

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

---

# Analysis of post harvest management systems and technologies and elaboration of intervention strategies for Mozambique

Mission report (final draft)



Isabelle Dauner Gardiol, Rural Economy team, HELVETAS Swiss Intercooperation  
Bern, September 2013

## Content

1. Introduction .....	3
2. The analysis of the post harvest system for maize, millet and cowpeas .....	4
2.1. Core functions .....	4
2.2. Supporting functions .....	8
2.3. Rules .....	11
3. The main constraints and bottlenecks in the post harvest market system .....	12
4. Proposal for an intervention strategy.....	15
5. Next steps .....	17
Annexe 1 : List of actors visited in Cabo Delgado and Nampula provinces .....	18
Annexe 2 : Sustainability matrix (the future vision or «what we would like to reach in 2016») .....	19
Annexe 3 : Example of a poster on the different steps of the maize value chain.....	21

## List of acronyms

CIMMYT	International Maize and Wheat Improvement Center
FDD	Fundo de Desenvolvimento Distrital – District Development Fund
GiZ	Gesellschaft für Internationale Zusammenarbeit
IFAD	International Fund for Agriculture Development
IIAM	Instituto de Investigação da Agrícola Moçambicana
MZN	Mozambican Metical (1 CHF = 32 MZN)
PHM-SSA	Post Harvest Management - Subsharan Africa
RAS	Rural Advisory Services
SAAN	Segurança Alimentar e Agro-Negócios – Food Security and Agribusiness Project
SDAE	Serviço Distrital das Actividades Económicas – District Service for Economic Activities
SPER	Servicio Provincial de Extension Rural – Provincial Service for Rural Extension
SETSAN	Secretariado Técnico de Segurança Alimentaria y Nutrición – Technical Secretariat for Food and Nutritional Security
SIMAP	Sistema de Mercados Agrícolas Provincial – Provincial Agriculture Market Information System
WFP	World Food Program

---

## 1. Introduction

---

This report contains the results of the study mission from July 17 to 26 in Cabo Delgado and Nampula provinces in order to identify functions and actors in post harvest management systems of maize, cowpeas and millet, and to provide inputs for designing an intervention strategy. The study follows the identification of post harvest technologies, current losses, as well as government policies, actors and possible interventions to improve post harvest management, made by two consultants from the University Eduardo Mondlane in Maputo.<sup>1</sup> The current study goes one step further and contributes to understand the underlying causes of a sub-optimal management of products after the harvest, in terms of handling of crops and use and dissemination of techniques and technologies. The current study also provides inputs to designing an intervention strategy.

The results of the study are based firstly on interviews in the field with different stakeholders of post harvest management: project staff, technical offices the line agencies of the ministry of agriculture (district and department level), secretariat on food security, farmer organisations, in particular those in charge of seed banks (SAAN), rural advisory service providers, research institutes, private companies or traders, microfinance institutions (see detailed list in annex 1). Secondly, a two days workshop on the Making Markets for the Poor Approach (M4P) in Pemba, where many of the above listed stakeholders intensively worked on mapping the post harvest system, also contributes to the findings of the mission.

The study team, composed of staff from the PHM (Post Harvest Management) project in Mozambique and an international advisor from the Rural Economy team of HELVETAS Swiss Intercooperation in Switzerland, visited communities and other stakeholders in the Cabo Delgado and Nampula provinces.

The study mission had the following objectives:

1. Analyze the post harvest and storage strategies, and the functioning of local post harvest systems with regard to maize, millet, cowpeas at the household and village levels, using an M4P approach.
2. Identification of main constraints and opportunities of the mentioned post harvest systems (M4P approach)
3. Elaboration of a draft intervention strategy with regard to the prioritized crops in the intervention zone(s) of the Postharvest Management Project.

The workshop had the following objectives:

- 1.1 Analyze - in a participatory way, with local and national experts, in the frame of a workshop - existing RAS systems (services, actors, methods, etc.) with regard to the postharvest topic, under an M4P approach (see separate document on workshop content).
- 1.2 Compile experiences and know-how of experts with regard to methodologies, packages of practices and tools of dissemination that are used to tackle the postharvest issue.
- 1.3 Facultative if time/resources allow: Contribute to develop ideas for new RAS methodologies, packages of practices and dissemination tools which aim to promote postharvest aspects.

