

**Post Harvest Management in Sub-Saharan Africa
(PHM – SSA).**

**Feasibility Study on the Promotion of Improved
Post-Harvest Technologies in the North of
Mozambique**

21.9 – 12.10.2014



Mission Report

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List of Abbreviations

ACIANA	Associação de comerciantes de Nampula
AFAAS	African Forum for Agricultural Advisory Services
AGRA	Alliance for a Green Revolution in Africa
Agridea	Swiss based Rural Advisory group
APHLIS	African Postharvest Loss Information System
CoP	Community of Practice
ENCAMOBIL	Productor de tecnología de Postcoleitha
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organization
GPFS	Global Programme Food Security
HSI	Helvetas Swiss Intercooperation
IIAM	Mozambique Agricultural Research Institute
IKURU	Empresa Comercial dos Produtores Associados
M4P	Making Markets Work for the Poor (framework)
MIC	Ministerio da Industria e Comercio
MINAG	Ministerio da Agricultura
Mt	Meticais (currency Mozambique)
NGO	Non-governmental Organization
NRI	Natural Resource Institute
PHL	Postharvest Losses
PHM	Postharvest Management
SDAE	Servicos Distritais de Actividades Económicas
SDC	Swiss Agency for Development and Cooperation
SSA	Sub-Saharan Africa
UEM	Universidade Eduardo Mondlane
UPC	Union de Produtores Camponeses
VAT	Value added Tax

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SUMMARY

The Post Harvest-Post Harvest Project in Mozambique has accumulated a lot of field experiences ; nevertheless the impact on a bigger scale has not yet been reached. This is mainly due to the absence of a focused strategy on promotion and extension work, as well as on a clear definition of the improvements to be promoted.

In our context we tested a selection of six improved options as solutions: (1) Improved bamboo silo, (2) Polypropylene bags, (3) Super bags-Super bags, (4) Tethere Silo, (5) Improved elevated traditional Sileiro, (6), Metal Silo. From the proposed, the Farmers had a preference for: Metal Silo, Improved elevated traditional *Sileiro* and Super bags.

The metal silo is not very well known in rural areas and hasn't been promoted actively mainly because of its high price. Meanwhile a new factory of metal sheets will be opening shortly in *Nacala*, with the effect of prices to drop sharply and become a more competitive option. This will make the silo prices more attractive for small farmer. The price of a silo, including all duties, taxes, transportation, retail margin and manufacturing labor cost, can reach US\$ 78 for (300kg), US\$92 for (500kg) and US\$102 for (700 kg). With a loss reduction of 15% and a stored grain market gain of 50%, the silo can be paid within two harvesting seasons.

Different business models have been analyzed and discussed with partners. As a result it has been suggested starting with a combination of public-private partnership models where a franchise model can be integrated and promoted. With this model we are able to reach the synergy between local and regional development organizations that also focus on food security activities, mobilizing local leaders and extension agents as well.

The introduction of the metal silo will bring many changes to farmers. It will be an incentive for them to produce more and have surpluses, that when well preserved, can later be marketed for a better price.

A subsidy is recommended for small farmers, the most vulnerable ones, for food security and social reasons (poverty alleviation). A good and feasible option can be to pay the price of the metal sheets, which represents a 43% of total silo cost. The rest has to be covered by the farmer. An investment of US\$ 1 Million could benefit 30,000 families in the Nampula and Cabo Delgado region.

For a proper implementation of metal silos local artisans have to be professionally trained and supervised to reach and maintain an acceptable quality standard.

To be effective, the project has to be gradually implemented and geographically focused. The overall role of the project will be: inter-institutional coordination, training, providing didactic and promotional material, and finally, monitoring. This role will gradually change till a complete withdrawal occurs within a period of 4 to 6 years.

1. Introduction

The mission took place from the 21st of September to the 12th of October 2014, in Cabo Delgado and Nampula Regions in Mozambique, where the Post Harvest-Post Harvest Management Project is operated by HELVETAS Swiss Intercooperation. The **Post Harvest Management in Sub-Saharan Africa (PHM-SSA)** is a project under the Global Program of Food Security (GPFS) of SDC, coordinated by HELVETAS Swiss Intercooperation (HSI) and implemented in a consortium with FANRPAN (Food, Agriculture and Natural Resources Policy Analysis Network), AFAAS (African Forum for Agricultural Advisory Services) and Agridea. The goal of the project is to increase food security of smallholder farmers in Sub-Saharan Africa through reducing Post Harvest losses at farm and community level. The project duration is six years.

