

Three Year Sustainability Plan

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List of Acronyms

ASSP: Agriculture Sector Strategic Plan

COVID-19: Coronavirus-19

CPU: Children of Peace - Uganda

EED: Environmental Enteropathy

FY: Financial Year

GAO: Good Agricultural Practices

GLI: Global Livingston Institute

GDP: Gross Domestic Product

HCI: Human Capital Index

ISO: International Organization for Standardization

LRA: Lord's Resistance Party

NGO: Non-Governmental Organization

TFP: Total Factor Productivity

RCT: Randomized Control Trial

Preface

During my short but memorable time in Uganda, I have met exceptional individuals who are committed to sustainable development in different capacities. While I appreciate the genuine compassion of these individuals, I am aware about the inextricable nature of non-governmental organizations' (NGOs) relationship with donors. What I mean by this is I am aware that NGOs are dependent on a donor-recipient relationship, as recipients. The challenge here is NGOs may have unstable donor-recipient relationships and this can inhibit the sustainability of community projects. To directly address this, in similar fashion to the Global Livingston Institute, NGO's must fund and facilitate community development projects, where community members can increase their household income by directly working for a NGO or learn and receive the tools that provide and sustain autonomy for community members. I am ecstatic about the potential of GLI's innovative solutions, and for this reason I have included ways that two GLI projects can increase their profit and extend their reach through additional services or partnerships. I would like to express gratitude to the Global Livingston Institute (GLI), specifically, its staff members Jerry Amany and Raymond Bokua for shedding light about the GLI's sustainability projects as well as Martina Namuddu and Thomas Karrel for simplifying the logistics of being on the ground in Uganda. In addition, I would like to express gratitude to Children of Peace – Uganda and its staff for sharing their brief feedback about this plan. I would also like to thank Jamie Van Leeuwen for providing me with this fruitful and once in a lifetime opportunity.

To a lovely organization all the best,

A rectangular box containing a handwritten signature in black ink. The signature is cursive and appears to read "Joshua Charles".

Joshua Charles

Introduction

1.1 Sustainability Plan Deliverables

In this sustainability plan, I first detail pertinent macroeconomic trends, as it mostly relates to agriculture and the implications of COVID-19. Then, I highlight development challenges and solutions in Uganda in two industries that largely impact Uganda's Gross Domestic Product (GDP) growth rate: agriculture and energy. Following suit, I explain the Global Livingston Institute's role in creating innovative solutions that can remunerate workers from infrastructure that creates self-sufficiency within communities. Lastly, I describe two plans that are geared towards increasing the sustainability of the GLI's farming cooperative, in partnership with Children of Peace - Uganda (CPU), and the solar lamp project in Kabale and Rubdanda. For organizational purposes, each new initiative and source presented in the sustainability plans are represented by a letter in alphabetical order. If the initiative or source is included in a year that is not of its original placement, the letter where the source or initiative is originally placed will be represented in the new year.

1.2 Sustainability Plan Assumptions and Scope of Study

In this sustainability plan, I make four assumptions that focus on the GLI's farming cooperative and solar project:

1. Both projects continue to function three years from now.
2. The GLI increases its financial capital to fund the plan's proposed deliverables.
3. The profit margin of the farming cooperative continues to be 15% until the end of 2023.
4. The non-governmental organizations who have recently expressed interest remain interested in future collaboration.

Overview

2.1 Uganda's Economy

North of Rwanda, Uganda's economic slowdown reflects the negative consequences of the COVID-19 pandemic. In FY20, Uganda's real GDP growth rate was 2.9 %, which is 3.9% lower than FY19 (World Bank, 2021). The Ugandan government initially mandated a domestic lockdown of four months. The spillover effects of the lockdown, as evident by the dramatic decrease of Uganda's real GDP growth rate, shows an all-too-common consequence in Sub-Saharan Africa: the disruptions of the global demand and supply chains related to COVID-19 have reduced public investment and the appetite for private consumption. If the consequences of COVID-19 persist, Uganda's exports, mainly in the form of agricultural commodities, and tourism are likely to stymie the economic productivity and recovery of Uganda (World Bank, 2021).

In recent years, discussion about Uganda's oil sector has attracted investors. Prior to the global pandemic, Uganda expected to produce and export its oil by 2024. The decreased oil price may set back the Ugandan government's timeline. Despite this possibility, the President of the United Republic of Tanzania H.E. Samia Suluhu Hassan and the President of Uganda H.E. Yoweri Museveni recently signed a tripartite agreement with the French multinational integrated oil and gas company Total SE and its Chief Executive Officer Patrick Jean Pouyanné. This agreement marks the beginning of the construction of the East African Crude Oil Pipeline (Petroleum Authority of Uganda, 2021). More importantly, the signing of the tripartite agreement showcases that the oil sector development in East Africa is a priority to advance East Africa's economies.

Though the oil sector is emerging in Uganda, the agriculture industry remains vital to stabilizing the country's economy. From FY 2015/2016 to FY 2016/2017, 2010 to 2017, the agriculture sector rose from 23.7% to 24.9% of Uganda's GDP (Ministry of Agriculture, Animal Industry and Fisheries, 2017). This growth represents a positive trend in Uganda's agriculture industry. The impact of COVID-19 has positioned the agriculture sector to maintain its share of Uganda's GDP, which is now estimated to be 25% (World Bank, 2021). Uganda's dependence on agriculture is stabilized by widespread firm closures and rapid shifts in the urban informal sector. Coffee, tea, cotton, and tobacco are recognized as the traditional cash crops in Uganda; in FY 2016/2017, coffee exports constitute the highest revenue of any crop in the country (Ministry of Agriculture, Animal Industry and Fisheries, 2017). In areas of Northern Uganda like Lira, soya beans, cabbage, and beans are highly produced. The food crop sub-sector increased from 12.1 percent to 13.6 percent FY 2016/17, representing the highest contribution in the agricultural sector (Ministry of Agriculture, Animal Industry and Fisheries, 2015).

2.2 Development Challenges and Solutions

There are challenges that Uganda must overcome to sustainably develop. Uganda, for instance, has low domestic savings (United Nations, 2016). As a result of low per capita income, Ugandans spend a significant share of their earnings on domestic expenditure. The low per capita income and the high levels of domestic expenditure are attributed with Uganda's Human Capital Index (HCI), which measures the human capital that a child born today can expect to attain by age 18 (IndexMundi, 2017). The HCI ranges from 0 to 1.00. A lower HCI score indicates that a child is expected to attain less human capital by age 18, whereas a higher one indicates that a child will attain more human capital by age 18. In other words, the HCI measures the contributions of health and education to worker productivity and ranges from 0 to 1.00 in scores (IndexMundi, 2017). Uganda's HCI score is .382 ranking, representing low human capital expectations of a child born today (World Bank, 2020).