---

<sup>1</sup> Araujo e Bucuane (02/2013). Identificação de Acções para Melhorar Segurança Alimentar e Gestão Pós-Colheita. Universidade Eudardo Mondlane. Maputo

The current report is structured along the M4P logic for analysing market systems and the underlying causes of system underperformance. The report starts with a description of the main core functions of the market, namely the offer and demand of post harvest practices and technologies, and the analysis of the support functions and rules needed in order to make the core functions work well. Finally, actors of the system are identified. The sustainability matrix provides the basic input to plan interventions. The author would like to thank Aly, Casimiro, H el ene, Karin and, in particular, Mauricio for their support during the mission and their contributions to this report. A special thanks goes to all women and men who gave their time to answer tricky questions.

---

## 2. The analysis of the post harvest system for maize, millet and cowpeas

---

### 2.1. Core functions

According to the M4P terminology, the core functions of the post harvest management market system are to be understood as the supply and demand of post harvest technologies and practices.<sup>2</sup> In the case of Cabo Delgado and Nampula, small scale producers are usually the ones who supply and demand post harvest technologies and practices.

Dominantly, post harvest technologies encountered in the study region are built with local material (clay, hay, bamboo, wood). The use of alternative « modern » technologies, like metal silos, Super Bags<sup>3</sup> and plastic recipients is very limited to nonexistent. However, the use varies between villages and districts, and highly depends on which project has promoted the construction of which type of « demonstration silos ». In one of the visited villages, producers store all kind of products in propylene bags. Small traders also widely use these propylene bags.

The technologies and methods used for drying (see pictures) :

- A platform made of wood, bamboo and hay is a very common and widely disseminated technology for drying maize and beans. Some of these platforms are covered with a roof made out of natural fibre.
- For small quantities, drying happens on the top of roofs or under the roof.
- Small quantities are also dried inside the house over the fireplace.



Products are dried in the villages, close to houses, or in the field. The **drying** lasts 1 to 3 months, depending on weather conditions and products. Climate Change studies predict that rainfall patterns are shifting towards rainfalls later in the year (not less rainfall), when crops are laid out to dry. The higher humidity may prolong the drying process. (see report by Tom ... – W4F). Problems that occur during the drying phase are attacks of insects and rats.

---

<sup>2</sup> See [Operational Guide for the Making Markets Work for the Poor \(M4P\) Approach](#).

<sup>3</sup> The IRRI Super Bag is made of multi-layer polyethylene plastic material. The bag is also incorporated with a gas barrier layer which controls oxygen and water vapor movement inside. Super Bags are relatively costly (USD 40 per ton according to Araujo and Bucuane).

Inappropriate **harvesting time** is also mentioned widely. Premature harvesting is a strategy to avoid destruction of the crop by elephants. The premature harvesting will lead to higher moisture content in the grain or legume, which will make it more difficult to dry them.

The technologies and methods used for storage and conservation of products: (see pictures):<sup>4</sup>

- Traditional silo made of natural fibre, looks like a small house, with a roof and a door.
- Traditional improved silo where outer and/or inner walls have been covered with mud which is supposed to improve efficiency in terms of temperature and attacks by rats (see cover picture).
- Beans and peanuts are dried and then stored in a « capsule » made of natural fibre.
- Silo « Tethere » has the form of a metal silo, but is built out of bamboo and mud. This silo has been invented by Mr. Tethere and promoted by HELNETAS Swiss Intercooperation for the seed banks, World Vision and OLIPA-ODES (organisation for sustainable development). One silo can contain up to 250 kg of seeds. It is also being used for “non seed” grains.
- Silo Gorongoza is cone-shaped and made out of clay bricks. Walls are covered with mud and the top is of cement. It contains 1 to 1.5 tons of maize. It was developed in a district of Mozambique called Gorongoza and promoted in Nampula province by GiZ and WFP, Cabo Delgado province by Aga Khan Foundation and IFAD.
- Propylene bags are mostly used for storage by small traders who keep the bags in warehouses.<sup>5</sup>
- Pots made out of clay, covered with mud, are used for storing small quantities of maize (mainly seed for the next campaign).
- Kind of pot made out of a tree bark which serves as repellent against insects.
- Metal silos.
- Plastic bottles where seeds are stored with ashes and which are placed in a thermic box made out of natural fibres and mud. This technology has been promoted by Aga Khan with funding from IFAD.



