bookkeeping for a certain period to familiarize the production units with the system and the importance of keeping these records. As a result of this intervention and continuous mentoring and coaching on the same, over 60% of the production units now keep their own records.

Research partnerships:

As a result of this IDRC funding:

- Heifer International signed a MoU with UIRI (public sector), and as a result UIRI provides the project with services of laboratory analysis of yoghurt samples.
- The project has provided yet another avenue in which Heifer International collaborates with the Ugandan government through the dairy sector. The project raises a podium on which topics such as ‘local value addition to food’ and ‘health benefits of probiotics’ are discussed.
- Heifer International has had preliminary conversations with Makerere University to extend the use of probiotics to other fermented foods, such as fermented millet (locally called obushera).
- Over the project period, FFFL increasingly collaborated with SNV. This led, among others, to the market survey on probiotic yoghurt, a grant program for yoghurt producers, and the pre-primary probiotic program (all described elsewhere in this report)

Governance

The project encourages participation of youth and women, especially in the mobilisation for trainings, and providing training near to home for a limited hours per day, considering the other tasks of women in their homes. Yoghurt production is a unique opportunity for women to participate in the dairy sector, as most women were previously completely excluded. In Uganda and Tanzania, 69% of the 133 individual PUs, and 80% of the 20 group-based PUs are women owned. The project interventions have also provided a unique opportunity for employment of rural youth who do not own assets. In both countries, Forty-five percent of the 1,247 people involved in yoghurt value chain are youths who distribute the product as sales representatives within several

communities. The continuous business development support involving mentoring, proper record keeping using a pre-printed bookkeeping book, and good governance (mostly when in cases where yoghurt production is under the cooperative society) by project staff has led to a fundamental shift of the mind-set of all the participating beneficiaries.

Research Ethics

The project also collects data on the characteristics of the yoghurt production units, such as volumes produced and people involved. Permission is asked to use this data for reporting purposes. Also contact details of owners or managers of the businesses are collected. All this information is treated as strictly confidential and only available to direct project staff and used only in the interest of the project. Any publication of production unit data is published as anonymous data.

Use of research results

The primary objective of the different research activities conducted was to develop and document a solid and successful business model concept, which can be replicated by other organizations, in other value chains (think of cereal fermentation) and/or in other countries. The FFFL symposium showed we have a clear story with a solid proof of concept, backed-up by hard data, attracting much positive attention.

On ground level, throughout the project, the incremental research activities helped the project staff to talk with more confidence, winning-over producers, high-level stakeholders and the general consumer.

Finally, the direct research results have given indications and point of reference for further scientific research.

4. Synthesis Towards AFS Themes

The project has remained relevant to all the four AFS themes and its contributions towards these themes during this reporting period can be highlighted as below:

Increasing agricultural productivity (Availability)

An innovative solution to increase food productivity: The fermentation of milk allows longer shelf-life due to acidity and the activity of yoghurt bacteria to inhibit the growth of spoilage organisms. This reduces post-harvest losses, especially in communities that have challenges with cooled milk storage or that have lack of immediate market for the fresh milk.

Contributing to improve risk-mitigation for food security: Income diversification can help stabilize revenue streams across seasons. Uganda has two wet and two dry seasons. In the dry seasons, milk production significantly reduces causing declines in income for dairy farmers and dairy cooperatives. Interestingly, the demand for yoghurt increases in the dry season, as yoghurt is usually consumed as a refreshing drink when consumers feel hot. The extra income from yoghurt in the dry season can balance the income reduction caused by reduced milk production. On the other hand, purchasing power of the population reduces during dry season, as income from agricultural produce reduces. This can counter the demand for yoghurt. The option of producing fermented cereal and juices, added by the research performed at Western University and by Yoba-for-life, provides alternative sources of food security and income during the dry seasons.

Addressing gender specific constraints in agricultural productivity: In Uganda, Tanzania and Kenya, women are increasingly empowered as a result of social change. The described intervention builds on, and at the same time stimulates social change by empowering women to start up their own businesses and generate personal income. This project was a breakthrough in that most research in the dairy sector indicate that while women contribute almost 70 % labour, they had no control of resources including incomes from the dairy sector. The FFFL project enabled women to have significant control of value and income within the value chain. This gender aspect is very critical, as women spend their income for a greater part on nutrition, education, health care and water and sanitation as compared to their male counterparts. Still, especially rural women, are facing constraints in their freedom of choice. Female youths are often protected from working outdoors or are occupied with domestic work. Operating in groups, as the vast majority of them do, is found to have a stimulating effect on their empowerment. It gives individuals more confidence, they have access to greater financial sources, their husbands are more likely to allow them to move out thus increasing their mobility and ability to market their yoghurt, and it opens opportunities for sharing knowledge and experiences. This in turn gives the women greater self-esteem and allows them to become more active in public life.

Food preparation is traditionally regarded as a task for women, and therefore yoghurt production is not regarded as a threat to traditional male jobs. Women are naturally interested, and culturally 'allowed', to engage in yoghurt production. Notably, societies are changing and this perceived 'control' over tasks by men is breaking down. The PUs empower males and provide a new paradigm towards equality in all aspects of life. It is perhaps too dramatic to state that this one project has overcome prejudices and profoundly altered societies in east Africa, but the principles have certainly exemplified a new respect for males and females across society.