Regardless of Uganda's exporting patterns, the general population's access to electricity stymies its growth. In general, 42.6% of Ugandans have access to electricity. Approximately, 203 countries have higher electricity accessibility rates than Uganda (World Bank, 2018). More pertinent to the development of Uganda, disparities exist between the urban and rural communities. While the access to electricity is 57.5% in urban communities, the access to electricity is 38.018% in rural communities (World Bank, 2018). Between 2015 and 2018, the rural population's access to electricity increased by 28.971% (World Bank, 2018). This represents an effort by the Ugandan government, civil society organizations, and private entities to accelerate electrification.

Uganda's generation capacity is 1,291 MW (USAID, 2021). Waterpower, fossil fuels, and renewable energy are the main energy sources in the country (WorldData.info, 2017). Infrastructure projects in the energy sector have attracted foreign investment. For instance, Power Africa, a U.S. government-led partnership, has financially closed a run-of-river 42MW hydropower plant in Uganda's Achwa River as well as a Super Madi Hydro Limited project that will provide 6.9MW of hydropower to eastern Ugandans (USAID, 2021). In addition to Power Africa, the People's Republic of China, the Madhvani Group, sugar manufacturers such as Kinyara Sugar Works Limited, and Sugar Corporation of Uganda Limited (and more) have funded power stations in Uganda.

Uganda is increasing electrical accessibility and utilization rates by addressing the deficits in the agriculture industry. 10 deficits, as cited by President of Uganda H.E. Yoweri Museveni are

1. Low commercial agricultural levels
2. Lack of linkage between research and farmers
3. Low use of fertilizers

4. Low coverage of irrigation
5. Land fragmentation
6. Low level of value addition
7. High cost of finance
8. Lack of agricultural machinery
9. Vectors and diseases
10. Poor transport network (Uganda, 2016)

Low commercial agricultural levels, lack of linkage between research and farmers, lack of agricultural machinery, and poor transport network impact communities like villages surrounding Lira the most (J. Amany, personal communication, April 23, 2021). In recognition of the potential of the agriculture sector, the Ugandan government reviewed the Agriculture Sector Development Strategy and Development Plan. Thereafter, the Ministry of Agriculture, Animal Industry, and Fisheries organized the Agriculture Sector Strategic Plan (ASSP). The plan details avenues of investment and development of Uganda's agricultural sector between FY 2015/16 and FY 2019/20. The ASSP requires collaboration between the Ugandan government, ministries, departments and agencies of government, district local governments, development partners, civil society organizations, and the private sector (Ministry of Agriculture, Animal Industry and Fisheries, 2015). Reflective of the National Development Plan 2, the goal of the ASSP is to propel the country towards middle-income status with a per capita income of \$1,033 USD by 2020. To address the 10 challenges above, in some capacity, the ASSP calls for agricultural extension, scaling agricultural research, water harnessing for agricultural production, investing in agricultural mechanization, and addressing cross-cutting issues such as HIV/AIDs and climate change (Ministry of Agriculture, Animal Industry and Fisheries, 2015).

2.3 The GLI's Role in Uganda's Economic Development

To reiterate, efforts from civil society organizations like NGOs are imperative so Uganda achieves its National Development Plan 2 goals. The GLI is uniquely positioned to promote Uganda's agriculture investment and development plan. The GLI is a Denver-based research institution and NGO designed to encourage meaningful dialogue and promote innovative and sustainable actions in international development. This is captivated by the GLI's mantra: "Listen, Think, Act." The GLI listens and thinks through immersion trips, a Global Scholars Fellowship Program, academic summits, and student-led research internships. The GLI acts through sustainability projects that include a model farm, solar lamp project, farming cooperatives, and a newly established recycling center.

Solar Lamp Project Overview

In the past, the GLI administered a survey in eight different villages surrounding Lake Bunyonyi. The purpose of the survey was to understand the electrical needs and experiences of community members. According to the survey results, 80 percent of the households in these villages use kerosene/paraffin lamps or candles as a primary light source (Koirala et al., 2019). Kerosene and paraffin gas have economic, environmental, and social implications. They are listed below:

- Environmental: Kerosene and paraffin lamps create black stains on the ceiling of houses, which are fire hazards (Koirala et al., 2019).
- Economic: These lamps are expensive and usually constitute 15% of a family’s household income (Koirala et al., 2019).
- Social: These lamps do not meet the technical requirements for daily life (i.e., charging a cell phone). The social interactions of families are inhibited to pure physical interaction.
- Social: Once kerosene runs out, conversations stop due to darkness. This can ultimately affect the social fabric of families (J. Amany, personal communication, April 23, 2021).

Understanding the multi-faceted consequences of kerosene lamps within households, the GLI has created the Off-Grid Solar Pilot Program to promote the reduction of indoor kerosene and paraffin lamp usage in Kabale and Rubdanda. The program allows community members to acquire an off-grid solar system at an affordable price (Koirala et al., 2019). The GLI has partnered with a solar enterprise called Greenlight Planet. This entity designs and distributes off-grid solar products to residents in low- and middle-income countries. Greenlight Planet has various off-grid solar options available for householders with different economic situations. Out of all the products that Greenlight Planet offers, the GLI identified Home 60 and Home 120 as being the most feasible options for community members in Kabale and Rubdanda to purchase – though Pro 200, Pro 300, Pro 400, and PicoPlus are all available to consumers at a higher price. Each product carries two years of factory warranty and five years of battery life (Koirala et al., 2019). Home 60 and Home 120 are described above:

	Home 60	Home 120
Watt Capacity	6 Watt	12 Watt
Battery Time Fully Charged	24 hours run time in full charge	24 hours run time in full charge
Lumens and Brightness Output	100 lumens on each hanging lamp. Total output 30X brighter than kerosene lamp	200 lumens on each hanging lamp. Total output 60X brighter than kerosene lamp
Design Characteristics	1 USB, 3 hanging lamps with	1 USB port, 3 hanging lamps

	switches	with switches
Pricing Characteristics	Wholesale price: \$68.26 MSRP: \$90.00 Margin: \$21.74 (32%)	Wholesale Price: \$83.14 MSRP: \$116.00 Margin: \$32.86 (40%)

Source: Koirala et al., 2019

As shown above, the profit margin is approximately 36%. The revenue model is detailed in the table below.