A broad variety of storage systems do exist in the study region, from traditional to modern, small to big, cheap to expensive. The **investment costs** to construct silos were difficult to estimate (see table 1). One producer group in Namiongolo estimated the cost of a silo Tethere (250 kg) at 2250

<sup>4</sup> The silos listed here are the ones seen or heard about during the study visit. Refer to Araujo and Bucuane (footnote 1) for a complete overview of silos.

<sup>5</sup> The hermetic Super Bags were not seen during the mission.

metical (70 CHF); another group estimated it at 1500 metical (47 CHF). The cost of an improved traditional silo is estimated at 2000 to 2500 metical (CHF 62 to 78). One 50 kg propylene bag costs 15 metical (0.46 CHF) on the local market.<sup>6</sup> According to CIMMYT, the cost of constructing a metal silo in Mozambique ranges from CHF 45 for a 200 kg silo to CHF 135 for a 1000 kg silo.<sup>7</sup> These numbers have to be taken with a lot of caution and verified!

**Table 1:** Very rough estimation of investment costs (money and labour) for different technologies

Technology	Storage volume (kg)	Cost (metrical)	Estimated loss
Silo Tethere	250	1500 – 2250*	10%
Traditional improved silo	Open volume	2000 - 2500	40 – 60%
Propylene bag	50	15	??
Metal silo	200	1495	Less than 10%
	1000	4485	

\*450 is the cost of the material. Construction needs 10 to 14 working days.

Traditional improved silos (see cover picture) for storing crops are widely disseminated; 50% to 80% of producers have improved traditional silos (source: Akoa and SDAE). However, interviewed producers and rural extension workers recognise that these silos are not efficient and that new improved and modern technologies (silo Tethere, silo Gorongoza, metal silo) allow reducing losses - from 40-60% in traditional improved silos to less than 10%.

However the new improved silos seem not to be much disseminated beyond those villages where different projects have created demonstration sites on different technologies. Even in villages where, for example, HELVETAS has promoted the silo Tethere, only groups who have benefited from training and coaching use this silo. The **adoption rate** is thus estimated to be rather low.<sup>8</sup> Public extension workers told that “it is a lot of work to construct a silo (Tethere)”. Also within SAAN it was communicated that the silo Tethere was meant for seeds. The current design is too big for seed storage of one household, but adequate for grain. Households would only change once they have to replace their old granary. Aga Khan Foundation which promoted the silo Gorongoza by constructing 60 pieces observed that adoption started only after five years, once farmers had increased their production.

Producers **combine different storage systems** among the above mentioned ones, depending on the product stored and the quantity of products. The study team had some difficulty to find out the criteria for choosing one or the other technology. Producers in the study region, who are also the ones who benefited from the SAAN project, are well informed about the silo Tethere, but not about other methods and apply what they are used to.

One difficulty in the core transactions of post harvest technology markets is the **matching of offer and demand**: various improved technologies have been promoted and tested through projects, but only few farmers (beyond the demonstration sites) know about them, and even less about where to buy them or were to get advice to construct them. Super bags are easily accessible on the local markets and relatively cheap, but few farmers whom we interviewed use them. Two reasons for not replicating or renewing the silo Tethere were the high cost of bamboo in terms of money and time (very long way to get it) and the lack of money for paying the promoter.

<sup>6</sup> Just as comparison, GDP per capita in 2012 was estimated at USD 402 (www.tradingeconomics.com/mozambique).

<sup>7</sup> <http://www.cimmyt.org/en/projects/effective-grain-storage-project/about-the-project>

<sup>8</sup> UPC (Union Provincial de Campesinos) is doing a survey to analyse the quantity of and causes for adoption of improved storage technologies.

