Livelihood Scoping Document

Tanzania

Knowledge Partner

Supported by

This study was conducted by Kakute with SELCO Foundation as a knowledge partner. Kakute is a 25-year old Tanzanian organization based out of Arusha aimed at supporting technology development, innovation and commercialization of solutions aimed at the poor. SELCO Foundation is based out of India and seeks to inspire and implement solutions that alleviate poverty by improving access to sustainable energy to underserved communities across India in a manner that is socially, financially and environmentally sustainable. The primary goal of this partnership is intended to develop a desired ecosystem or enabling conditions for design and delivery of energy access in Tanzania to meet critical development parameters. There is a mutual recognition to develop local resources, local problem-solving tactics suited towards building local solutions.

The study intends to inquire and gain a broader understanding of the measure of energy interventions possible across different livelihoods and the gaps thereof. This is the first phase towards a larger scoping exercise for identifying regions and entrepreneurs to pilot livelihood interventions. Further the study seeks to understand the specific needs of communities and identify possibilities for energy interventions. This study also informs on existing practices of business, ownership and delivery models in the identified regions of Tanzania. This also helps in documenting and capturing the learning in a manner that the project can be used by other stakeholders to better inform similar interventions.

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1. Introduction:

Access to energy is among the most important anti-poverty tools. It underpins all other development goals. Yet energy access, in a decentralized manner, as a pathway to fight poverty is often greatly underappreciated. It is typically approached from a technology centric (lights or machines) or a delivery model (mini grid or PayG) centric lens and often in terms of number of connections rather than how it can effectively be used to meet critical development needs for the poor. No society has modernized without reliable, affordable, accessible energy. Yet its unequal, largely centralized access has also left many behind.

Decentralized sustainable energy solutions offer a way to build on local resources, processes and customizations that are tailored to suit local contexts such that they can appropriately adapt to these adverse changes. Current energy planning and intervention efforts often take on a one size fits all approach that does not take into consideration multidimensional poverty and root causes of inequality. In itself access to energy is not panacea, it should be built on a detailed understanding of the end users' needs with an understanding of the opportunities and constraints arising from local socio-economic and cultural contexts.

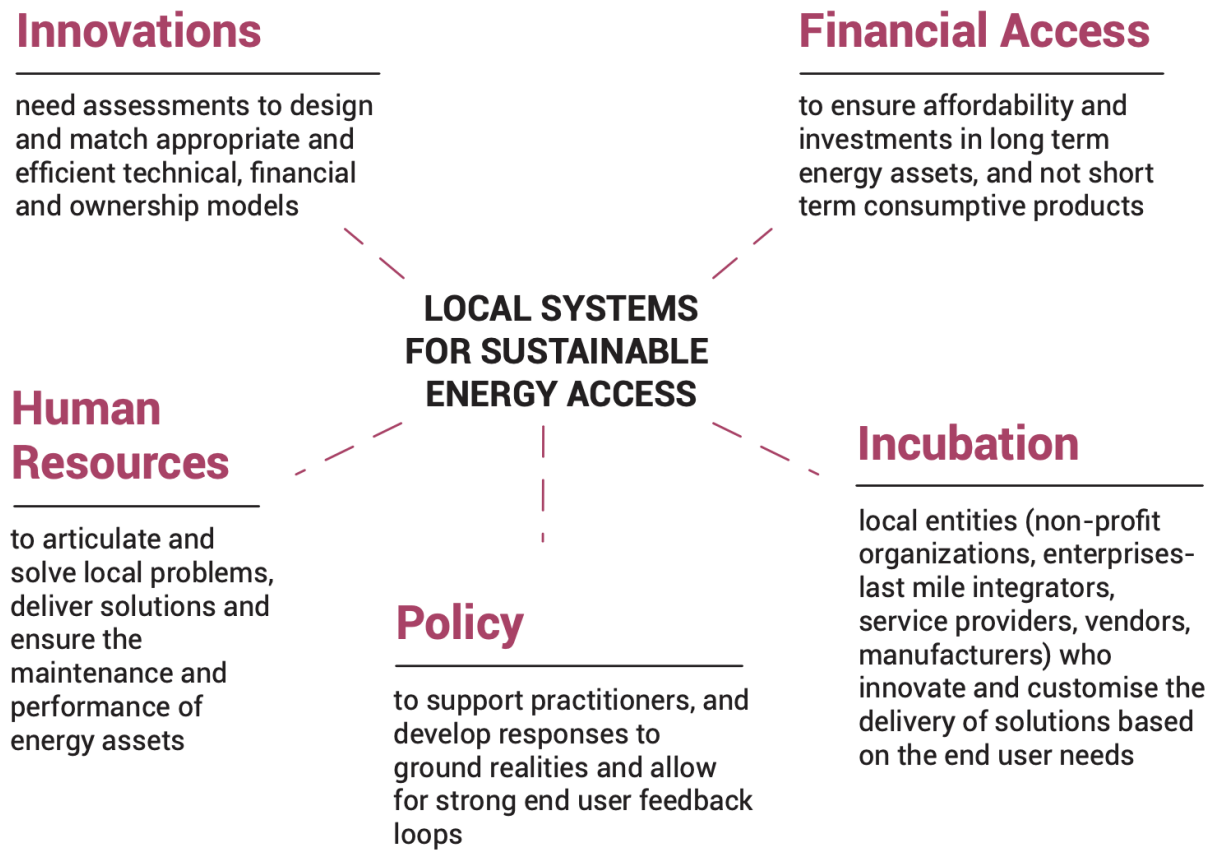
The marginalized populations of the world are distributed mostly in the global South and are differentiated in numerous ways. The poverty levels and forecast can be classified by income levels, places of residence (rural, urban or tribal), minority status, adjoining geo- graphical terrains and climate issues. A deeper understanding warrants a basis for the need of a collaborative platform, which is proposed to be built for and by the global South. The Global Ecosystem Hubs for Sustainable Energy is an international platform to position UN's SDG 7 as a critical catalyst for a sustainable and equitable future. The idea is to facilitate productive transfers of local knowledge, local expertise and networks to catalyze implementation of pro-poor sustainable energy solutions - all through South-South cooperation. The platform is proposed to become a cross-learning platform for sustainable energy and development practitioners across Global South.