Contributing to environmental sustainability, and environmental impacts: Compared to yoghurt produced in a national processing plant using milk transported to the plant then yoghurt transported across the country, locally produced yoghurt greatly reduces the burden of transport and the therewith associated fossil fuel use and carbon dioxide emission. On the negative side, the Yoba/Fiti yoghurt uses plastic packaging material. In the future, the hope would be that recyclable material or easily degraded material can replace the plastic.

Improving access to resources, and/or markets and income (Accessibility)

Contributing to improved access to resources: The Ugandan youth report a lack of access to applicable and practical skills training. In a survey among youth entrepreneurs, 29% had finished at least lower secondary education and only 30% had received business skills training, mostly in the form of apprenticeship. Lack of finance was reported as the major constraint to receiving training. Lack of skills are reflected in the fact that as high as 48% of youth who previously owned a business subsequently closed it. The FFFL project offers free training, both technically on yoghurt production, and more general business skills trainings, thereby creating access for the youth to become successful entrepreneurs.

Addressing bottlenecks and constraints to markets: By encouraging and empowering women to run a business as a group, greater access to markets is created. Well-functioning (women) groups are often found to depend on ties with women who grew up in the community, but have evolved to educated urban women, who then support the rural groups in their business and establish market for the yoghurt in the urban centres, connect the group to inputs for their business and avail the group with information that is critical for the business.

By supporting PUs on applying the right production procedures, and subsequently to acquire certificates for microbial lab analysis, PUs are empowered to penetrate greater and more formal markets. Secondly, linkages are created to help PUs to obtain increasingly professional looking packaging material, hence allowing them to compete with industrially produced brands.

Contributing to improved income: Preliminary results from analysing records of PUs indicate profits over 1000 UGX per liter of yoghurt produced. Specifically, job creation through locally produced yoghurt rural areas forms a solution to youth unemployment, which attributes for 83% to the overall unemployment in Uganda. Considering the fact that over 70% of the youth labour force is located in the rural areas of the three countries, youth entrepreneurship is important for the growth of the rural non-farm sector.

Contributing to successful partnership models

- The Uganda Industrial Research Institute (public sector): UIRI provides the project with services of laboratory analysis of yoghurt samples.
- The Dairy Development Authority (public sector): DDA provides monitoring and training services with the aim of developing the dairy sector.
- Tanzania Food and Drug Authority (TFDA); provides technical backstopping on food safety and standards.
- SNV The Dutch Development Organisation (NGO): SNV takes increasingly interest in milk value addition through yoghurt production in their intervention in the dairy sector in South-West Uganda.

Improving nutrition (Utilization)

Contribute to adequate and diversified diets, particularly for women and children: Yoghurt, being a product from milk, is a complete food. The probiotic attribute makes it a functional food. Research has shown that the probiotic strains present in Yoba and Fiti inhibit a wide range of harmful bacteria; prevents and reduces diarrhea, respiratory tract infections and ulcers; and bind and degrades aflatoxins; all of which currently pose commonly faced and serious risks to people living in Uganda, Kenya and Tanzania. Through trainings, IEC materials, branding of the products and other promotional materials, FFFL contributed significantly to nutrition education.

Improved post-harvest food processing and storage techniques for better nutrition, quality and safety: The multiplication of probiotic bacteria during this process adds great nutritional value to the milk through their metabolite production.

Equitable intra-household allocation of food: In addition to the fact that the largest part of the yoghurt is owned by women, our data show that 19% the demand for the product is among children. Combining these two observations leads to an assumption of an intra-household allocation of the yoghurt that favours the vulnerable (women and children).

Informing Policy

Direct engagement of policymakers and decision-makers: During the FFFL Symposium, the Dairy Development Authority presented their vision on increased collaboration.

Demand for the research results from the policymakers: In its presentation, the DDA re-emphasised its mandate to develop the dairy sector. Still in many places where they visit, they find farmers with no market for their milk, and no other option then to either consume it all themselves, sell it at extremely low prices, or even dispose of it. Especially in these areas, DDA requested Heifer to make an impact through skilling people in the production of yoghurt.

Evidence or research results presented to policymakers, evidence of usage by policy makers: The NGO Lutheran World Federation has adopted the concept, and as a result two groups in refugee camps have been trained on the production of yoghurt. With over one million refugees in Uganda alone, this is a significant development.

Critical success factors or bottlenecks for engaging with and informing policymakers and decision makers: Heifer has a long standing and flourishing working relationship with the DDA, which greatly helped to create appreciation for the FFFL project. A bottleneck is the registration requirements for production units by DDA, which include fees that are unaffordable to most units.