Revenue Model

Upfront Cash	Flexible Loan
If the cost of the device is within the savings of the customers, the customer pays upfront in cash. In this case, the customer owns the solar device.	Customers take out flexible loans, provided by the GLI, if they are not able to pay for a solar device upfront. Customers make a down payment of at least 30 percent, with the remaining cost paid in installments for at most three months at zero interest.

Source: Koirala et al., 2019

Of the initial customers who chose a financing option, the “on time” repayment rate is around 85%. (R. Bokua, personal communication, April 19, 2021). The next step for the GLI is to ascertain the profitability and scalability of the solar lamp project. The pilot project is qualitatively promising and potentially sustainable.

There are a few pertinent matters to understand prior to detailing the three-year sustainability plan for the solar lamp project. The GLI spent money to buy solar devices and cover logistical costs such as transport, labor, and airtime. To date, this project has provided 18 households with an average of 10 members per household in the Lake Bunyonyi region with affordable, reliable, and clean electricity (R. Bokua, personal communication, April 19, 2021). This has directly contributed to health, education, and business in a few different forms:

1. Improved health outcomes due to a decreased use of Kerosene.
2. Improved education levels due to reliable lighting for studying at night.
3. Stable income generation since the solar lamp is reliable for business (R. Bokua, personal communication, April 19, 2021).

Despite the positive impacts of the solar lamp project, there are a few challenges that the Entusi Staff have encountered within the last year. The challenges and their consequences are as follow:

1. The weather inconsistencies decrease the effectiveness of the solar lamp.
2. Rainfall shocks alter the harvest season timeline, which customers largely depend on. In turn, the customer cannot make flexible loan payments and thus hampers the profitability of the project.
3. Rats may chew the solar device's wires. This not only damages the solar lamp but also reduces the effectiveness of the product.
4. Some customers mishandle the solar lamp devices and throw the product away. By doing so, the GLI is unable to fully evaluate the effectiveness of the product.
5. There are 3 lumps on Home 60 and 120 devices. Most houses have six fully occupied rooms, so households must determine which ones to light (and may only light half of their house). While purchasing two Home 60 or 120 devices is an option to light an entire house, owning two products is expensive.

Solar Lamp Sustainability Plan

Year 1: 2021

Project	Action Item	Plan	Benefit(s)	Supporting Source
A: Increase Incentive for Community Members to Purchase Solar Lamps	A: Off-Grid Solar Pilot Program	<p>A1: The GLI conducts a randomized control trial (RCT) based on Zelen's design to evaluate the economic, environmental, and social impacts of solar lamps on school children and their families.</p> <p>A2: Upon the completion of the RCT, the GLI will monitor and evaluate the Entusi solar project in the short, intermediate, and long term.</p> <p>The details of the RCT and Monitor and Evaluation are discussed below this table.</p>	<p>A1: The GLI compares the effectiveness of solar lamps and kerosene lamps with more preciseness compared to alternative research methods.</p> <p>A2: The GLI determines the solar lamp effectiveness.</p>	A1: (Bamber et al., 2010)
B: Increase Customer Coverage to 100	B: Immobile Agents and Mobile Agent	B1: The GLI hires immobile agents, who remain in one setting and train	B1: The immobile agents specialize in administrative duties,	B1 and B2: (Koirala et al., 2019)

		<p>mobile agents, bookkeepers, and accounts.</p> <p>B2: The GLI hires mobile agents, who visit different villages to promote the awareness of the solar lamp projects.</p>	<p>completing tasks to sustain the mobile agent's direct responsibilities.</p> <p>B2: There is some natural comfort between community members and mobile agents because mobile agents are from the respective villages of a customer. I suspect this natural comfort will result in high levels of information receptiveness. The GLI can determine the validity of my inclination with experience and continued research.</p>	
C: Improve Safety for Installation Workers	C: Safety Equipment and Health Coverage	<p>C1: The GLI purchases two overalls, two pairs of gloves, and half round pliers.</p> <p>C2: The GLI purchases health insurance or provides a refund or stipend to Entusi staff</p>	<p>C1: Less costs are incurred by Entusi staff since they protect their hands and bodies from cuts. The staff uses half round pliers to straighten and bend wires, possibly avoiding dangerous wire positions.</p>	C1 and C2: (H. Bumari, personal communication, April 1, 2021)

		who are injured from installing solar lamp devices.	C2: Less costs are incurred by Entusi staff. The NGO covers the medical expenses associated with Entusi staff's injuries caused from the installation or repairs of solar devices.	
D: Community Education	D: Workshops and Seminars	D1: Entusi staff educate community members about the solar lamp devices. D2: An outside intern or the GLI staff based in Kampala confirms the effectiveness of the solar lamp as disclosed by Entusi staff.	D1 and D2: The purchasing rate of solar lamps increases. According to Hannington, customers purchase more solar devices when GLI affiliated personnel confirm information presented by Entusi staff.	C1 and C2
E: Reduce Operation Costs of Solar Lamp Project for Entusi Resort	E1: Transportation Stipend for Customer Assistance E2: Ladder Purchase	E1: The GLI provides a stipend to Entusi staff to decrease the direct transportation costs associated with the solar lamp project. E2: The GLI purchases an extension ladder	E1 and E2: Entusi retains expenses that can be used for additional services. E2: Entusi retains 3,000 Uganda Shilling per installation, as Entusi no longer has to	C1 and C2

		for the Entusi staff responsible for the installation of solar devices.	rent a ladder for solar device installation.	
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Off-Grid Solar Pilot Program

Presently, the GLI has not begun the RCT or the smart lending of solar lamps. However, the RCT will commence upon the Aids Support Organization Research Ethics and Institutional Review Board approval. In the RCT, the GLI will randomly select 10 children from one school who are from different villages in Rubdanda or Kabale districts. The GLI will then monitor study participants' improvements in education and health in response to solar lamp usage. In doing so, the RCT will provide the GLI with data to compare the effectiveness of solar and kerosene lamps. In turn, the GLI will show the tangible benefits of solar lamp usage and boost participants' confidence to invest in the product.