In Tanzania, the Global hubs program is facilitating ecosystem development with grassroots energy innovations for livelihoods by strengthening local stakeholders. One of the primary objectives of the study is to understand the specific needs of communities and identify possibilities for energy interventions. This study also informs on existing practices of business, ownership and delivery models in the remote identified regions of Tanzania. This also helps in documenting and capturing the learning in a manner that the project can be used by other stakeholders to better inform similar interventions.

2. Approach and Methodology:

2.1 Inclusive Ecosystem for Sustainable Energy Access

Poverty and climate risk are the two most important issues that are decreasing social sustainability and leading to more disparities across geographies. Both are man-made and solvable using sustainable energy as a catalyst. Replicable ecosystem processes, banking on sustainable energy that encourage various income generating activities for the marginalised populations can help solve poverty and climate crisis. In recent times, the majority of innovations in livelihood and productivity have been focused on a centralised industrial scale- whose benefits do not trickle down and the ownership does not transfer to the poor. Innovations for the vulnerable have to be decentralised and customised. At the same time, 'innovation' often focuses on technology alone, and not on processes around ownership models, financial models, supply chain and service delivery models; that allow for sustained impact from the design and deployment of the technology. The need of the hour is to catalyse and enhance these missing ecosystem factors in order to demonstrate the linkage between sustainable energy and development: thus, demonstrating the capability of decentralised energy to transform communities. While a huge potential lies in enhancing and decentralising agriculture value chains through energy, financing has been a barrier to scaling. All aspects of the ecosystem need to be developed for any solution to be self-sustainable and a long term investment.



2.2 Value Chain Approach:

Any livelihood practice if looked at through the lens of value chain approach helps determine the gaps and requirements at every stage. Any solution looked at in a silo ignores the holistic nature of the problem at hand. In agriculture - pre-farming, farming, market level and processing are the broad stages of any value chain which require to be studied for mapping gaps and the interconnectedness of issues. Considering that farming communities are facing challenges in procuring basic amenities due to the economic gap, value chain mapping can help develop understanding in possible areas of intervention to reduce production cost by increasing the value of the product. Energy might not be the only area of intervention, but collaboration with an array of stakeholders can promote solutions by using the ecosystem approach.

One of the major hindrances faced when it comes to agriculture based livelihoods, is the lack of appropriate farming technologies across the value chain specifically for small and marginal farmers, either severely lacking in terms of access or completely missing from the value chain of products, services and systems available to farmers in India. Efficient need based productive assets can improve productivity, increase incomes and maintain well being by removal of drudgery, increased savings and product diversification. Decentralization presents the opportunity to maintain maximum value at a farm and farmer level. This combined with efforts on strengthening value chains via sustainable technologies can go a long way towards social, financial and environmental sustainability of small and marginal farmers.