5. Project Outputs

- Report on socio-economic assessment by Dr. Onesmu
- Study on the health impact of probiotic yoghurt consumption among primary school children by Esther Anyimo
- Market research on probiotic yoghurt in Uganda by marketing excellence consultants
- Nduti N.N. McMillan A., S. Seney, M. Sumarah, P. Njeru, M. Mwaniki, and G. Reid. 2016. Investigating probiotic yoghurt to reduce aflatoxin B1 among school children in eastern Kenya: preliminary study. *Int Dairy J.* 63: 124-129.
- Nduti N.N. P. Njeru, M. Mwaniki, and G. Reid. 2017. Aflatoxin variations in maize flour and grains collected from various regions of Kenya. *Afr. Food Agri. Nutr. Devel.* 17(1): 11743-11756.
- Di Stefano, E., J. White, S. Seney, S. Hekmat, T. McDowell, M. Sumarah, and G. Reid. 2017. A novel millet-based probiotic fermented food for the developing world. *Nutrients* May 22;9(5). pii: E529.
- McMillan, A., J. B. Renaud, K. M. Burgess, S. J. Allen, J. D. Miller, G. Reid, and M. W. Sumarah. 2018. Aflatoxin exposure in Nigerian Children with severe acute malnutrition. *Food Chemical Toxicol.* 111:356-362.
- Reid, G. 2018. Microbes in food to treat and prevent disease. *Exp Rev Precision Med Drug Develop.* 3(2): 79-81.
- Reid, G., R. Kort, S. Alvarez, R. Bourdet- Sicard, V. Benoit, M. Cunningham, T. Mackle, D. M. Saulnier, J. E. T. van Hylckama Vlieg, H. Verstraelen and W. Sybesma. 2018. Expanding the reach of probiotics through social enterprises. *Benef. Microbes.* May 25: 1-10.
- Nduti, NN, G. Reid, M. Sumarah, S. Hekmat, M. Mwaniki, and P. N. Njeru. 2018. *Weissella cibaria* NN20 isolated from fermented Kimere product in Kenya shows ability to sequester AFB1 invitro and ability to ferment milk with good viscosity and pH in comparison to yogurt. *Food Sci Nutr Technol.* In press.
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- Westerik, N., R. Kort, W. Sybesma, and G. Reid. 2018. *Lactobacillus rhamnosus* probiotic food as a tool for empowerment across the value chain in Africa. *Front. Microbiol.* In press.
- Westerik, N., W. Matovu, G. Reid, R. Kort and W. Sybesma. 2018. Improving health and wealth by an intervention with an affordable starter for locally produced probiotic yoghurt in Uganda. A longitudinal descriptive study. *Challenges.* To be submitted by October.
- A manuscript on characteristics of fermented bean products will be submitted for publication later in the year by the JKUAT group.

Research partnerships - as a result of IDRC funding:

JKUAT and Western University had been in partnership before the project, but the activities done previously were on a much lower scale. This project has brought a technology and new food to ordinary Kenyans and has made a contribution to the lives of the few groups and individuals who

are now equipped with knowledge and regulatory greenlight for commercial scale yoghurt production business.

Has capacity improved for each of the organizations involved? If so, how? Yes. JKUAT obtained equipment for research. Yoba-for-life and Western Heads East are now operating more in a coordinated fashion and engaging key partners, such as Mikono Yetu to develop larger facilities to reach more consumers.

Have the organizations involved developed any new research networks or research partnerships? If so, which ones? JKUAT has developed new research contacts with Heifer International and with researchers from Yoba-for-life.

Mikono Yetu has helped activate PUs across Tanzania and is in closer ties with Heifer International and Yoba-for-life.

Has there been any formal recognition of organizational or individual achievements? (E.g. an award, letter of recognition, etc.). If so, how? Dr. Reid was inducted into the Royal Society of Canada and awarded the Distinguished Career Achievement Award by the Canadian Society of Microbiologists.

Nieke Westerik was invited to present her work in Singapore in June 2018 at the International Scientific Association for Probiotics and Prebiotics.

JKUAT is collaborating with one of the daily newspapers in a project dubbed 'Smart Harvest' to showcase research that is having impact on individuals, communities or specific sectors of the Kenyan Economy. Under this program, journalists are given details of ongoing projects, and they visit some of the project sites without the JKUAT researchers to investigate the impact of the projects. Based on this, an article reporting on the impact of the project in one location was recently featured in the daily.

For CIFSRF-funded projects only: is there increased use of Canadian knowledge and resources to address environmentally sustainable agricultural productivity and nutrition problems in developing countries? Use of the Yoba and Fiti cultures is contributing to better nutrition, food security and reduction in post-harvest losses, as well as significant reduction in aflatoxin exposure, and we believe it will impact cognitive development in children.

Likewise, the project has helped stimulate more Canadian research in particular to reduce honey bee losses and negate the consequences of environmental contamination.

Governance: How has the project provided opportunities to promote principles of good governance, such as participation and inclusion, transparency and accountability, equity and non-discrimination for the needs and priorities of project beneficiaries? The project gave equal opportunities to potential units without discrimination in terms of gender or age.

Research ethics: Has the project collected corporate or personal information? If so, what are the protocols the project put in place to obtain informed consent and maintain confidentiality?

No confidential information has been collected. The probiotic fermented porridge and juices have the potential to spread benefits to many other communities and schools where 3 million children are part of a food program.