Following the randomized control trial, the GLI will move onto the Monitoring and Evaluation inspired by the United Way outcome evaluation model. The evaluation model is listed below:

1. Initial Outcome Evaluation: Takes place 15 days after the household starts using the device. The agent or franchise conducts a survey of the household to examine whether they have acquired the necessary skills to operate the device. The survey aims to examine awareness, attitude, and motivation of the family members.
2. Intermediate Evaluation: Takes place after three months to understand the behavioral changes.
3. Long-Term Evaluation: Takes place after one year to examine improvements in the overall wellbeing of the family and the role of the solar device within the household (United Way, 2015).

The GLI will also transition into the smart lending program. Smart lending is commonly referred to as a Village Savings Loan Association (VSLAs) and they extend credit services to most Ugandans who are on the bottom of the income pyramid at very low and flexible rates, as opposed to commercial banks who are even out of reach for many local folks in Uganda. Rural folks near Kabale and Rubdanda can greatly benefit from these ventures as they would easily access some credit to start or recapitalize their small businesses and ventures.

To reiterate, the GLI is uniquely positioned to deliver sustainable community development projects. In the case of the Entusi Solar Project, the NGO can provide the necessary resources for a successful randomized control trial, Monitoring and Evaluation, and smart lending of the project. Consequently, community members, who purchase the solar lamp devices, will gain

knowledge, adopt new practices, and witness altered conditions so long as the GLI remains committed to the solar project. The logical model below reveals the activities, inputs, and outputs of the solar lamp project.

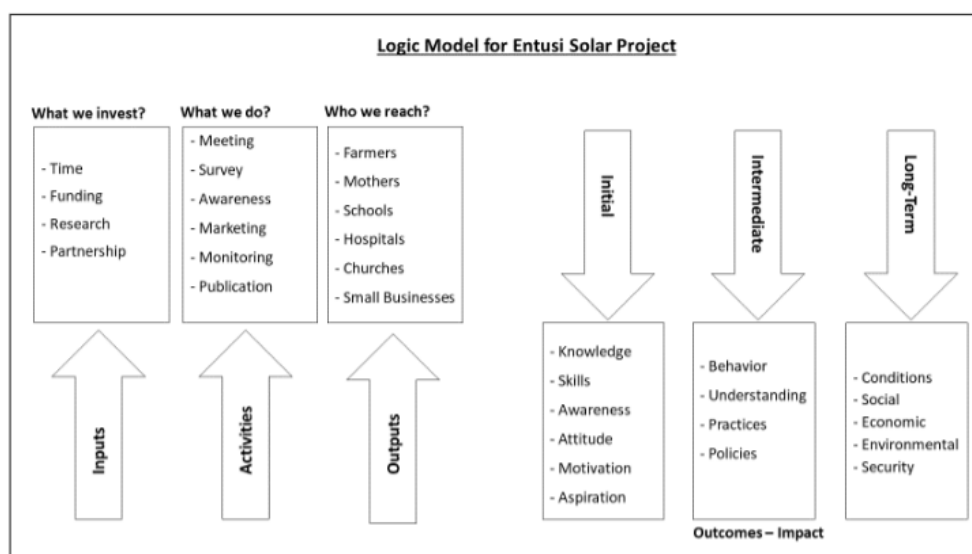


Table 2: The Logic Model table presents the overview of the project and discusses different phases of the outcome evaluation

Source: Koirala et al., 2019

Year 2: 2022

Project	Action Item	Plan	Benefits	Supporting Source
F: Solar Lamp Evaluation	F: GLI Affiliated Discussion to Determine Continuality of Solar Lamp Project	F: GLI provides pertinent data (ie. spreadsheets and study results) in advance of a group discussion between Jerry Amany, Anit Koirala, Raymond Bokua, Jamie Van Leeuwen, Nathan Davis,	F: Key stakeholders engage in discourse to move the farming cooperative forward in a sustainable manner. This action is important because the function of a dialogue between	

		<p>and Joshua Charles. The group will then discuss the viability of the project and interrogate its potential continuation. Prior to the discussion, Raymond will also facilitate a discussion with Hannington Bumari and Gilbert to gain qualitative feedback about the solar lamps.</p>	<p>stakeholders, who have calibrated and exerted their resources accordingly to sustain this project, is to listen to group feedback, think about the feedback, and finally act upon the listening and thinking.</p>	
G: Increase Customer Coverage to 200	B	B1 B2	B1 B2	B
H: Introduction of More Powerful Solar Devices	H: Power for All Partnership	<p>H: Power for All funds the distribution of solar lamps. The GLI and Power for All can collaborate on a Monitoring and Evaluation of the solar devices. Power for All and the GLI will engage in discourse and research to identify suitable solar devices</p>	<p>H: The collaboration between the GLI and Power for All mutually benefits both organizations and enables them to address urgent community issues.</p>	

		appropriate for agricultural yield promotion.		
D	D	D1 D2	D1 and D2	D
E	E2	E2	E2	C1 and C2

Power for All

Power for All is a global coalition of 200 private and public organizations that seeks to advance renewable and decentralized energy solutions to approach universal energy access. The NGO engages with media, policymakers, and researchers in various capacities. More importantly, the organization facilitates projects with implementers on the ground, whose missions are to support the increased electrification of farming communities. In doing so, Power for All acts as a powerful partner to increase agricultural production by mobilizing the supply chain to address energy access issues (Power for All, 2021).

Year 3: 2023

Project	Action Item	Plan	Benefits	Supporting Source
D	D	D1 D2	D	C1 and C2
I: Increase Customer Coverage to 300	B	B1 B2	B	B
J: Additional Services	J1: Seasonal Migration Grants J2: Sanitation Subsidies	J1: The GLI utilizes Entusi's profit from the solar project to provide seasonal migration grants to households. J2: The GLI utilizes Entusi's profit from the	J1: The recipients of the seasonal migration grants sustain their income levels that approach, meet, or exceed what they make during harvest seasons.	J1 and J2: (Yale University, 2021)

		solar project to provide sanitation subsidies to households.	J2: The GLI improves the health of residents, enabling them to be more productive farmers instead of allocating income to cover medical care costs associated with open defecation.	
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Seasonal Migration Grants

Despite the many efforts to address food insecurity, approximately 842 million people suffer from hunger. The vast majority of those who suffer from hunger are in Asian and Pacific regions as well as Sub-Saharan Africa, constituting 553 and 227 million people in hunger, respectively (The Borgen Project, 2017). An estimated 300 million people suffer from seasonal hunger (Devereux et al., 2008). Seasonal hunger, primarily occurs in agrarian societies, proliferates between planting and harvest times. The demand for crops such as rice and soya remain high while labor demand and wages remain low. In translation, members of agrarian societies are less productive as the market determines the selling price of its output. 84% of Ugandans live in agrarian societies (The Borgen Project, 2017). Even if rural Ugandans produce a surplus of crops from harvest, storage facilities are largely inaccessible due to their high market price.