3. Assessment Methodology

One of the key innovation partners, the study set out to explore the gaps and needs for decentralized energy solutions for rural livelihoods through its assessment visits to regions of Dodoma, and Iringa, primarily to study different aspects of the local livelihoods landscape and the general challenges faced by the population.This methodology has been filtered and distilled from the exercise carried by KAKUTE and seeks to transfer practitioners learnings of assessments in Tanzania.

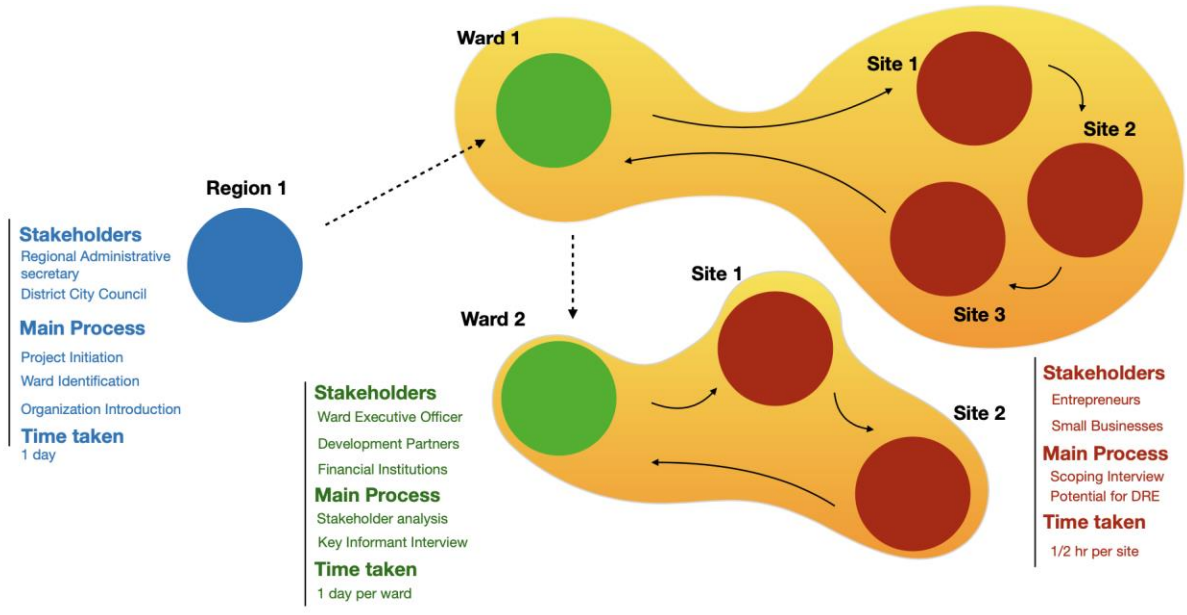
It identified and carried out surveys in 7 wards in Dodoma and 5 wards in Iringa. Various government officials at the district level such as Executive director, Deputy Executive Director and district community development officer were interviewed. Similarly, at the ward level, dialogues were held with the ward executive officer, village head/ chairperson and community development officer. Apart from public officials, the study also covered village banking groups, entrepreneurs, local NGOs and community organizations.

The two regions of Dodoma and Iringa were chosen to understand the different ecosystem maturity of the regions and cross-compare the value chains emerging through assessments.

3.1 Assessment Process

In its assessment, the study took a macro to micro approach in Dodoma and Iringa, the chosen geographies. This primarily meant that the study started by studying the priorities in the regions by speaking to key stakeholders, slowly narrowing down to specific priorities.

The regional administration was key in getting key insights on overall livelihood and energy scenario, and identification of the most vulnerable wards. A buy-in from the ward executive officers also facilitated meetings with local stakeholders- NGOs and key entrepreneurs.



4. Sorghum Value chain - Overview

Out of the total farm-based households in Central Tanzania (Dodoma, Singida), **44% cultivate sorghum**. In the southern parts (Ruwuma, Mtwara, Lindi) around 24% households cultivate sorghum. Sorghum crop is consumed as grains and is also processed into flour. Sorghum processing is either done by farmers themselves or is done by informal millers. **Around 43% of the domestic sorghum supply enters the formal sector for processing**. The sorghum grains are hand threshed and then cleaned before they are sent to mills for processing. Some farmers sell the grains directly to the millers or sell it to traders after processing. Rural engagements start from sorghum cultivation, hand threshing, milling by informal local millers and consumption/sale of sorghum grains and flour.