6. Problems and Challenges

- Quantifying of the number of consumers was for a long time a challenge within the project. Several methods have been deployed to count them in one or the other way, but in the current reporting period we have provided several means to tackle this challenge. We feel confident that we are reaching 250,000 consumers per week. Importantly, we are providing access populations around the PUs, in excess of 10 million (population of Mwanza 2.7M, Kampala 1.5M, Mbeya region 2.7M, Nairobi 3M, plus other regions where PUs are located).
- The movie ‘The promised land’ did not have the envisioned impact on the project. This was in part because over 500 copies were never collected from a location in Nairobi, despite repeated requests, and Heifer did not get the movie translated from Swahili into Ugandan dialects. Thus, the movie was barely shown. Ironically, the low-key ‘family’ story that was selected following the rejection of the initial proposal for an action-thriller, was deemed by some to lack the drama and appeal that many people prefer in rural East Africa. Nevertheless, in areas where questionnaires were used, including in Canada, and in reviews by prominent African film critics, the movie was extremely well received.
- Quality and safety issues associated with the locally produced yoghurt remained an area that required constant attention throughout the project. Poor quality yoghurt from one producer has the ability to harm the name of the ‘Yoba/Fiti yoghurt’ and the project in general. However, thanks to the regular visits of the field staff (with university degrees in Food Technology), the workshops on yoghurt quality & safety, and the stimulation of the production units to bring their product for laboratory testing, this risk has been contained throughout the project. The structures put in place and the attention to hygiene engraved in the producers is likely to lead to a continuous production of high-quality and safe yoghurt after project closure.
- Towards the end of the project, the Ugandan team was constrained by lack of funds, as they had the manpower and seal to implement more activities than finances would allow them. The inability to more easily transfer funds from JKUAT made this more challenging. Nevertheless, post-funding, all parties continue to train and launch new PUs, introduce probiotic fermented cereal and juices, and retain strong allegiance with the people along the value chain.
- The failure of JKUAT to adequately take responsibility for the project, establish a financial mechanism to track funding and payment for sachets, produce research data equivalent to the enormous funding provided, and their inability to dislodge the original PI Dr. Pamela Odhiambo wasted over one year of project activity and funding. A volatile political environment in Kenya from August 2017 to January 2018 was not conducive for project activities. A university workers’ strike from February to May 2018 also slowed down activities. It was only when the new PI Dr. Arnold Onyango was appointed that success was achieved. Unfortunately, this raises concerns over the suitability of JKUAT as a future partner for IDRC funding, albeit the efforts of Dr. Arnold Onyango are much appreciated.

7. Overall assessment and recommendations

1. A key lesson in our project achieving so much success is that **selection of partners** is paramount. The on-the-ground activities and linkages so carefully developed by Heifer International, Yoba-for-life, Western Heads East and Mikono Yetu, were critical. The research instigated by Western University, Free University of Amsterdam and Makerere University on fermented cereals and aflatoxin reduction were vital to make the project continue to advance and adapt to seasonal variations, as well as send strong educational messaging to the frontline. We recommend greater flexibility in choosing partners at the outset (for example Yoba-for-life is a Foundation but they were not eligible to be an official partner, and we felt pressured to include a university such as JKUAT), or be able to change partners and move funds from one institution to others (JKUAT to Heifer International and Yoba-for-life) during the project if one is stagnating. This could have helped reach success sooner and more effectively.
2. The project was well funded, but still insufficient in total and in timeline, given the absolute novelty of probiotics to this part of the world, and the extent of the need of the communities we reached. The adoption takes time in poorly developed countries and moreso in rural settings, where literacy levels are low and integrating all aspects of the value chain require time and logistics. The extension of three months certainly helped to address some of this issue. We recommend one year longer and a higher budget cap of say \$2M in future projects. In addition, we recommend more emphasis on lessons learned overseas in projects such as this, being **transferred back to Canada**, where many people could benefit from the knowledge, practices, pro-poor business model and methods of implementation.
3. Without doubt, the project has demonstrated **an enormous opportunity** to scale-up the innovation to impoverished parts of the world. The flexibility to use various local resources with the bacterial cultures and the involvement of males, females and youth across a value chain makes this application unique and transferable. The experience and knowledge that was built across the time frame of the project, now presents Global Affairs Canada, IDRC and the Canadian government as a whole with an amazing opportunity to put a 'stamp on the world'. The process of peace and prosperity begins with overcoming malnutrition and empowering men and women alike to optimize the resources at their disposal. We recommend that Canada take on the role of champion to facilitate global outreach of the FFFL concept.
4. In closing, it has been **an incredible project** that has brought together sincere, hard-working partners to a common cause. Although it is now the official end of the project funding, it is by no means the end of these relationships and central purpose. It has been a privilege and honour to share in the great success, and mostly in seeing so many lives changed for the better.

Gregor Reid PhD MBA FCAHS FRCS
Professor, Western University.

Appendix – Figures.