Regarding the purchase or construction of silos, the author has the feeling that the argument “too expensive” was used as an excuse not to invest own resources by producers who have been used to receive much support (capacity building, coaching, inputs) from donor funded projects and the government.

Interviewees mentioned that the major **causes for post harvest losses** were:

- Rain
- Diseases in the field and during storage (fungus and gorgulho)
- Early harvesting when product is not yet ripe (also makes the drying difficult)
- Late harvesting with birds, rats, termites attacking the product in the field
- Drying is not made correctly
- Bad storage with rats and insects eating the product<sup>9</sup>, place not enough protected from rain
- Lack of conservation products
- Lack of knowhow and advice in the production, drying, and storage processes.

The awareness of crop losses seems generalised, with interviewees feeling that they lose up to 50% of their product between harvest and final use (consumption or sale). However, small producers do not seem to be aware of existing solutions for reducing losses, except for seeds, and apart from using chemicals.

### **Gender aspects and distribution of roles for post harvest management**

According to interviewed producers, the distribution of work between men and women is quite equal for post harvest management in the study region. Women control the product in the field, men and women harvest, transport, select, dry, shell and store. Men usually construct the granary and women help, depending of the type of technology. Both men and women decide on quantities used for consumption, seeds and sale, but men have the last word! Men go and sell the product at collection points. In the matrilineal system, which is predominant in Nampula and Cabo Delgado, women used to be responsible for the granary and food distribution. With increasing market orientation men’s influence in these decisions has also increased.

Strikingly, a poster produced by a project funded by the WFP only shows women dealing with the maize value chain (see annexe 3).

### **Sale of crops**

The main food crop in the study region seems to be Sorgho, but data is needed to corroborate this information. Maize has shifted from being the main food crop to being also a cash crop. Interviewees were not able to exactly say how much of maize they would sell, how much they would use for consumption and how much for seeds. One producer said the use was 50% for consumption, 30% sold and 20% kept for seeds. Another mentioned 20% for consumption, 20% for seeds and 60% for sale. Obviously this is a function of the produced amount and the size of the family.

Maize is sold to small traders, some of whom hire collectors. Collection happens either in the field, or at collection points along the road. Some producers also sell their product at the house or shop of small traders who own warehouses. Interviewed traders mentioned that the quality of the product was not so much an issue. Demand is very high and traders would like to buy more but have no access to credit. They go and sell on big markets or directly to the processing companies.

The mission had no time to really dig into challenges regarding access of smallholders to markets in terms of transport, sufficient quantities, negotiations power, etc. and it would be worthwhile analysing this during field visits.

---

<sup>9</sup> One women producer said that she got a cat in order to chase rats. I do not know if it was a joke or meant seriously !

The period of food scarcity is January to May, which seems quite long; there many different references to this period. Maize is the food crop harvested earliest, which is only in may. Until then there is food shortage. Small producers use different strategies in order to overcome these hard times: work for food programs, neighbours and family helping out, collection of wild fruit and tubercle, sale of coal and bamboo. Alternative products to diversify the diet and get additional income, such as growing cash crops (sesame and peanuts); chicken and goats are sold during these times.

## 2.2. Supporting functions

According to the M4P terminology, supporting functions are composed of a range of functions supporting the core exchange helping the market to develop, learn, adapt and grow. In the case of post harvest management and technologies, supporting functions are provision of raw material and inputs, information, advisory services, research and development, financial services and transport.

### Access to raw material and inputs

Material used for constructing traditional silos - mud, bamboo and other natural fibre - is relatively accessible from producers' fields or from neighbours, although accessibility and availability varies between communities. The same applies for silo Tethere and thermo box. These silos have a life-span of three to four years.

For constructing more sophisticated technologies like silo Gorongoza, the access to cement seems difficult. Propylene bags are available in local markets and the price seems affordable, but interviewees did not make much use of those, although they mentioned their utilisation for transporting grain. The multilayer Super Bags were not seen during the mission.