4.1 Sorghum post harvesting stages

Sorghum Seeds are often locally sourced and pre-harvest operations can be smoothened by structural changes such as formation of collectives. **The critical interventions are, therefore, required in the post-harvest phase, strategically aimed at reducing drudgery, enable proximate processing at local level and consequently, ensure better returns to the farmers**. Presently, available machines to process small millets at village level are less efficient in terms of head rice recovery and loss of nutrients due to high level of polishing. Some of the post-harvest stages wherein interventions can be made are as follows;

Stages	Farm Level	Agro-processing	Distribution
Solar Technologies (either in testing, pilot or replication stage)	• Irrigation pumps • Fertilizer sprayers	• Millet Destoner • Pre-hulled grading • Hulling • Post-hulling • Milling/ Pulverizer	• Weighing • Digital centre for subsidies and policies

Harvesting

Harvesting technologies are gauged by their efficiency of harvesting, straw quality, and time and the number of labour involved. **Lack of manpower, mechanization and power supply are three major concerns pertaining to harvesting when the crops are read**y. Introduction of eco-friendly technology can bring about major increase in yield, and therefore income to the farmers. However, in a country like Tanzania, with a small mean landholding size ranging from 0.9 to 3 hectares, there is a need to design small equipment which are affordable and have a relatively high life span.

Drying

Millet grains harvested during the rainy season may be left to dry in the field for up to two weeks, which is a prerequisite for easy grain separation during threshing. **Sun drying is a very good method of drying but the problem it has is unsteady solar radiation which makes some of the farm produced get spoilt**. Sun drying also has a problem of microorganism growth before the food is dried due to fluctuation of solar intensity. Supplementary heaters could be used to improve the performance of unheated air-drying in areas where weather is not in favor of the drying process. Oil, gas or electric burners are usually used as a source of heat. The use of solar dryers is already in progress, which opens up possibilities for manufacturers to introduce varieties of clean energy mechanisms aimed at providing uniform drying to seeds before milling.

Threshing

Threshing refers to the removal of grain from harvested plant or plant part and is usually done manually by women and men. It entails beating the millet heads with sticks or clubs repeatedly until almost all the grains are detached from the heads. The beating action may be done either on a mat, canvas or bare ground. In order to ease grain collection after beating, sometimes the heads of millets may be stuffed into bags, prior to beating. Whole plant threshers are to be developed for small millets for areas where the whole plant is harvested.

Dehulling

Dehulling (removal of husk) millets is a difficult task owing to its small size and husk. Without husk removal, it is impossible to explore the full value addition of such products. Manually an individual with a pestle and mortar can de-hull about 1.5 kg per hour providing a non-uniform poor keeping quality kernel. **Machines operating with single phase electric motors have been developed** and used in certain areas. Some machines come with a provision to adjust between the dehulling surfaces to suit different sizes of minor grains. **There is a possibility of introducing solar powered de-huller with capacity to trap the husk mass and other by products, while at the same time, reduce drudgery**.

4.3 Sorghum value chain - Learnings from the field

a) Current sorghum milling entrepreneurs in Dodoma who have machines, are using antiquated and overpowered technologies. Most of them use - diesel based machineries. It was identified that there was **no skilled technician to service and repair the equipment in close by areas**.
b) The entrepreneur identified that the **current capacity of the machine was not enough to meet the local demands** and hence proposed the introduction of more efficient and higher capacity milling solution. It also specified the need for a reliable alternative source of energy due to weak-grid connectivity.
c) **Establishing a well-built storage area/warehouses was seen to be a concern** for a few sorghum producers, where the produce can be safely stored at reasonable prices till markets can get reasonable prices for it.
d) There were other **input and output issues around market linkages, difficulties in financial linkages, packaging, pricing communication** capacity building in agri-business and road infrastructure.

4.4 Case story 1: Sorghum milling

Mr. Masumbuko Matias Njimaita, a speech challenged entrepreneur who runs a sorghum milling machine in Wa Muungano street in Mbalawala ward of Dodoma region. Primarily involved in the business of sorghum milling process, Mr Masumbuko owns a diesel based milling machine. He processes at home and people from the same village and neighboring villages come to mill sorghum, mostly through word of mouth. His monthly expenses come to Tsh 40,000. Apart from the cost of running the business, the primary concern for Masumbuko is that there is no available technical support that he could approach in case machinery requires servicing and maintenance and he takes sufficient time and effort for its maintenance, in case of breakdowns. There has always been a requirement for creating a cadre of technicians for such technologies. Especially for sustainable energy technologies, servicing and maintenance form a critical part of its lifecycle.