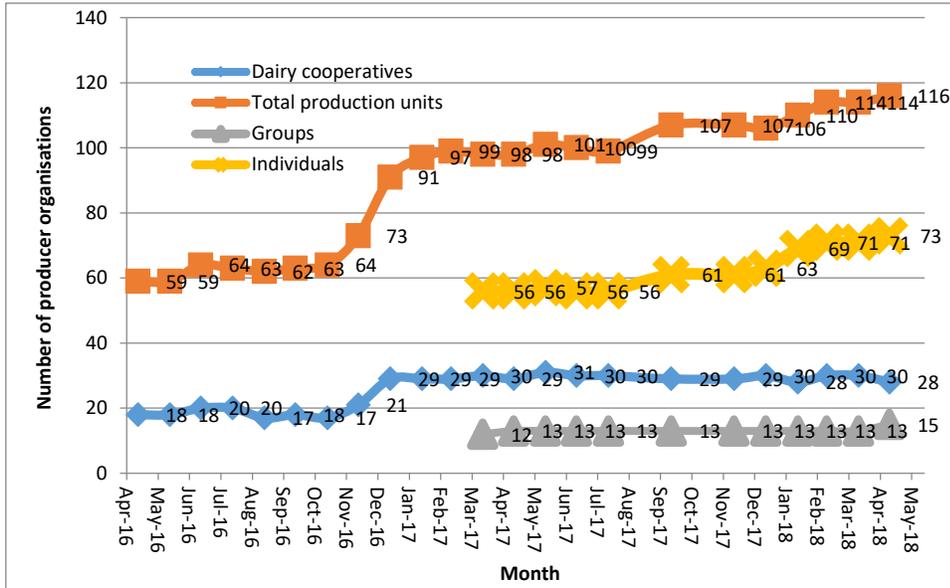


Figure 1:
Development of the number of active Heifer-Yoba production units of probiotic yoghurt in Uganda between April 2016 and May 2018

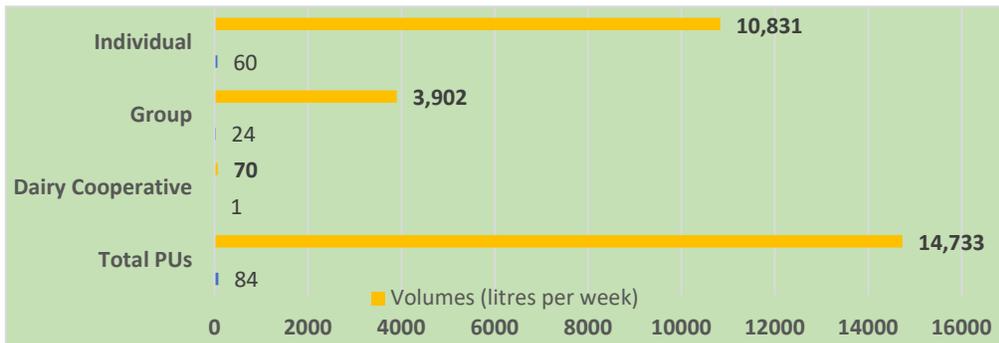


Figure 2:
Overall active Heifer-Yoba production units and their weekly volumes of probiotic yoghurt in Tanzania.

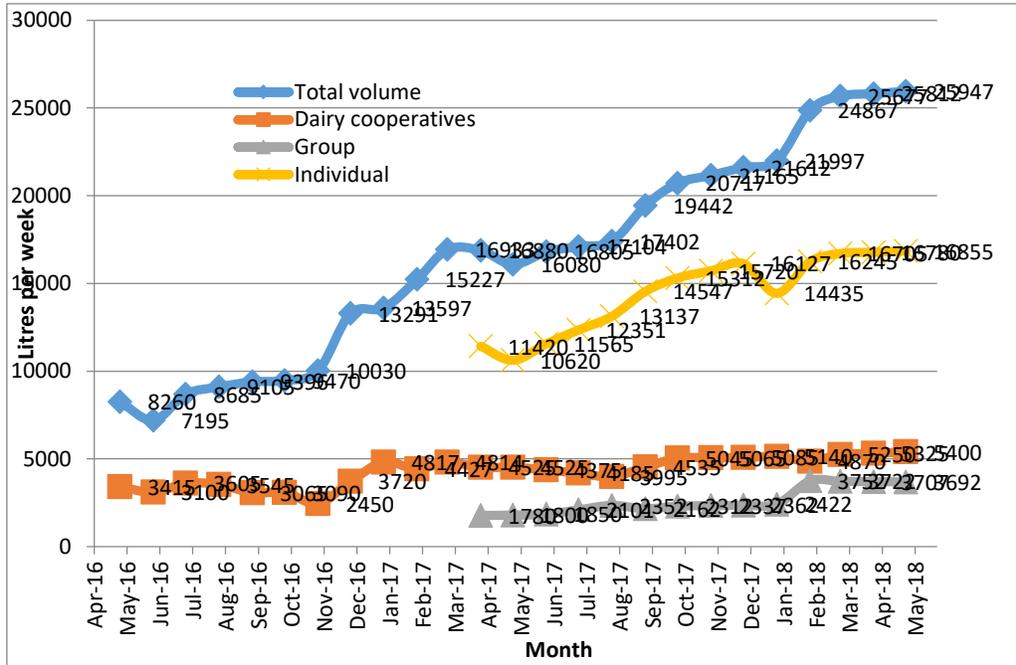
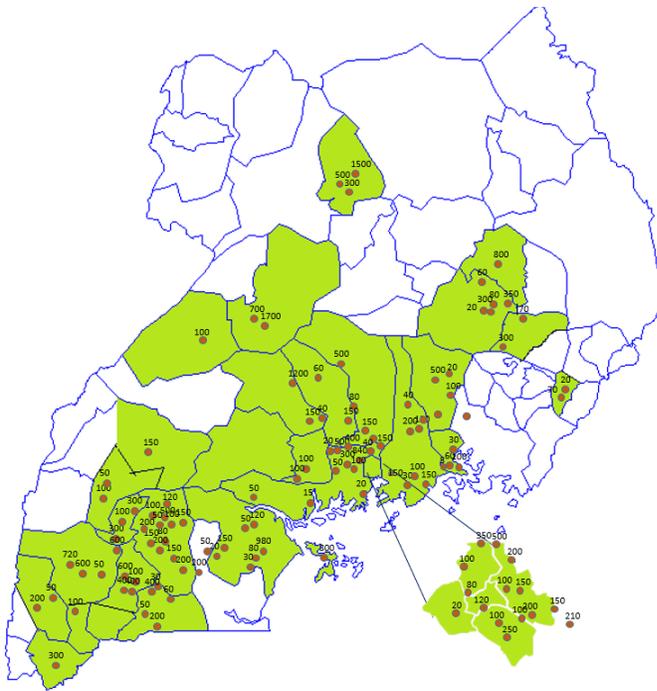