The objective of the mission was to get a better understanding of the current situation of the Post Harvest project, and support the project team in developing a strategy to promote improved Post Harvest management practices and technologies. To reach this objective the mission carried out the following activities: 1. Recent project and research document revision, 2. Field visit interviews with: farmers and extension people, Input suppliers (Agro dealers, Hardware stores, Metal sheet providers, and others), government agencies, artisans and small mechanical entrepreneurs, 3. Training of artisans in metal silo manufacturing, 4. Testing acceptance of Post Harvest improvements in the field, 5. Findings validation and staff Feedback. At the end of the mission, a workshop in Nampula with Partners and stakeholders was conducted to validate the different inputs and recommendations. A debriefing with the project staff and the HELVETAS Swiss Intercooperation coordinator also took place. In this document, findings, conclusions and recommendations of the mission are presented. Different working documents for field test and validation discussion are contained in the annex 1 and 3.



Map Northern Mozambique : Working area project, Province : Cabo Delgado and Nampula



Field visits, Checking stored maize cobs

2. Findings from the field visits / Post Harvest management

2.1 Institutional support towards grain storage

The District Commissioner office in Chiure, Nacaroa and Bekumburi, who we visited during the mission, supported the effort of the project and gave a clear statement that the Post Harvest management of grain and pulses has to be addressed and assistance given to farmers needs. There is a need also to facilitate infrastructure for farmers to gain better access to market their grain. In this sense it is advised to also consider the quality of marketed grain (humidity, damages and purity) and introduce an incentive scale for better quality.

2.2 Use of traditional and improved Post Harvest practices

People use different traditional storage technologies with significant differences on levels of losses. The use of different practices can be explained through the following arguments and feedback from farmers:

- There is no reliable practice that guaranties suitable long term conservation
- Local traditions and habits
- Material availability
- Local Skills and capacity to manufacture storage facilities
- Financial capacity to buy external inputs such as: bags, pesticides, etc.
- Personal preferences
- Harvesting processes and Post Harvest value chain
- Volume of harvest and need for home consumption.



Traditional store: Ethatapo in Namaouuo

The new introduced methodologies and practices are not well known by many farmers. Most of those who apply some type of improvement are directly assisted by the project, because of having performed a trial or special activity, like seed preservation. This approach did not lead to sustainable results.

In general farmers experience a prolonged period for drying and harvesting that can last more than 3 months. As a consequence grain is not handled properly resulting in insect infestation and losses due to rats and birds.

The stored amounts vary because due to farm size and climate conditions, but in average, farmers store around

- 500 – 1000kg of maize
- 200 – 300 kg of beans

The use of this harvested amounts shows the following pattern:

- Around 50% is sold after harvesting
- 25% is sold during the rest of the year
- 25% is kept for food and seed.

For farmers, the portion designated to seed is the most important. They often keep it in a different place, apart from the other portions. These grains are selected from the field. Even though they are better taken care of, samples show that this seed is also heavily damaged by insects and other pests.

Three months after being harvested, the grains show high insect infestation. Most of the time the farmer is not even aware of this happening. This same infestation pattern is observed in different storage structures like Etathapo, Bambu strip silos, Tethere silos, bags, trees, roofs, etc. In most cases the insects come from the field itself.

Traditional conservation methods are not so efficient for long term storage (over 2 months). Many grains found in these traditional structures were heavily infested.

Most farmers do not use pesticides for conservation. This is due to:

- Lack of access
- Lack of knowledge and
- Cost (Price)

In some places where pesticides are used, a wrong dosage is applied. Some farmer groups get Actelic dust through the extension officer. In very few places, they know about Phostoxin, but they use it for rat control. In general they are not aware of how dangerous that product is.

The use of traditional “medicine” for protecting stored grain, such as onion, garlic, pepper, yam leaves, etc. is limited and not very effective in the long run (see Helen Besson study). In some cases it affects the odor of the grain and in general it's not effective against rats.