The offer of metal silos is quite limited, only used by big producers and available in one size (1.5 tons). The general manager of IKURU told us that artisans have been trained to construct metal silos in Nampula and that they could also construct different sizes.<sup>10</sup>

For conservation of grain in the silo, most interviewees use natural products like tree bark (baobab), leaves (papaya, neem, eucalyptus, piriprii), ashes, fruit peel (casha-casha), but their efficiency is variable, depending of how the grain has been dried beforehand.<sup>11</sup>



The synthetic product most often mentioned and promoted by the district rural extension service is Actelic super. This product is used in demonstration sites for storage of seeds, and some can be purchased at district level. Many interviewees have said that Actelic super is hardly available on the market. However, the study team has seen it on market stalls (packed in poulder form in very small quantities) and in retail shops: in bottles of 333 tablets (one tablet costs 10 MZN; 15 tablets are needed for one warehouse).<sup>12</sup> The district service sells bottles of 30 tablets for a cost of 150 MZN. One bottle covers 500 kg.

### Information and dissemination

Beyond project phases and project locations, the replication of improved storage technologies is limited. Even in villages where HELVETAS Swiss Intercooperation has implemented the SAAN project, the replication of silo Tethere beyond the supported seed bank groups is nonexistent. The same observation applies for other silos which have been developed and promoted

<sup>10</sup> The « Servicio Provincial de Extensao Agrícola » (SPER) of Nampula has a list of metal silo constructors.

<sup>11</sup> The study of the HAFL student shall provide information on the effectiveness of these products.

<sup>12</sup> It has to be mentioned that the bottle was taken from below the counter and is probably not sold to anybody !



by donor funded projects (silo Gorongoza, thermic box, metal silo). All these projects had similar approaches: organise farmer groups, train local promoters on silo construction, coach groups in constructing silos, provide seeds, and provide capacity building for managing seed banks. Many projects also developed leaflets and information posters which are hardly seen at community level, but available in district extension offices. These materials are meant to be used by advisors and promoters.



Basic information on efficient storage technologies<sup>13</sup>, where to get them or where to get support to build them, and on good post harvest handling, does not exist in a simple, centralised and local language form.

Technicians from the district rural extension service consider that the process of adoption for improved silos is complicated because the process takes a long time, producers do not perceive the benefit from it, it is a lot of work to construct a silo and there is no information on how much you can gain from it.

Some projects, including SAAN have used radio programs in order to disseminate information. Pescador de Comida was a movie that was shown in several communities to promote local seed production and the silo Tethere.

Providers of information in the project region are community chiefs via public servants from SDAE (Servicio Distrital de Actividades Economicas), community leaders, and NGOs. Interviewees did not have much trust in small traders/collectors to provide them information. Radio is quite well disseminated in the project region and people see it as an important source of information.

The SIMAP plans to develop a price information service via mobile phone with Movitel. The lack of information about offer and demand of agricultural products, as well as prices, in particular grains, was mentioned as a problem by various interviewees. The SIMAP in Cabo Delgado provides weekly information on market opportunities via flyers and radio (supported by the SAAN project) but the mission is not sure whether this information reaches the target group. Small traders use their mobile phones and personal connections to peers in the markets in order to get price information.

The community radio of Chiure provides weekly information on prices and availability of products with funding from PROMER (IFAD project). This radio provides both programs in Portuguese and the local language, Enakhua, and covers around 194'000 persons. According to the coordinator of radio- television Chiure, 90% of households own a radio.

#### **Advisory services on post harvest management<sup>14</sup>**

The term « advisory services » (Serviços de consultorias) is not much used in rural Mozambique. Instead, « rural extension » is used and defined as « an educational process which consists of transferring technologies generated by research to be disseminated to producers ». This definition underpins the fact that advice to producers is seen as a continuous process with capacity building, demonstration sites on farmer field schools, etc.

The methods used in Mozambique for rural extension are quite diverse: farmer field school, participative demonstration sites, trainings, meetings, field tests, exchange visits, theatre, radio, TV, leaflets, brochures.

Theoretically, the formal steps that should be used by the public extension services are as follows:

<sup>13</sup> For example, for a silo Tethere which costs 1750 MZN and contains 250 kg seeds, if the loss is of 10% compared to 50% in a traditional silo, the producer will win 3000 MZN in one year (price of 1 kg maize seeds estimated at 30 MZN). For an investment of 1750, the producer wins 3000 MZN.