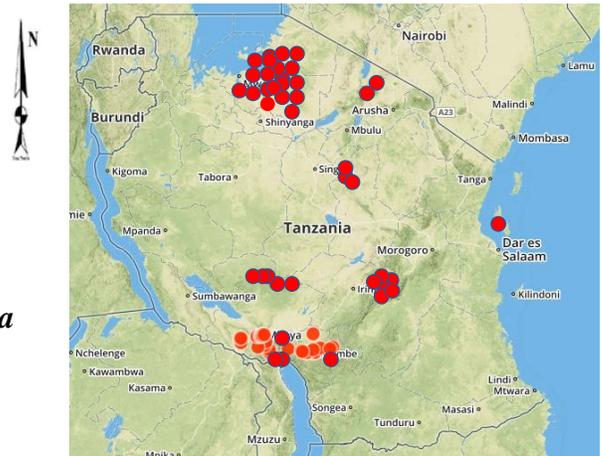
Figure 3: Development of the weekly Heifer-Yoba production volumes of probiotic yoghurt in Uganda between April 2016 and May 2018



volumes per week, and Mwanza-Fiti and Heifer-Yoba Tanzania PUs (right)

Figure 4: Geographical overview of Ugandan PUs (left) and production

GEOGRAPHICAL OVERVIEW OF THE TANZANIA PRODUCTION UNIT:



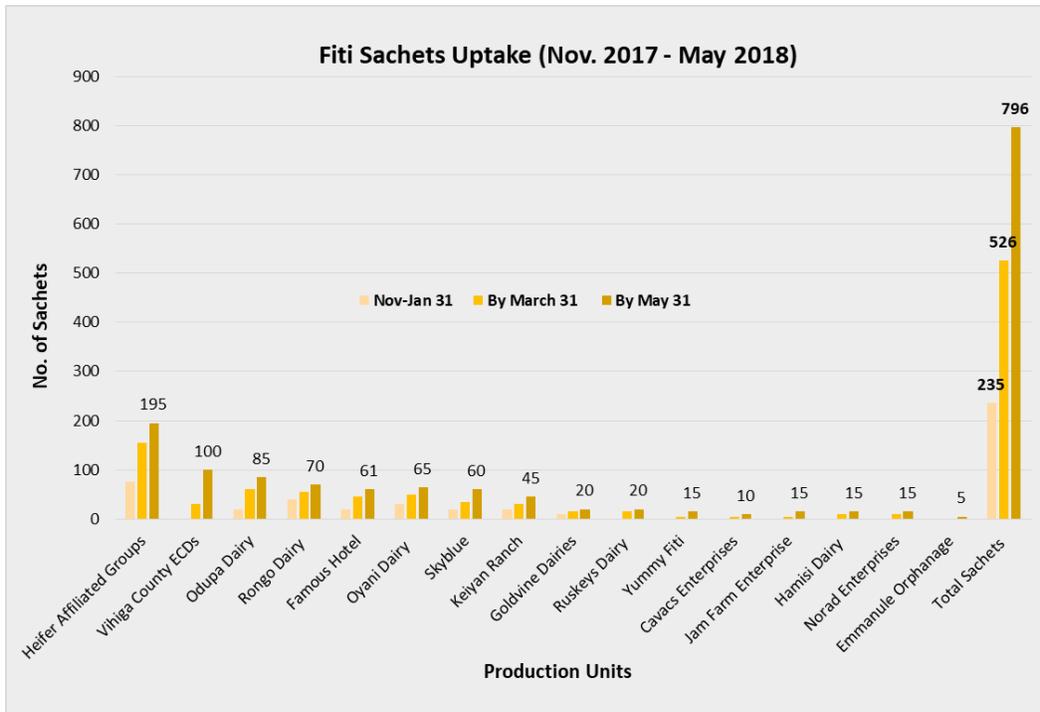


Figure 4:
Trends in Fiti sachet uptake in Kenya

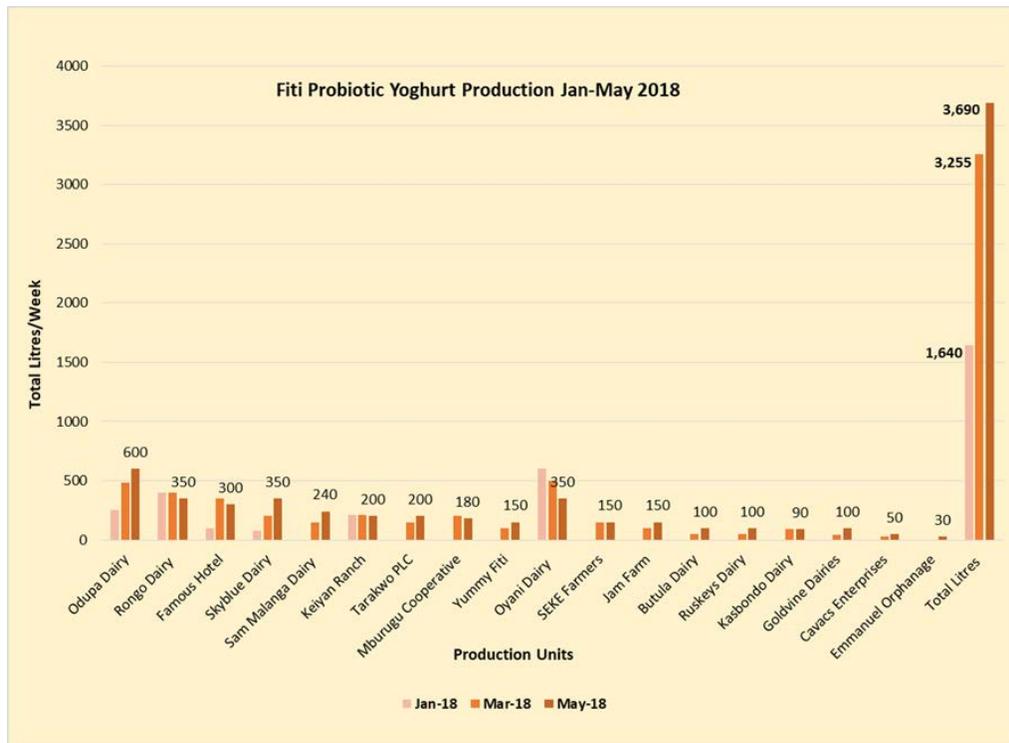


Figure 5.
Trends in Fiti probiotic yoghurt production by 18 PUs in Kenya from January to May 2018

Figure 8: Busunju Women come together to produce yoghurt as a group. This is a social activity as well as an income generating activity, and empowers women to take charge of their own lives



Figure 10: Michael Byamukama of Dotcom Chemical Investments sells up to 300 Yoba cultures per month, making it one of his



Figure 11: Children in a pre-primary institution are excited to be consuming a small pack (125ml) of yoghurt twice per week.

In the third interim report we described the demographics of the consumers (location, age, gender), looking at a sample of 16,103 consumers. The outcomes of this survey can be found in figure 12.

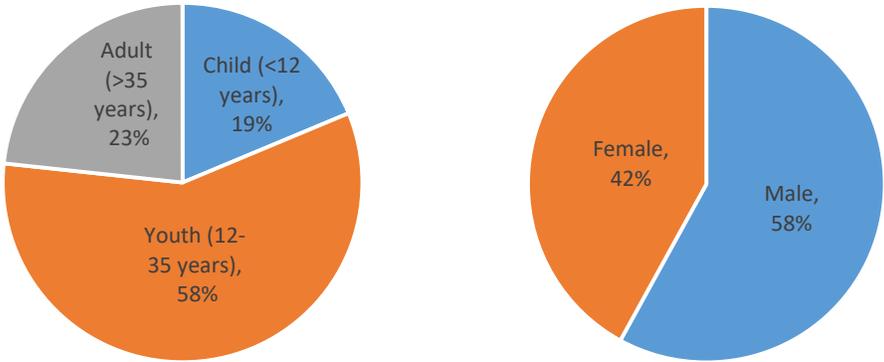


Figure 12: Age (left) and gender (right) distribution of probiotic yoghurt consumers



Figure 13: Children of Aparisa Asamuk primary school consuming their daily portion of 100ml of probiotic yoghurt, while posing next to the weight and height meter used in the study



Figure 14: Kindergarten students enjoying probiotic yoghurt at Zelezeta Primary school