Farmers are not aware of the value chain of grain, and even less concerned about the losses along the food pipeline from production to consumption. However, it is the storage stage the one considered to suffer the highest loss.

Even if the official extension service recognizes the importance of Post Harvest management, it does not offer a lot of support or assistance to farmers in a concrete way. Some other institutions like OLIPA, CLUSA, AFRICARE, IKURU and others have worked on that issue, but on their own.

Farmers mostly complain of not having good access to market, so they depend strongly on ambulant buyers who come to the village and buy their grain. For that reason quality is not an issue they take into consideration when setting the price.

In some villages like Namauowo and Menheuene farmers have experienced at the end of the season, food shortages in some periods over the last five years. These have made them become very concerned on how to better store food.

It is also mentioned that at the end of the season grain prices (maize and beans) are very high and not accessible for small farmers.

The Tethere Silo can be seen in different villages where HELVETAS promoted seed banks. Most of them are in bad shape and nearly abandoned. Farmers stated that they

had a lot of insect and termite attacks. It is not considered as an improvement fit for farmer needs. The construction has to be done by a specialist and the effort is quite big.

The Metal silo has not been actively promoted at this stage by the project, and people do not know this technology. However in some places a silo of 1000kg has been introduced by AFRICARE / CLUSA. The farmers there are satisfied with the result and use them for seed storage. For this reason the group in Namauowo switched from Tethere Silo to metal silo. The silos were too big and not used efficiently. The quality of the silos was not uniform and not hermetic.

2.3 Material and Input supply:

We have to distinguish between two types of material, one for metal silo production and the other for conservation such as pesticides, repellents, super bags, cement, wire, bags, etc.

For the metal silo we basically need:

- Galvanized metal sheets
- Tin
- Tools for manufacturing



Galvanised Metal sheets : Imported by coil. One coil contains about 900 sheets.

These materials are not available everywhere, and prices vary a lot. After contacting hardware stores in the different Regional towns (Pemba, Chiure, Nampula), we observed general good acceptance in bringing these materials in. The most difficult ones to find, for a reasonable price, were:

- Galvanized metal sheets 0.5mm
- Soldering copper hammer
- Tin bar (50%tin x 50% lead)
- Chisel and
- Ammonium salt

See information sheet in annex No. 4

The metal sheet market seems to be more and more competitive. The main target is metal sheets for roofing. There are two main actors, the importers and the local producers. Since a few weeks ago, KIBOKO a new company from India has been building a factory in Nacala to galvanize and locally cut metal sheets. Their intention is to cover most of the northern part of Mozambique. Through them, the project can access 0.5mm metal sheets for a price of Mt 210.- (0.9m wide) per meter FOB factory. See calculation sheet in the annex. This new factory is now building up a network of outlets in the region. Comparing prices, we get US\$ 7.78 / m² against US\$ 13.33 / m² in the traditional market, resulting in a difference of 71% in price.

We couldn't find soldering hammers or the other materials. These issues have to be negotiated through bigger Hardware stores like Recol, Trevo or Condor in Nampula.

Import duties and taxes: For importation of galvanized metal sheets in coil a duty of 7.5% plus a handling fee in the port of about 5% has to be paid. The duty for the

importation of raw material, such as metal sheets (not galvanized) is 2.5%. Of all this material a VAT (IVA) tax of 17% is charged.

Agricultural inputs: Another concern is that there is no well-established retailing system with easy access for inhabitants from remote rural villages. There, some products are delivered sporadically by the Agricultural extension officer or a private dealer.

2.4 Silo quality made by local artisans

In our visits we went to different local artisans who were contacted by HELVETAS and also worked in the past for HELVETAS. The silo quality did not fulfill the required standard and so, are not acceptable. In general we could observe the following errors:

- No precision in measurements
- Welding
- Sheet folding
- Use of good sheet quality
- Dimensions of intake and outlet
- Optimization of material cutting



As a consequence of these we could note the following:

- No hermetic conditions
- Functionality is not optimal
- High cost
- Not uniform for marketing
- Jeopardized life span

Local made silos in Pemba

2.5 Local Artisans

The four local artisans selected by HELVETAS never got a proper training on silo manufacturing and it was assumed that they could copy the silo manufacturing procedure from a book. This was a big mistake with big consequences.