Seasonal migration grants, also known as transport subsidies, encourage household migration for job opportunities, increase their consumption, and benefit non-migrating individuals in their local communities (Yale University, 2021). Researchers have introduced varying saturation levels and controlled trials to evaluate the effectiveness of seasonal migration grants. One study, that analyzed the outcomes of 5,792 potential seasonal migrants across 133 villages in Bangladesh, asserts that transport subsidies not only increase the beneficiaries' income from higher wage occupations in urban settings but also have spillover effects. The spillover effects during the lean season are as follow:

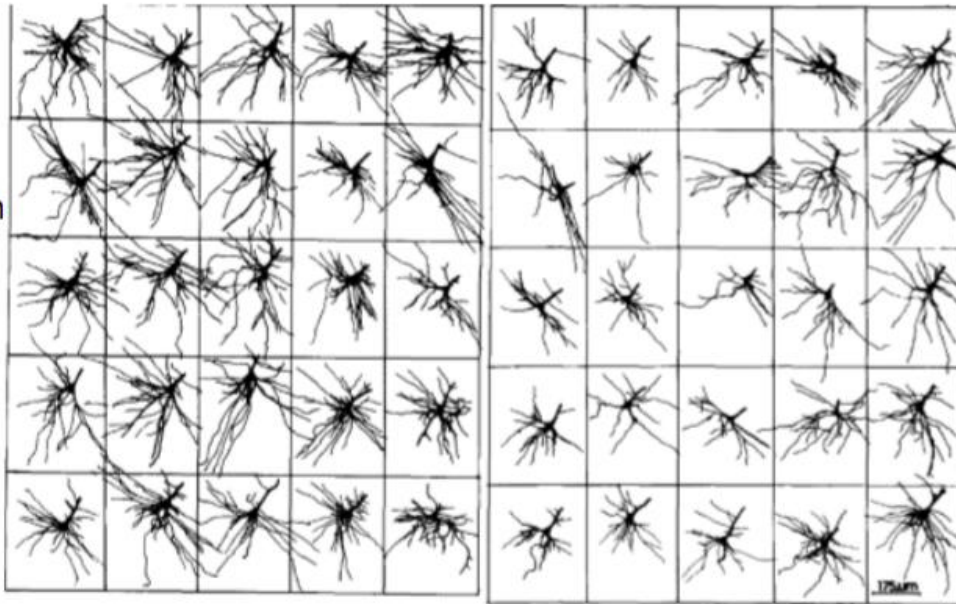
1. An increase in the individual take-up rate induces those connected with the beneficiaries to migrate. The village emigration rates increased from 35% to 65%.

2. The male agricultural wage rate in a village, where beneficiaries out-migrate from, rises from 4.5% to 6.6%. The decreased competition in the agricultural sector enhances the remuneration of the male workers in a village.
3. Although the labor supply of intra-households remains the same, the wages of primary workers rise (Mobarak et al., 2017).

When the GLI determines that sufficient profit has been made to provide additional services to the communities in Kabale and Rubdanda districts, I **strongly** suggest the NGO considers utilizing profit to fund seasonal migration grants.

Sanitation Subsidies

15% of the global population practice open defecation (OD), which largely takes place in agrarian societies such as in the villages surrounding Lake Bunyonyi. There are several health consequences affiliated with open defecation. For example, those that practice open defecation may suffer from infectious intestinal diseases, adverse pregnancy outcomes, soil-transmitted helminthiasis, impaired cognition, environmental enteropathy, and stunting (Mara, 2017). Environmental enteropathy and stunting, from undernourishment, are particularly concerning outcomes of OD. Cordero et al., 1993 compared the motor cortex dendrites, structures that receive signals through axons in the brain, in nourished and undernourished children. The motor cortex dendrites developed less in undernourished children. Below is an image from Cordero et al, 1993:



Well- nourished brains of children (left) and malnourished brains of children (right)

The image from Cordero's study reveals the impact of different nutritional receptiveness patterns of motor cortex dendrites in the hippocampus. Consequences associated with damage to the hippocampus include poor spatial navigation and memory formation.

On the other hand, environmental enteropathy disorder (EED) is a subclinical disorder that stems from frequent intestinal infections. There is a stronger likelihood of developing EED in resource poor settings compared to resource rich settings. This is because children in resource poor settings are exposed to bacterial infections via contact with fecal matter during OD. In turn, when a child is infected with bacteria, their body diverts energy to fight off the infection. Over time, the child's intestinal system changes, as it poorly absorbs energy and macronutrients. This can lead to malnutrition, anemia, and impaired cognitive function.

Arnold et al., 2013 compared markers of EED, parasite burden, and growth in 119 children across rural Bangladesh in household with different cleanliness levels. These levels are defined by indicators of water quality and sanitation infrastructure. Adjusted for confounding variables, there was a 22% standard deviation (SD) difference between the height-for-age z scores in clean households compared to contaminated households. In addition, clean households are recorded to have lower lactulose:mannitol ratios in urine of .32 SD and immunoglobulin G endotoxin core antibody titers of .32 SDs. All these assessed metrics confirm the hypothesis that contaminated environments lead to greater stunting rates confounded by EED.

Sanitation marketing, behavior change communication, and enhanced sanitation centers all constitute the predominant strategies to approach OD elimination. Aside from the aforementioned strategies, sanitation subsidies may create sustainable OD elimination. In Bangladesh, Y-RISE researchers concluded that sanitation subsidies increased latrine adoption by 22% for subsidized residents ($P < .001$) and 8.5% for unsubsidized neighbors ($P = .001$). Researchers also observed a 14% OD reduction in the cluster-randomized trial. The P-values indicate moderate to strong levels of statistical significance. The OD reduction alludes to the possibility of a decrease in adverse pregnancy outcomes, stunting, and environmental enteropathy among many other conditions.