5. Rice Value chain - Overview

Rice is the second most cultivated food and commercial crop in Tanzania after maize, representing 18% of the cultivated land. In addition, 71% of the rice is grown under rainfed conditions. About half of the country's rice is grown by smallholder farmers in the Tabora, Shinyanga and Morogoro, Iringa regions of the Central Corridor. However, overall national productivity per hectare shows that **productivity remains low at 2.5 against the potential of 6.5 tonnes per hectare**.

Youth and women are mainly involved in the rice value chain – youth perform planting and rest of activities are done by women. Processing centres are scattered with rice milling done at the local level, while the de-husking process is done at the town/city level. There are small, medium sized and large-scale actors all throughout the value chain – input supplying, processing and selling (wholesale).

5.1 Rice post harvesting stages

The journey from farm to table for the paddy crop is similar to other cereal crops. Labor requirements are heavy in the growth stage with most farmers adopting transplanting methods of growing paddy. **The last stage is one of high value addition where the price of grain and by products exponentially increases**. The major stages in the value chain along with associated technologies are shown in the table below. Many technologies can be identified for appropriate stages. These machines range from individual use machines to a greater number of rice farmers or groups/clusters. The machines identified are similar in nature to those required for other major cereals like Wheat, Millets, Maize with contextual changes in some cases.

Stages	Farm Level	Agri-processing	Distribution	Food processing
Solar Technologies (either in testing, pilot or replication stage)	• Irrigation pumps • Fertilizer sprayers	• Rice hullers • Rice polishers • Rice milling	• Weighing • Digital centre for subsidies and policies	• Puffed rice machine • Break making machine

Harvesting

Before processing, grains are cleaned and graded according to size. **Winnowing machines can be used to separate out the chaff, soil and dirt.** Some machines have integral sieves that combine cleaning with grading.

Hulling

Several grains have an unpalatable husk or shell that needs to be removed by a decorticator. A range of specialized machines are available for this task. However, after identifying existing rice mill technologies within India, **it was realized that the production capacity was too large and so was the energy requirement**. A mini rice huller was designed from scratch to cater to marginal and small farmers in remote areas. The huller would be **small enough to be used by a single farmer or used as a rental/community owned model to serve a small community of farmers**. This gives scope for production of unpolished rice at domestic level as low cost, cottage scaled value addition business for farmers. Less rice is broken during hulling if the rice is parboiled first. Rice polishers are available for removing the rice bran after hulling.

Polishing

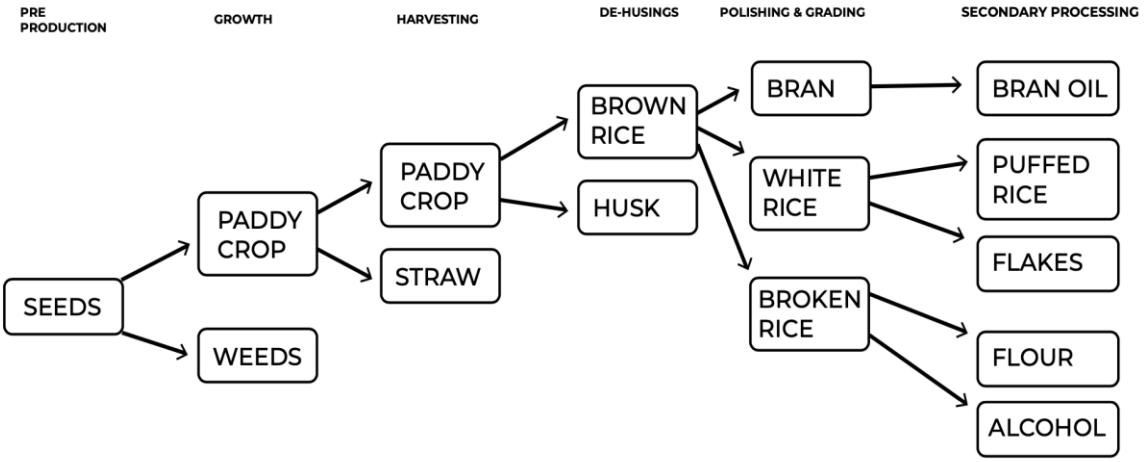
Polishing is the process of removal of bran layer in brown rice. After harvesting and drying, the paddy is subjected to the primary milling operation which includes de-husking as well as the removal of bran layers (polishing) before it is consumed. The rice obtained after this process is called raw rice. A rice polisher is a machine for buffing (or "polishing") kernels of rice to change their appearance, taste, and texture.