During the training activity in Nampula all four artisans were invited to participate on a five day training course conducted by the author, where the whole manufacturing process was practiced with the methodology “learn by doing”. Although these artisans have the skills to do the work, it is difficult to change their old habits.

To increase competence between the artisans, it is further advised to look for younger elements to be trained.

Another reality lies in the fact that these local artisans are not good at promoting themselves, therefore not good sales people. They are rather used to staying at work waiting till the client comes in requesting something. An even bigger issue is that the client has to bring the input so the artisan can do the work. This is an important finding to consider in the marketing strategy for metal silos.

3. Improved Post Harvest Technologies

3.1 Concept test / Best accepted option

In the project we have to take into consideration the experiences given to us from the past twelve years and the feedback given from different assessments that have been carried out. It is necessary to draw a strategy from these, to offer farmers a variety of solutions and give them the opportunity to choose and improve.

Based of this, we proposed six options to get a better understanding on acceptance of improved Post Harvest management practices from the farmers and their wives: We choose the following storage options:

1. Improved bamboo silo.
2. Polypropilen bags.
3. Super bags
4. Tethere Silo.
5. Improved elevated traditional *Sileiro*.
6. Metal Silo



Menu of 6 tested Postharvest Technologies

A detailed description was made for each option including building, handling and the approximate investment and operational cost. See description of each technology in annex No. 1.

These options were chosen by the following selection criteria:

- Price.
- Handling.
- Accessibility. Effectivity.
- Adaptability to local conditions.
- Availability of local material.
- Previous experience.
- Durability.
- Space.

Table No. 1 Comparison of different improved storage practices

Improved technology	Investment Mt	Yearly handling cost Mt	Life span (years)	Depends on external inputs	On farm manufacturability	Space (1=small, 5=big)	Effectivity * low ** medium *** high
1. Improved bamboo silo (250kg)	400.-	165.-	3	No*	Yes	5	**
2. Polypropilen bags (250kg)	505.-	100.-	2	yes	no	2	**
3. Super bags (250kg)	700.-	600.-	1	yes	No	3	**
4. Tethere Silo (250kg)	1,285.-	100.-	3	No*	Yes	5	*
5. Improved elevated traditional Sileiro (250kg)	905.-	250.-	3	No*	Yes	5	**
6. Metal Silo (300kg)	2,300.-	15.-	20	yes	No	1	***

* Use of Actellic is an external input

In an exercise in a village (Menhueene, Mekuburi) with the presence of 13 women and 16 men, we tested the acceptance of the different storage practices getting the following preferences:

1. Metal Silo
2. Improved elevated traditional *Sileiro*
3. Super bags

The other options were discarded for different reasons like:

- Bad experience.
- Not effective (Tethere Silo).
- Not proven against rats.
- Availability of space.
- Safety against robbery.



Concept test: Metal Silo is observed by farmers.

It is interesting that the metal silo was chosen as the first option, despite its high initial investment cost. This was just a very rugged and short test. To get a more representative sample, this market test should be done in a more systematic way in different villages and combined with individual interviews. But it draws our attention to see that farmers are open to new innovations. This can also be taken as an indicator of their frustration with the other experiences.

It is also an interesting combination of other preferences. There seems to be a correlation between a common concern and rat attacks which is mentioned many times.

3.2 Metal silo

Metal silos draw people's attention a lot. But there is still the big question, is the metal silo an option for small farmers in Mozambique? The answer is underlined by two main issues:

1. The purchase power of small farmer, or the other way around, is the price of a silo affordable for a small scale farmer.
2. The cultural acceptance of this new innovative storage structure.

The price is then related to the profitability which depends mainly on two factors:

1. The value of the avoided losses and
2. The market gain from better prices because of a longer storage period.

In the following tables you will compare these aspects to have a better understanding on the issues. As we can see the price for a 250kg silo rises to Mt 2335. - For a 500kg silo to Mt 2745. - And for a 700kg silo to Mt 3043.-

Table No. 2 Silo Prices

Cost item	Silo capacity			
	300 kg	500 kg	700kg	1000kg
Material	1,868.-	2,255.-	2,528.-	2,874.-
Manufacturing	300.-	325.-	350.-	375.-
Transportation	150.-	150.-	150.-	150.-
Depreciation of tools	15.-	15.-	15.-	15.-
Total	2,335.-	2,745.-	3,043.-	3,414.-
Price / 100 kg	778.-	549.-	434.-	342.-
Total in US\$	78.-	91.50	101.50	114.-

The price calculation for galvanized metal sheet (1.6m x 0.9m x 0.5mm) is presented in the following table.