When the GLI determines that sufficient profit has been made to provide additional services to the communities in Kabale and Rubdanda districts, I **strongly** suggest the NGO considers utilizing profit to fund sanitation subsidies.

Farming Cooperative Overview

In the agriculture sector, the farmers often lose profit from expensive middlemen who are a part of the agriculture supply chain. These middlemen purchase their products from farmers at low values and generate greater revenue when their products are sold at markets and commercial stores. Consequently, due to business transactions between small farmers and middlemen, farmers make less profit than what they could make if they had direct access to the market in a manner comparable to commercial farmers. The GLI created a farming cooperative outside of Lira to address the negative consequences of unfair engagements between middlemen and farmers. The members of the farming cooperative are from the sub-counties of Ogur, Agweng, Aromo, and Alito. These sub-counties are within 20 to 40 kilometers from Lira, which is in Northern Uganda: a region of northern Uganda heavily impacted by rebellious movements of the Lord's Resistance Army (LRA) in the late 1990s and early 2000s. Lira is in Northern Uganda, which is in a post-conflict area in Northern Uganda. In effort to overturn the Uganda government, the LRA forced many children to become soldiers. Approximately 90 percent of Northern Ugandans were displaced from their homes into camps. Throughout the years, the priorities of Northern Ugandans have shifted from desiring peace and security to strengthening supply chains that address educational and health disparities (Human Rights Center, 2010). While the Lord's Resistance Army impacted Northern Uganda, the rest of Uganda focused on economic and social advancement. To this day, there are notable differences in development between Northern Uganda and Southern Uganda. Lira's economy has suffered immensely at times from the LRA's influence.

In the farming cooperative, members grow and harvest their crops. The GLI, when compared to the middleman in the market, purchases produce at a fair price. Following suit, the GLI stores the harvested produce until the market prices are competitive or better. Finally, the produce is resold to large bulk or wholesale buyers. The GLI has spent capital, which is wired money, to cover operations and seed purchase activities. As of this date, Lira's farming cooperative has united community members to boost their agricultural production and income. The potential of farming is captivated by community member Denis Odong's promising success. After emplacing capable storage facilities, he expects 15 tons of soya beans in August (J. Amany, personal communication, April 23, 2021). Such an example of agricultural yields shines light on the importance of adequate storage facilities.

Encountering challenges are inherent in any community development project. In the sub-counties of Lira there are infrastructure deficits in the roads that are ill-prepared for the rain season. When there is heavy rainfall, the GLI cannot access farmers. Moreover, poor post-harvest handling mechanisms impact the quality of a product. The poor post-harvesting strategies reduce the moisture and weight that a product can maintain when properly stored and managed following harvest seasons.

The objectives of the sustainably plan are as follow:

1. Increase membership and maintain membership retainment.
2. Provide farming cooperative members with sustainable access to public health services.
3. Provide farmers with additional services.
4. Reduce costs and inject money where profitability is promising.

Farming Cooperative Sustainability Plan

Year 1: 2021

Project	Action Item	GLI's Role	Benefits	Supporting Source
K: Increase Farming Cooperative Membership to 1,000	K: CPU Partnership	K: GLI brings the resources needed on the table, and these are used to run the programming planned activities. The GLI also does monitoring and evaluation to assess project success and strategic direction.	K: Increased and improved incomes of farming cooperative members. K: Strengthened community partnerships and synergy that acts as a springboard for other initiatives to be birthed.	K: (J. Amana, personal communication, May 7, 2021)
L: Community Education	L: Crop Introduction and Training	L: The GLI educates farming cooperative members about proper post-harvest handling strategies.	L: Farming cooperative members strengthen their agricultural chain.	
M: Increase Revenue of Farming Cooperative	M1: Beekeeping M2: Chili Production M3: Additional Certifications	M1: The GLI provides the inputs for beekeeping. M2: The GLI provides inputs for chili production. M3A: The GLI	M1: Additional revenue is generated from the diversification of beekeeping extractives. M2: Additional revenue is generated from	M1: (UNDP, 2015) M2: (Fortune of Africa, 2021) M3: (DeBree, 2019)

		<p>educates and guides farming cooperative members to attain a Certificate of Origin.</p> <p>M3B: The GLI educates and guides farming cooperative members to attain a Phytosanitary Certificate.</p>	<p>chili production.</p> <p>M3: Farming cooperative members generate a higher profit margin through the recognized value of additional certifications in the market.</p>	
N: Reduce Costs of Operations	<p>N1: Pilot Light Foundation Partnership</p> <p>N2: CPU Partnership</p>	<p>N1: The GLI defines the constraints of a storage facility and the Pilot Light Foundation funds it.</p> <p>N2: From previous efforts between the GLI and CPU, the GLI shares the architectural design of a storage facility with the Pilot Light Foundation.</p>	<p>N1 and N2: The amelioration of recurring costs of monthly rent for a storage facility of 750,000 Uganda Shilling, whereupon profit increases and enables the GLI to invest money in additional services.</p> <p>Enhancement of resource optimization from the usage of the architectural design.</p>	

O: Consultation Assistance	O: Makro Agriculture Services and Technology Limited Partnership	O: The GLI pays Makro to receive agricultural consultation as a service via Zoom or Microsoft Teams.	O: The GLI receives tailored agricultural consultancy for animal production, crop product, and aquaculture (if appropriate).	
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Crop Introduction and Training

Community members can largely benefit from increased knowledge about post-harvest handling. In short, qualitative and quantitative losses occur in the distribution chain of produce. Post-harvest deteriorations such as diseases and pests, injuries from temperature effects, and water loss impact the post-harvest health of produce. The distribution chain of produce includes harvesting, packing, storage, and transportation of produce to consumers. Understanding that many farmers in northern Uganda produce crops for subsistence, farmers must be supported and primed for commercialization. In this case, through community education, the GLI can instruct farmers to meet quality requirements suitable for consumers in high quality post-harvest handling markets. These high-quality post-harvest handling markets abide by procedures that focus on control of relative humidity, controlled atmosphere, ripening fruits with ethylene gas, supplemental procedures, and temperature management practices (Sommer, 1982). The GLI can play a significant role in educating farming cooperative members about impactful post-harvest handling strategy.