Pounding/Milling

Milling is a crucial step in post-production of rice. The basic objective of a rice milling system is to remove

the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Depending on the requirements of the farmer, the rice should have a minimum number of broken kernels. An **ideal milling process will result in the following fractions: 20% husk, 8−12% bran depending on the milling degree and 68−72% milled rice or white rice depending on the variety**. Total milled rice contains whole grains or head rice, and brokens. The by-products in rice milling are rice hull, rice germ and bran layers, and fine broken.

Product value additions through the value chain



5.3 Rice value chain - Learnings from the field

a) The entrepreneurs mentioned the **high fuel cost of running existing machineries** used for agriculture. This is primarily due to use of **outdated technology**. Moreover, **the reliability of electricity is questionable** as there are long periods of blackouts.
b) The **output quality of rice/maize flour from diesel-based machines is poor as it smells of petrol/fuel as well as leading to change in color of the flour**. This leads to loss of customers.
c) There is **a need for storage space for raw harvest**. Most often, the rice is stored in shared warehouses and on high rent charges. Also, there is a l**ack of quality packaging technology** causing loss of post-harvest processed goods for supply.
d) The **lack of poor road infrastructure** has been recounted by entrepreneurs' multiple times. The market centers away from villages is quite far leading to higher transport costs.
e) **Formal access to affordable financing is far and few**. The entrepreneurs also sounded the need for financial literacy support as they are not aware of the modalities of financing.
f) Currently, most of the microbusinesses are family run and for basic sustenance. There is an **awareness gap on the available technologies and their workings**. Other business skills like bookkeeping and market development were key challenges faced by them.

5.4 Case story 2: Rice agri-business

Mr Allan Laurent Mdede established agri-business in 1998 having primary occupation in rice cropping and processing. To supplement his income, he has livestocks such as cows, chicken, sheep and goats and runs a small grocery store. For working on larger 19 acres of land, Allan acquired power tiller (diesel based), pikipiki (diesel fuel) and grinding and peeling machine (run using electricity). Having higher produce, he sells to local buyers in Iringa as well as outside the region and he has a sufficient marketing network to have a stable demand. Other issues flagged by the entrepreneur are poor quality of packaging and dismal road conditions. Allan has also mentioned the affordability of credit for agricultural inputs.

Alan also has concerns on the quality of raw materials and high costs of running machinery. The average operational cost of the business per month is 7,701,000 TSh, out of electricity cost cover upto 6-8%, which is again unreliable and inadequate. A solar powered solution can bring down these costs in the long run. Solar powered rice mills, catering to lower volume & high output quality have been developed and piloted in India which could be appropriate for the need identified by Mr Allan. The small scale rice milling machines result in energy savings of 68.5% compared to diesel based solution and processes 150 kgs/hour of rice in semi-automatic mode and 350 kgs/hour in fully-automatic mode. Local manufacturing and production of such DRE appliances could find a wide take-up in the geography.

6. Other livelihoods:

In addition to the above other allied or secondary livelihoods were also identified during the assessment. These are primarily non-agriculture livelihoods like Batik, sorghum, fishing and ice making.

6.1 Batik clothes making:

One of the **unique livelihoods found in Iringa** is Batik clothes making. In Tanzania, handcrafted batik is made by painting or stamping hot liquid wax onto a piece of cotton fabric in the desired pattern. The fabric is then dipped into a fabric dye which adheres to all of the areas that are not covered by the wax. Through handling and dying the fabrics the wax will crack and the dye also slips through these fine cracks, giving fabrics a unique look. After dyeing the wax is removed (washed out with hot water) and the first pattern is visible. The process of painting or stamping and dyeing can be repeated with other patterns and colours and beautiful fabrics are created. Women entrepreneurs were trained in Dodoma on Batik-clothes business

Problems shared by entrepreneur:

1. The processes are **mostly manual and require mixing chemicals manually, which is not only tedious but also dangerous**. The entrepreneur mentioned that there is a facility to receive capital loan upto 9 million shillings from the government which they have tapped. However, they are unaware about new technologies available for Batik production.
2. Other issues pointed to were **poor packaging** and **high cost of transportation**.

6.2 Fishing & Ice-making activities

Iringa is one of the major regions active for freshwater fish production. There are four regions which have more than 1 000 fish ponds each. These are Ruvuma (4942), Iringa (3137), Mbeya (1176) and Kilimanjaro (1 660).[1] Production has been low due to small pond size coupled with poor management. Most farmers use feeds such as domestic leftovers, maize bran, wheat bran, vegetables and wild grass. To keep fish fresher throughout the day, many micro-entrepreneurs have emerged to make ice for fish storage, sometimes as a secondary activity.