Table No. 3 Price of Metal sheets

Description Value chain	Unit / %	Added cost per level	Price per level	Remarks
Sales price FOB Factory	Mt / m		210.-	KIBOKO / Nacala
	Mt / 1.6m		336.-	
transport	10%	33.6	369.60	
Major distributor	20%	73.92	443.52	
VAT 20%	17%	12.57	12.57	73.92 x 17%
Retail sales price			456.09	
trsp distr / art	5%	22.80	478.89	
Final Price artisan	Mt		478.89	
Price Artisan	US\$		15.96	

Between the factory and the artisan's place, a price increase of 42.5% can be observed. This price structure can only be changed if a distribution network is set up. In exceptional cases KIBOKO is willing to deliver sheets to another place if there is enough demand (a minimum of 250 sheets) and if these can be combined with another delivery order. The final metal sheet price delivered in the artisan's place would be Mt 478.89 (US\$ 15.96)

Table No. 4 Profitability of silos 250 kg and 500 kg

Description	Description of calculation	Calculation	Silo 250 kg	Silo 500 kg
Loss estimation	15% of loss at MT 10.- / kg	37.5kg x 10.-	375.-	
	15% of loss at Mt 10.- / kg	75 kg x 10.-		750.-
Market gain	Price differential: Mt. 6.- harvest Mt 4.- Shortage Mt. 10.- applied to 50% of storage capacity	250kg x 50% x Mt 6.-	750.-	
	Price differential: Mt. 6.- harvest Mt 4.- Shortage Mt. 10.- applied to 50% of storage capacity	500kg x 50% x Mt 6.-		1500.-
Total			1,125.-	2,250.-
Price of silo			2,335.-	2,745.-

Conclusion: The 250 kg metal silo can be paid within two harvest periods and the 500 kg silo within one. When farmers pursue this objective, they will be more interested in storing for a longer period and therefore have better conditions for food security.

In our price calculation, cost for promotion and artisan/farmer training, on silo manufacturing and grain handling, are not included. It is assumed that these costs are absorbed by the project during the first period of introduction and is considered as the seed money for startup.

The question lies on how a farmer can get a credit to make that first investment, of buying a silo. This will have to be analyzed together with Micro finance institutions, another option would be for the project to Village based Safe and Loan Groups.

3.3 Artisans

As we mentioned before, the local artisans are not capable of manufacturing silos with acceptable quality standards without additional training. It is difficult for older artisans to change their habits.



Artisan training : « Learning by Doing »

Additionally artisans are “lazy” promoters and do not have mobility means to go out to the village to promote and sell their product. To manufacture the silo in a regional town and transport it to the villages or farms, is not a suitable solution because of the long distances and the dimensions of the silos. This would only increase prices a lot. Therefore the silo has to be manufactured in a radius of 10 to 15 km from the customers place.

The metal sheets and the other materials can easily be transported to the villages. The artisans can also move to the villages and assemble the silos there.

4. Scope and Business model

4.1 Business models

The general idea to develop a business model is to obtain better outreach and focus more on extension and effective adoption of Post Harvest improvements. On the other hand it also has to allow mobilization of the local participants, from the private and public sectors, as well as from Parastatal institutions such as NGO's, Cooperatives, Farmer unions and training institutions. The Business model not only has to focus on silo transfer but also offer different solutions for Post Harvest management. This can reach from the improvement of traditional systems to the adoption of modern technologies such as the silo and the use of super bags. The idea is to have a solution for each different social category and farm size.