Beekeeping

Beekeeping is a promising practice in Uganda. In Uganda, many bee products are traded in the form of pure honey, combed honey, and boiled honey. Presently, a kilo of honey is valued at 15,000 Uganda Shilling. Unexploited products include propolis, venom, and wax. I recommend the GLI investigate the profitability of beekeeping extractives and ultimately contribute to strengthening the linkages between producers, processors, and traders to adhere to quality standards. There is unique task management and honey production is dependent on when the queen bee lays eggs that requires workers to use their honey reserves from autumn. This is important because the queen bee's activities drastically impact the availability and potency of beekeeping extractives. I also recommend that the GLI investigates seasonal production patterns and becomes well informed about management variances (UNDP, 2015).

Chili Production

Chili production has an increasing demand in Uganda, so the farming cooperative can contribute to growing a supply of chili to meet the demand. In doing so, additional revenue will be generated. Chili matures in approximately 3 months. The average expected yield of chili is four to six tons per hectare. Rain shocks and other weather inconsistencies and management deficits impact the yield of chili. Chilis are used as a cash crop for small scale farmers, foreign exchange earnings, and an ingredient in curry ingredients and chili sauce. A kilo of chili is currently valued at 18,000 Ugandan Shilling (Fortune of Africa, 2021). I recommend the GLI examines the potency of investing in chili production.

Additional Certifications

The additional certificates will provide favorable positions in international markets.

Certificate of Origin

In international trade, a Certificate of Origin is a document that is issued to identify the economic nationality of a commodity. In other words, a Certificate of Origin indicates the country where a commodity gains origin status. Certificates of Origins are classified as either Preferential Certificate of Origin or a Non-Preferential Certificate of Origin. The former claims that a particular shipment is of a specific origin as defined by bilateral or multilateral free trade agreements. The Non-Preferential Certificate of Origin is only given to all World Trade Organization members. Favorable tariff treatment is given to Preferential Certificates of Origin importers. Since the Certificate of Origin is a global requirement, exporters who attain the Certificate of Origin have access to a larger market, contingent upon their ability to abide by certain rules of regulatory bodies in other countries (Uganda Export Board Promotion, 2021).

Phytosanitary Certificate

In international trade, a Phytosanitary Certificate is a document that certifies that plants are free from regulated pests and the phytosanitary requirements of importing countries are met. Ministry of Agriculture, Animal Industry and Fisheries: Department of Crop Inspection and Certification inspects the shipments. The shipments normally contain fresh produce, grains, and semi-processed agricultural products. The Phytosanitary Certificate costs 5,000 Uganda Shilling (Uganda Export Board Promotion, 2021).

Pilot Light Foundation

Pilot Light Foundation is an NGO that seeks to address extreme poverty by supporting the mechanisms required for sustainable income. More specifically, Pilot Light Foundation funds the infrastructure that will enable financial sustainability in extreme poverty communities (Pilot

Light Foundation, 2021). There have been discussions with Carol Levy, Jamie Van Leeuwen, and Jerry Amanya to ascertain potential collaboration between Pilot Light Foundation and the GLI. I mark this partnership being the **most pressing matter** to address in 2021.

Children of Peace Uganda

CPU provides psycho-social support, education sponsorship and community sensitization, sanitation and clear water platforms, livelihood support, and advocacy to communities to address these economic sensitivities (Children of Peace – Uganda, 2021). The GLI and CPU have remained partners over the last few years. CPU, for instance, introduced Lira farmers to the farming cooperative. Regarding the farming cooperative, in exchange for remuneration, CPU staff provide farmer mobilization, sensitization, welfare, and training to the farming cooperative members. The CPU partnership can assist the GLI’s goal to increase the membership capacity of the farming cooperative. CPU and the GLI can also leverage community partnerships through local community leaders, word of mouth, and public media to attract members to the farming cooperative. CPU also has an advantage of good grass root presence and understanding of the culture; these qualities are vital in community rallying and mobilization. CPU can also provide the architectural design of a storage facility intended for the cooperative’s post-harvest activities from a prior engagement with the GLI.

Makro Agriculture Services and Technology Limited

Makro Agriculture Services and Technology Limited offers services to small scale farmers in crop farming, livestock farming, and fish farming. Makro also links farmers to agricultural loans, market access, and agriculture insurance. The consultation company seeks to increase agricultural yield and production to 100%. In the case of a partnership with the GLI, Makro can provide expert consultation services to ensure the farming cooperative meets or exceeds the projected profit.

Year 2: 2022

Project	Action Item	Plan	Benefits	Supporting Source
P: Increase Farming Cooperative Membership to 2,000	K	K	K	K
L	L	L	L	L

M	M1 M2 M3	M1 M2 M3A M3B M3C: The GLI educates and guides farming cooperative members to attain an ISO 22000: 2018 Certificate.	M1 M2 M3	M3
J	J1 J3: Rainfall Insurance J4: Microfinance Funded by the Pilot Light Foundation Partnership	J1 J3: The GLI conducts a RCT to evaluate the effectiveness of rainfall insurance. J4: Pilot Light Foundation provides funding so the GLI can offer microfinancing to farming cooperative members.	J1 J3: The GLI contributes to research that may support a newly sought poverty intervention. J4: The GLI improves the welfare of poor and entrepreneurial individuals.	J1 and J2 J3: J1 and J2 J4: J1, J2, and J3
O	O	O	O	

ISO 22000:2018

ISO 22000:2018 is an international set of standards for safety management systems. From farm to fork, the ISO 22000:2018 mitigates risks associated with the supply chain of food safety. ISO 22000:2018 certification provides members with better management of risks, resource optimization, controlled supplier or vendor management, hazard management, and ultimately promotes international trade. Supplier and producer members of this certification have a

competitive advantage to trade in the international market. Trade presents an opportunity for certification members to maximize their economic position, since customers desire products from trusted suppliers, where traceability, safety, and risk management are prioritized (CertPro, 2020). Moving forward, I suggest the GLI assess the export capabilities of the farming cooperative and ascertain the valuation of ISO 22000 certification as a component of the cooperative in 2022.

Microfinance

Microfinance is well recognized as a mechanism of macroeconomy and growth that has positive welfare effects on investments and entrepreneurship. However, microfinance is not shown to have a significant effect on the income and consumption of borrowers. In the long run, small loans lead to less savings and higher interest rates. This combination between savings and interest rates serves as a precursor to efficient allocation of loans by productive entrepreneurs, and, as I alluded earlier, increases the welfare for poor and marginal entrepreneurs (Yale University, 2021).