Problems shared by entrepreneur:

1. The **high cost of maintaining or renting deep freezers** for fish storage is one of the overwhelming responses from the fisherman (who have any kind of cooling technologies) especially in villages with no to weak grids.
2. The fishermen showed interests in learning new farming techniques and processing - **fish oil processing and fish preservation** - adding value rather than selling fish instantly.
3. The **price of the market varies considerably** and market information on price becomes available to them through buyers/middlemen only.

[1] http://www.fao.org/fishery/countrysector/naso_tanzania/en

Case story 3: Fish Farming

Since 2010, Mr Emmanuel Kalinga from the village of Migori, has been engaged in fishing (mainly catfish and sardines) and selling produce on the sea shore. He uses a canoe and a paddle to go fishing and stores the catch in a diesel-run deep freezer near the shore. The villagers from the same village and other local buyers from other regions like Mbeya come to buy his fish. He explains that the deep freezer has high cost maintenance and profits from the business are usually ploughed back into repairing the equipment. Out of the monthly cost of 1,715,000TZS, he spends 150,000 TZS on the fuel, approximating 8-9% of the total cost. Moreover, the market is also limited which he wishes to expand, the poor road connections making it worse.

One of the potential solutions is to have a boat mounted solar powered refrigerator on the fishing boat. Such an intervention could potentially save Mr Emmanuel's cost of maintenance and sell fresh fish for a longer duration at a better price.

6.3 Sunflower Milling

Tanzania is counted amongst top sunflower seed producers and Sunflowers are grown all over the country, mostly by small-scale farmers. **The Dodoma region in the country's central zone is a major producer, accounting for over 20 percent of national production**. About half of the region's farmers are engaged in sunflower oil production but few small-scale producers have realized the full potential of this sector, either in terms of improved quality or higher volumes. Among the factors contributing to low productivity and quality are inadequate machinery and limited or no access to value-added services and markets.[2]

Problems shared by entrepreneur:

1. The **spare parts for the existing milling machine are not available in Dodoma** and have to be purchased from Dar which is about 400kms away adding to the cost of service and maintenance.
2. While procuring the seeds, some farmers supply the seeds are not dry enough or contaminated with water or sand causing damage to the oil milling machine which results in more frequent repairs. There is a **need to clean the seeds before milling**.
3. The **wiring system for the machines is not proper and this results in power wastage** and consequently increases electricity bill.

Case story 4: Sunflower milling

Pendo Masi has been in business for the last three (3) years not only in Hombolo but even outside the district and Dodoma city where she sells cooking oil and sunflower cake to traders and factories engaged in animal feed production. Now, she has become known by the name Mama Neema, now a household name. The business procured an AC power driven oil milling machine (above 2.5 hp capacity) from China which could take a load of 520 kgs. The milling capacity is about 80 bags of sunflower seeds/day. The spare parts for the machine are available in Dodoma and Dar, but they are expensive to get. Although there are two oil mill machines in Hombolo, Mama Neema's business has been getting more customers as the other businesses have operational issues. The supply ie. sunflower seed is sourced from local farmers in the ward.

The sales business is peak during the months from April to September with the price of sunflower cake Tsh250/kg, while in off-season from Oct to March, due to the scarcity of seed, the price increases to Tsh 300-400/kg. Apart from Sunflower cake, there is also Sunflower oil sold at 2500/ltr. Residents and farmers within the Ward and some from neighbouring villages/ward are regular customers of Mama Neema. Pendo Masi is intending to buy a second larger capacity milling machine and increase the storage capacity, so that she has enough raw seeds for the entire year and increasing stability. She is looking to raise 15-25

[2] https://www.unido.org/news/tanzanias-sunflower-oil-producers-come-bloom

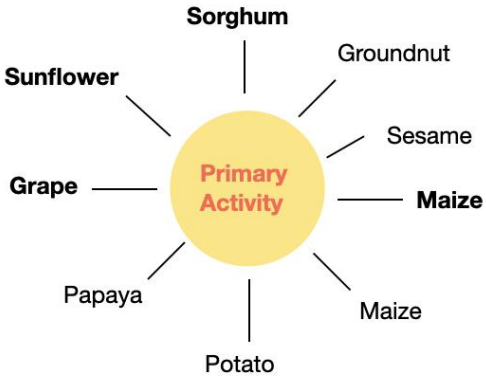
million shillings as capital loan from Microfinance.

Many times, unfavorable financing terms for capital expenditure, limit the capacity of local entrepreneurs like that of Pendo Masi, to scale up. SELCO foundation along with TAMFI (Tanzania association of MFIs), are taking efforts to build a more accessible financial ecosystem for technology uptake and build awareness and trust amongst MFIs to lend loans to technologies such as milling machines.