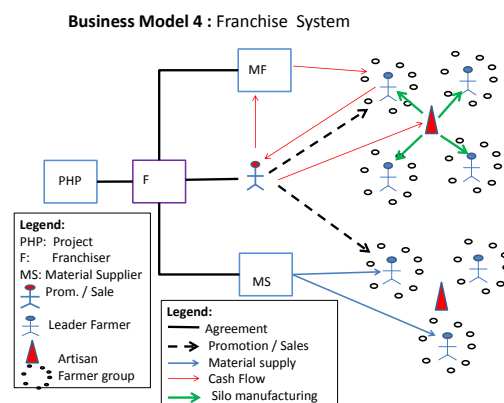
From the six chosen Post Harvest management options, we developed 4 Business models which best fit the local and regional context. These are:

1. Public – Private Corporation
2. Private Regional Approach
3. Private centralized with Regional promotion
4. Franchise System

Each model is described in the annex No. 2. These Models respond mostly to overcoming the observed constraints:

- Lack of money to buy improved technologies.
- Lack of assistance and advisory services.
- No availability of Metal silos in the villages.
- Lack of access to pesticides and other Agro-inputs.
- Absence of artisans in the villages and districts.

In the following table we present these business models in a synoptic form to give an overview and facilitate the comparison. The strengths and the weaknesses as well as the rating, which is the result of the validation meeting with partners and different private and public stakeholders, carried out on the 12th of October in Nampula are evaluated. In general people see a combination of number one and number four as an interesting option.



Business model: Franchise System

Table No. 5 Synoptic presentation of the 4 business models

Business model	Brief description – Main characteristics	Driving forces	Strength	Weaknesses	Rating 1: low 10: best
1. Public – Private corporation	Different Dev. Organization incorporates promotion of PHT in their activity plan.	NGO's	<ul style="list-style-type: none"> - Multiplication effect - Geographic division and coverage - Cost sharing - Synergies between different actors 	<ul style="list-style-type: none"> - Price policy - Willingness of cooperation - Maintain quality standard 	7
2. Private Regional Approach	Local entrepreneur adopts silo and PHM as a business	Private entrepreneur with sales agent	<ul style="list-style-type: none"> - Local knowledge and contacts - Price oriented - Efficiency oriented 	<ul style="list-style-type: none"> - Customer service - Not interested in holistic approach (general advisory services in PHM) - Not small farmer oriented 	8
3. Private centralized with Regional promotion	Big company adopts silo transfer as a social business articulated through a local entrepreneur	Local entrepreneur with sales agent	<ul style="list-style-type: none"> - Geographic coverage - Economy of scale - Competitiveness between local entrepreneurs 	<ul style="list-style-type: none"> - Long term commitment - Resistance from farmer groups - No integral advisory service 	5
4. Franchise System	Local leader and Sales persons promote improvements	Franchiser together with Sales agent	<ul style="list-style-type: none"> - All stakeholders get incentives - Active Local Leader involvement - Payment agreement can be flexible 	<ul style="list-style-type: none"> - Artisans jeopardize system through own sales. - Cost of material distribution - Leader does not pay back money to franchiser 	6

4.2 Adoption of Metal silo

The metal silo is a valuable option for the small Mozambican farmer. It's true that it is not the cheapest solution as there is an investment to make in the beginning; however a well managed silo can have a life span of 20 years. So it has to be considered as a long term investment. As we have seen in other countries, the metal silo represents a tangible improvement that contributes to the elevation of the farmer's status and social reputation. It improves not only the storage conditions and maintains good grain quality, but also the hygiene of the house and the use of space.

It will be necessary to find a solution on how to facilitate the financing of the silo. Therefore a credit scheme has to be considered with local financing institutions such as Microfinance, Banks or Safe and loans communities. A subsidy model where the government intervenes on behalf of the people with the biggest disadvantages also has to be considered.

For better and effective marketing of the silo, standardized sizes are recommended (300 kg, 500 kg, 700 kg and 1,000 kg). Each silo should have a sticker on its cylinder that explains in a didactic manner how to be used and how maintenance should be given to the structure. At the delivery point an introduction has to be given to the farmer on how to use it correctly and where to place it in the house.

4.3 Artisan training and the role of artisans

The artisans play an important role in the promotion of silos as we opt for a decentralized strategy. Nevertheless, we need more trained artisans to get started. In the beginning we need to start with the offering forces and only after the product is well known can we rely on demand size.

Some artisans can collaborate and will adopt a more active role in the promotion, once the silo has a wealthy demand. The training of the artisans can be done through a master trainer controlled at the beginning by the project. If the demand increases, an institutional solution should be envisaged.