A quantitative evaluation examines the aggregate and distributional impacts of microfinance programs. The baseline model used for this evaluation interrogates the variable relationship amongst entrepreneurial ideas, new entrepreneurial ideas, entrepreneurial persistence, individual preferences, technology, capital renter markets, microfinance, recursive representation of individual's problems, and stationary competitive equilibriums. Researchers begin the quantitative analysis by utilizing US data on standard macroeconomic aggregates in relation to a set of technological and preference parameters. Then, the researchers re-calibrate parameter government enforceability of contracts and entrepreneurial ability distribution utilizing Indian data. Finally, the researchers assess the effect of microfinance in the short and long run. Data from this evaluation indicates that microfinance programs are stronger in general equilibrium than in partial equilibrium (Buera et al., 2013). This is evidenced by an increase in the aggregate total factor productivity (TFP) in general equilibrium, where there is a decrease of TFP in partial equilibrium. Accordingly, the quantitative evaluation stipulates there is a small impact on per capita income when a microfinance program is scaled beyond its original scope. An increase of the TFP, consequently, is counterbalanced by lower capital accumulation within an impacted community. In translation, researchers find that there is an increase in the efficiency and intensity of inputs as a direct response to engagement with a microfinance program when the entire chain of a network of independent markets moves towards general equilibrium. The increased levels of TFP in general equilibrium analysis signifies that the GLI is poised to impact the efficiency and intensity of inputs in communities. For the farmer, this signifies that they can allocate their time to activities aside from farming, such as spending time with their children or engaging in additional entrepreneurial activities. This reality is supported by savings heterogeneity, where the

median saving rate for entrants and continuing entrepreneurs are 32 and 65 percent higher than non-entrepreneurs and exiting entrepreneurs, respectively.

Rainfall Insurance

As a result of a drop in rainfall, the hunger season extends beyond its normal range of March to July in locations such as Lira (Action Against Hunger, 2016). The rainfall shocks affect planning on behalf of the farmers, and even the GLI's projected outcomes. Rainfall insurance, when sold exclusively to land-owning cultivators, lowers the welfare of wage laborers compared to a situation where there is no insurance scheme (Mobarak & Rosenzweig, 2014). There are a few insurance schemes that the GLI can adopt such as formal index insurance and informal risk-sharing schemes. Firstly, formal index insurance, as defined by the World Bank, pays benefits based on a pre-determined index or loss of assets (Introduction to Index Insurance (Self-Paced): World Bank Group, 2021). This design mitigates adverse selection problems by indemnifying individual losses. There are also informal risk-sharing schemes, which are often incomplete. Generally, research suggests that recipients of informal risk-sharing schemes choose low risk and lower-yield production methods (Barnett et al., 2008). Assuming that innovation is a precursor to agricultural production in unfavorable climate conditions, risk is unavoidable. The formal index insurance can offset the risk burden associated with farming. Research investigating formal index rainfall insurance is still developing. Acknowledging the potential income benefits of beneficiaries within a household, the GLI can play an important role in contributing to a solution to combat poverty by conducting a randomized control trial, whereby rainfall shocks are controlled and confounding variables are limited.

Year 3: 2023

Project	Action Item	Plan	Benefits	Supporting Research
Q: Increase Farming Cooperative Membership to 3,000	K	K	K	K
L	L	L	L	L
M	M1	M1	M1	M3
	M2	M2	M2	
	M3	M3A	M3	

		<p>M3B</p> <p>M3C</p> <p>M3D: The GLI provides support to farming cooperative members so they attain a GLOBALG.A.P. certificate.</p>		
J	<p>J1</p> <p>J2</p> <p>J3: Rainfall Insurance</p>	<p>J1</p> <p>J2</p> <p>J3: The GLI subsidizes rainfall insurance and simultaneously conducts a RCT.</p>	<p>J1</p> <p>J2</p> <p>J3: The GLI contributes to research that may support rainfall insurance.</p>	<p>J1 and J2</p> <p>J3: J1 and J2</p>
R: NGO Collaboration	<p>R1: Locally Haiti Partnership</p> <p>R2: Child Voice International Partnership</p>	<p>R1: The GLI conducts comparative research with Locally Haiti and publishes the results in an acclaimed journal.</p> <p>R2: GLI works hand in hand to acquire the necessary resources and skills to start the piggery project.</p>	<p>R1: By doing research with a Haitian organization, the GLI extends their research capacities beyond Uganda, Rwanda, or Denver.</p> <p>R2: Child Voice International provides to farming cooperative members to enable project success.</p>	

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GLOBALG.A.P.

GLOBALG.A.P. is a trademark and a set of standards of Good Agricultural Practice (G.A.P.). The certification is fixed on creating a safe and high-quality agricultural supply chain that abides to farm assurance systems. GmbH, a German limited liability corporation, manages GLOBALG.A.P. worldwide from standard setting to certification management. As of today, GLOBALG.A.P. is leading the world in farming assurance programs, effectively reaching over 135 countries. Applicants must apply to become GLOBALG.A.P. members (GLOBALG.A.P., 2021). Moving forward, I suggest the GLI interrogate the possibility of strategically positioning their farmers to become GLOBALG.A.P. members in 2023 by evaluating the economic performance and scalability projections of the farming cooperative.

Locally Haiti

Locally Haiti, an NGO founded in 1989, advocates for Haitian leadership and vision by investing in community-based work. The NGO is involved in education, agriculture and food security, community health, and girl's empowerment and mentoring (Locally Haiti, 2021). Most pertinent to this sustainability plan, Locally Haiti is engaged with 21 cooperatives; some cooperatives have been created in response to disaster and others have existed prior to Locally Haiti's involvement. Recently, Wynn Walent, Jerry Amany, Jamie Van Leeuwen, and I have all considered, in various capacities, a partnership between Locally Haiti and the GLI. Granted that the farming cooperative breaking even is a pressing priority for the GLI, we have collectively decided to halt the discussion about a partnership and circle back in the future. I suspect the farming cooperative will be in a profitable position in 2023. During this time, collaborations solely intended to increase profitability will not be as important in 2023 as in 2021 or 2022. Therefore, comparative research between the GLI and Locally Haiti can be of mutual benefit for each respective organization.

Child Voice International

The Child Voice International, founded by Joe Saunders, helps trafficked children by providing scholarship opportunities and acting upon joint efforts (Child Voice International, 2021). The Child Voice International has experience in piggery. In partnership with the GLI, Child Voice International will provide care, farmer training, market links, and technical assistance.

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