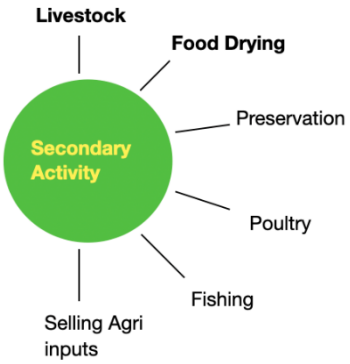
7. Entrepreneurs Profile

7.1 Dodoma Region

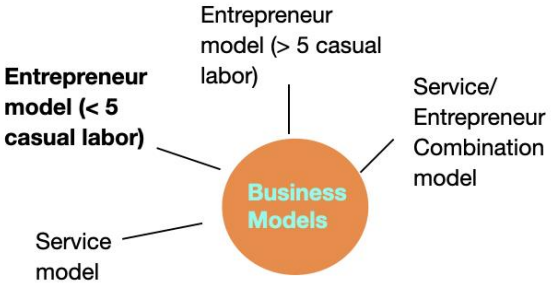
In phase 2, the study focused on analysing the business landscape of the potential entrepreneur. In Dodoma, 13 entrepreneurs were interviewed for the baseline assessment.



Sorghum, Maize, sunflower & maize emerged as prominent crops



Food-drying & **livestock** emerged as secondary activity. Only few had secondary livelihood activity, showing higher vulnerability to income shocks.

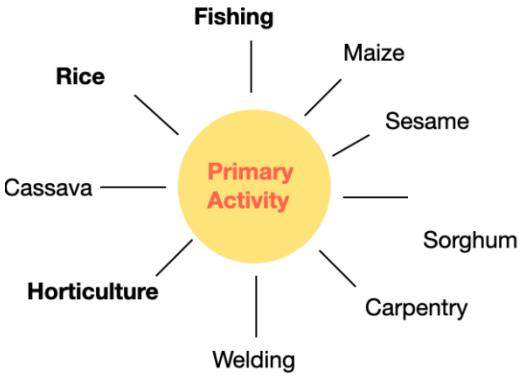


Although the entrepreneur model (< 5 labours emerged as dominant model , **the combination model** emerged as unique one - byproduct of sunflower seed milling (service) was sold as sunflower cake in the factories (entrepreneur).

Local Market came across as the most convenient place for selling. Although, they would get higher prices in towns, transportation cost and low shelf life of perishables makes it difficult.

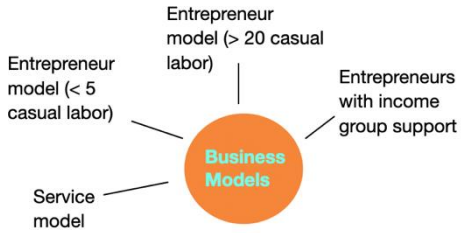
7.2 Iringa Region

In phase 2, the study focused on analyzing the business landscape of the potential entrepreneur. In Iringa, 20 entrepreneurs were interviewed for the baseline assessment.

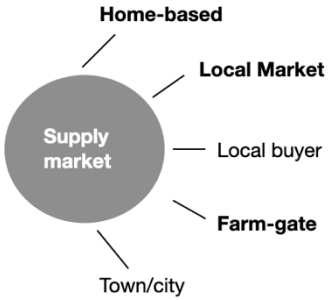


Rice is the dominant livelihood crop in Iringa. Being closer to lakes, **fishing** is another important one. **Horticulture** such as spinach, ladysfinger, bell peppers is also practised.

Secondary activities were diverse and few. Contextually relevant livelihoods were Soap making, Batik clothes and ice-making.



Entrepreneur model is more dominant over service models here, however, there is a stark difference in number of labours employed >20-30; mostly since rice is a labour intensive crop production process.



Home-based, local market and **Farm-gate** selling was the primary mode. Although selling through traders and market centres in Iringa town is also seen.

8.Way forward:

1. **Understand the technology landscape with vendors and manufacturers**, ideally from Tanzania and African regions to improve access to these technologies as well as map supply chains for spare parts of the same.
2. **Develop capacity amongst last mile clean energy enterprises** to deploy and service solar powered productive use applications
3. **Create demonstration sites and conduct pilots** to assess viability and feasibility of solutions, while **raising awareness on the impact and benefits amongst end users**, community-based organizations, NGOs, institutes and government entities.
4. **Capacity building and training of entrepreneurs** to facilitate operations of these technologies. Awareness building & exposure to DRE technologies for building consensus around need for technology