It is highly recommended to establish a good monitoring system to control the quality of the artisan's product. We calculated an average income per silo of Mt 300,- per artisan. In average an artisan can manufacture a silo within a day. This type of business can become interesting for an artisan once he can produce from 50 silos up, in a year. That means an additional yearly income of Mt 15,000,- (US\$ 500.-) for approximately 50 working days.

4.4 Role of the Project

In a new set up, the project will be more oriented to promotion and adoption process. Within a horizon of a 4 to 6 year period for implementation, the project will mainly go through three stages:

1. Inter institutional Coordination / Market exploring / working agreements / Demonstration
2. Support on the implementation / Supervision / Monitoring
3. Monitoring / Quality check

It is considered that in a period of 2 to 4 years, a business model can be set up. The project has to adapt to the local situation and be flexible, but always keep in mind that its role is to change, so that in the end the local players will continue their work on their own.

4.5 Promotion

Promotion is the essential part of this new phase, Promotion includes showing farmers new solutions that work and result in positive changes. In this sense, promotion will include:

- On site Demonstration
- Training
- Supply chain arrangement
- Inter institutional arrangement
- Preparing all kinds of promotional materials such as leaflets, radio spots, Posters, comics, etc.



Training and Promotion activities with extension personnel

It is important in this stage for the demonstration plots to be working well and for the inputs to be available.

4.6 Subsidy

Subsidy can be justified for social and humanitarian reasons. So in these cases I would state that it is justified. The HSI in Maputo should explore that option through the MINAG. Given that in several areas of the project intervention zones, food shortages occurred during the last years, resulting in tragic consequences to human lives. Post Harvest management can make a difference. There is local food production that has to be properly stored for the whole season. The metal silo makes it possible. If we consider 10% of the rural population as being the most vulnerable, we then have a number of 30,000 farmers in the Region of Cabo Delgado and Nampula as a result. A 300kg silo needs 3 metal sheets at a price of Mt 336.-. This totals 30,000 farmers x 3 metal sheets x Mt 336,- = Mt. 30,240,000.- or US\$ 1 Million. For one million US dollars we can clear food security for 30,000 rural families.

A 300kg silo costs Mt 2,335,- from which the metal sheets represent Mt 1,008.- (VAT included). The rest will be paid by the farmer Mt 1,327.-. This represents 57% of total cost. The subsidy represents 43%.

4.7 Constraints for adoption

The biggest constraints for adoption are a lack of good practices and good demonstration examples. This is mostly due to the absence of advisory services and input supply. The lack of money to buy improved technology or agro inputs is a double problem which represents a trap. For this reason farmers are suspicious and adopted the more cautious option to optimize risks. They will not invest in producing more if they cannot store the grain properly and have to sell it for a lower price after harvest. With a good storage facility they can break this cycle.

4.8 Monitoring

The monitoring activity is to measure project progress in a broad sense. But it is also to check continuously the quality of work done in the field. In an adoption process of this scale, it is important to establish the quality criteria for improvement and technologies. The project has to be aware, especially at the beginning, of the minimum quality standard to be attained. This will be an important task till the end of the intervention. The result of this monitoring on the adoption process has to be reported as feedback periodically to the implementers.