Figure 15: Pupil measured on weight at Zelezeta Primary School in Mbozi district

Table 1: Current level of production units and their weekly production volumes, segregated based on governance structure (Uganda)

	Total PUs	Dairy Cooperative	Group	Individual
Active	116	28	15	73
Volumes (litres per week)	25,947	5,400	3,692	16,855

Description	Total PUs	Dairy Cooperative	Group	Individual
Active (PU)	84	1	24	60
Volumes (Lt/Week)	14,733	70	3,902	10,831

Table 2: Weekly probiotic yoghurt production volume (Tanzania, not including all 50 in Mwanza)

Table 2: Different distribution channels through which probiotic yoghurt is sold in Uganda, and the percentage of production units making use of this channel

TYPE OF MARKETING CHANNEL	PERCENTAGE OF PUS USING THIS CHANNEL
Own outlet	66%
Rural kiosk	33%
Urban shops	31%
School canteens	14%
Hawking	15%
Acquaintances and personal orders	9%

Table 4: Outcomes of the study at Aparisa Asamuk primary school. The incidence (in number of children) is given for different parameters for the baseline and the endline (at 5.5 weeks).

Condition	Baseline	Endline
Diarrhea in last two weeks	4	2
Skin Rashes at time of measurement	101	15
Cough in last two weeks	15	22
Flu in last two weeks	16	19
Weight gain		0.3 kg ± 1 kg
Absenteeism	40	23

Table 5: Probiotic study findings (*Baseline, Midline and the Endline*) at Zelezeta primary school.

Condition	Baseline	Midline	End line
Diarrhea in last two weeks	80	2	-
Skin Rashes at time of measurement	-	-	-
Cough in last two weeks	99	-	20
Flu in last two weeks	99	2	20
Weight gain	-	55	80
Absenteeism	-	42	25

Table 6 Summary of key profitability and cost parameters – Uganda (Figures in UGX)

Milk			
	Individual model (n=6)	Group model (n=1)	Cooperative model (n=7)
Average cost per litre	851	796	760
Average gross margin per litre	715	804	512
Yoghurt			
	Individual model (n=11)	Group model (n=4)	Cooperative model (n=9)
Average cost per litre	1,323	1,090	1,696
Average gross margin per litre	2,311	2,860	1,726

Source: Field survey data, August, 2017

Table 7; Summary of key profitability and cost parameters – Tanzania (Figures in TZX)

Milk			
	Individual model (n=2)	Group model (n=1)	Cooperative model (n=2)
Average cost per litre	416	-	265
Average gross margin per litre	534	-	535
Yoghurt			
	Individual model (n=2)	Group model (n=1)	Cooperative model (n=2)
Average cost per litre	848	600	446
Average gross margin per litre	1,902	800	554

Table 8. Potential for scaling up: Aggregate rating for FFFL business models

Business model	Overall score	Remarks
Group model	Most promising	The model is the most profitable and can bring significant changes in household's socioeconomic status. Groups are more innovative and are able to manage costs as well as reaching out to critical mass of consumers. A number of them have demonstrated a high degree of innovation and creativity. Some have done exemplary work in product diversification. There are also significant opportunities for women empowerment particularly due to division of labour - young women are involved in pursuing marketing initiatives and product distribution.
Individual model	Promising	The model is reasonably profitable both in Uganda and Tanzania. In Uganda, the unique strength of the model lies on its ability to manage business risks. Most individual entrepreneurs sell a number of other products over and above probiotic yoghurt. Other strengths include ability to maintain good packaging and labelling standards. There was also a strong evidence of women empowerment because of their direct involvement in project activities. A good number of probiotic yoghurt selling enterprises were female owned and managed. The women enterprises also create employment opportunities. There are also a host of other indirect benefits including improved nutrition of mass consumers including school going children. Similarly, in Tanzania, the model has more scope for women empowerment given that most of the enterprises are owned and managed by women. A number of households in Tanzania reported increased household income as well as nutrition status.
Cooperatives model	Average	Though profitable, yoghurt businesses are small outfits run mainly by women cooperative members. In general, they are viewed as of secondary importance. This is mainly because most cooperatives, particularly in Uganda deal with milk sales. As a result, the yoghurt outfits are "dwarfed" by male dominated milk business units which are largely the domain of men. For this reason, scaling up strategies should be geared to addressing key business parameters such product promotion, packaging and distribution. However, in terms of potential, there are a number of evidences which demonstrate the unique advantage of the model in empowering women. For example, because of their involvement in the probiotic yoghurt businesses, women have been able to access loans from the cooperatives to which they are members. In turn, they invest the money in other microenterprise activities and the proceeds are used to cater for the various household needs including paying school fees for their children, health care and food. In cases where FFFL project has been used as a springboard to access business finances, the welfare of most women and their families have been improved. In comparison, there is more scope for women empowerment under the Tanzanian cooperative model, mostly because cooperatives are exclusively involved in yoghurt production and secondly, women take a more prominent role. As such, there were no instances of "male domination". This means women are increasingly able to make decisions for running the enterprises as well as in the use of proceeds accruing from them.

Source: Summarised from field information, August, 2017