5. Conclusions and Recommendations

5.1 Conclusions

- There is a potential to improve the Post Harvest management in the northern area of Mozambique.
- There are too many “half tailored” options on the list for improvement with the following consequences:
 - o Lack of knowledge.
 - o Lack of available inputs in the rural villages.
 - o Not enough practice oriented.
 - o Difficult to transfer for effective and numerous adoption.
 - o Not properly managed by extension people.
- The intervention area to start the introduction of new practices is too big because of the large distances. It resulted in being inefficient and in the loss of time due to travel.
- Local artisans are not good at promoting and selling. They are rather used to waiting for their clients at their workshop.
- Just because local artisans are working with metal sheets, does not mean that they make good quality silos. Especially if they never learned properly how to make a silo.
- The local made silos do not meet required quality standards and show a lot of errors in:
 - o Measurement precision.
 - o Welding.
 - o Sheet folding.
 - o Using the right metal sheet quality.
 - o Dimensioning the intake and outlet.
 - o Optimizing material cutting.
- Price and quality of available galvanized metal sheets varies a lot from different stores and towns.
- A new supplier (factory: KIBOKO) located in Nacala can offer the required quality of 0.5mm galvanized metal sheets for a reasonable price. The factory is developing a retail system with outlets in different regional cities.
- The project works too isolated in the field of PHM and does not exploit synergies with other development organizations.
- The project does not have a clear strategy to promote PHT and practices. Its effort is diluted into too many activities such as coordination with partners, research, promotion, logistics, internal reporting, etc.
- The storage losses of grains at farm level are considerable and are not taken into account by the farmer itself (lack of consciousness)
- There exist different PHM solutions with different technical degrees of perfection and price levels, which can respond adequately to small farmer’s needs.
- The price of metal silos is affordable for medium size farmers with a production capacity between 500 and 1000kg of maize. The use of one silo can be combined by storing two products, such as maize and beans or other.

- There is no decentralized availability of silos, nor a manufacturing dispositive at regional-local level.
- Distances for transporting silos to farmers from urban areas are very long and expensive. Ex. Nampula – Menheuene 144km, this is not viable.
- There is a lack of extension and promotional material for farmers and extension people.
- There is a lack of training capacity for artisans. There is no master artisan trainer in the project, who can train and supervise the trained artisans and provide aid and assistance if needed.
- There exists an absence of Financial institutions like microfinance, development banks or Safe and Loans institutions in rural areas for financial services facilitating credits for buying metal silos. The existing ones are not actively involved or aware of the issue.



Geographical scope as a starting point

5.2 Recommendations

- It is recommended to make a selection of a limited number of Post Harvest Management solutions (technologies) and to prepare the corresponding documentation for them for the promotion, training and adoption. This menu of technologies could be:
 - **1. Improved bamboo silo**
 - **2. Polypropilen bags (Sacos de rafia)**
 - **3. Super bags**
 - **4. Tethere Silo**
 - **5. Improved elevated traditional *Sileiro***
 - **6. Metal Silo**

- To have a better understanding of what farmers prefer, I would start making concept test on an individual and collective base in different villages. This is also a promotional activity which helps to kick off the adoption process. After the concept tests, the number of options can be reduced to be between two and four technologies.
- Reorganize project implementation structure to a more effective and geographically accessible size. It is absolutely imperative to reduce the intervention zone and concentrate in a specific geographical area to be more focalized.
- Choose 2 working districts with good production potential to start with. Do not start with the most vulnerable farmers, they may be more reluctant to adopt the new solutions and change. The best ones to start with are always the leaders and the most recognized people.
- Concentrate on promotion with a limited number of practices and technologies. Training can also be a part of the promotion, in the sense of acquiring the needed knowledge to develop a good promotional strategy.
- Mobilize other development partners to join the topic by giving them technical support at the beginning. This can be done through training, promotion material and monitoring on quality checks.
- The project should focus and concentrate on:
 - Preparing good promotional and didactic material
 - Training extension people
 - Training artisans
 - Making inter institutional collaboration agreements
 - Making quality monitoring
 - Ensuring availability of Input (tools, metal sheets, pesticides)
- The election of the business model is essential and has to be experienced from the beginning. The business model should be based on a market oriented approach bringing together:
 - Offer and Demand (Ex. Artisans and Farmers)

- A “pilot” business model could be a combination between the public - private cooperation and the franchise models, understanding that the public institutions are helping to kick off the franchise model. In this sense it is important to mobilize different actors such as:
 - NGOs
 - Farmer associations
 - Extension services
 - Financial institutions
 - Material Providers
 - Local artisans
 - Private players (Social entrepreneurs, etc.)

- Explore option of subsidy through government. The following option could be considered:
 1. Material supply:

The government buys the metal sheets and the farmers pay the transport and the manufacturing.

The project ensures that only selected farmers can have access to this option.

 2. Price reduction
Through a voucher system the government pays a 50% subsidy on price release for metal silos.

For smaller farmers it will be always difficult to have the capacity to buy a silo. These farmers are more exposed to food insecurity and are more vulnerable. So from this point of view a subsidy system is justified.



Metal Silos : Capacity 1000kg, 500kg, 250kg