<sup>14</sup> The workshop on advisory services for post harvest management with an M4P lense held in Pemba with different stakeholders from research and advisory institutions also contributed to this section (see workshop minutes).

- Technicians form a minimum of 10 groups of average 25 producers. Each group has a contact producer. Technicians and group members elaborate a work plan.
- Existing producer associations are identified and supported.
- Technicians transmit the know how via farmer field schools.
- Technicians promote demonstration sites, in particular for post harvest management.<sup>15</sup>

The public rural extension provider at district level is the SDAE. This service is divided in four teams. 1. Rural extension on agriculture and fishing. 2. Administration and human resources. 3. Industry and trade. 4. Tourism. For example, in the district of Ancuabe, the rural extension team has 7 technicians of which one is supervisor. Out of 78 communities, the SDAE can cover 14 representing some 1750 producers. Other communities are covered (or not) by NGOs according to donor funded projects. In Cabo Delgado province, the Provincial Farmer Union (UPC) plays an important role of advisory service provider to its 4607 individual members (2252 men and 2355 women) organised in 224 associations. The union has 13 technicians.

The topics that technicians transmit to agricultural producers are production techniques (seed production, soil management, use of inputs), post harvest technologies (improved silos) and management (harvest time, drying, crop selection), natural conservation products, promotion of associations. As mentioned, different projects have promoted improved post harvest technologies and tried and disseminate them via demonstration sites. The SDAE technicians are thus aware of post harvest losses and have acquired know how from different projects. However, they admit that they do not have enough staff capacity and transportation means to reach the target group.

### **Research & Development**

There does not seem to be a wealth of research on post harvest losses (causes, volumes, consequences) in Mozambique nor on post harvest technologies, in terms of which technologies have the best cost-benefit ratio. In this sense, the results from the field tests currently done by a HAFL student and a staff member of the IIAM (Mozambican Institute for Agricultural Research) on comparing the performance of different technologies and different conservation products will be of high interest and importance to the PHM project.

The most important actor for agricultural research is the IIAM under the ministry of agriculture. According to the interview held at IIAM, research focuses mainly on improved varieties and seed production, and very little on post harvest management.<sup>16</sup> The know-how from IIAM is transferred to the producers via the district extension coordinators. IIAM also forms district extension staff when demands come from the SDAE.

### **Financial services**

Access to financial services can be an important contributor for improving storage systems when the stored product can serve as guaranty for a loan and help producers refrain from selling their product at harvest time when prices are lowest. Also, when producers have the motivation and possibility to save some money in a safe place, they can use that money in cases of emergency instead of selling crops at a low cost.

In Mozambique however, unlike other sub-Saharan African countries, rural finance is very much underdeveloped, institutions are weak and interviewees did not have much experience with financial services. Microfinance institutions which have been mentioned in the study region are “cajas comunitarias de microcrédito”, “rede de cajas rurales de Nampula”, KAM microcrédito, Kuyakana microcrédito and Fondo de Desenvolvimento Distrital (FDDN). “Rede de cajas rurales” in Nampula

<sup>15</sup> Technologies which have been demonstrated in the study region are silo Tethere, silo Gorongoza and hermetic boxes.

<sup>16</sup> HELVETAS Swiss Intercooperation collaborates with IIAM in the SAAN project.

had 12'000 clients, 3 agencies and 44 sales points. Its business model was not sustainable and the institution has been restructured and is being transformed into a microfinance bank (FIDES). KAM closed and Kuyakana is new. The FDDN, a publicly managed fund, faces problems of clientelism, bad management, and low repayment rates. The first Microfinance Bank of Mozambique, promoted by the Aga Khan foundation, did not manage to develop a viable business and had to shut down operations.

The SDC funded project INOVAGRO in Nampula plans to develop a warehouse system for the soya, cotton and bean value chains.

### **Transport**

The question of transport was not directly addressed in the study. However, during the RAS workshop working groups, where the post harvest market system was analysed, one group mentioned transport as a major bottleneck in the system. Indeed, if transport is difficult, trade of products to and from the area remains expensive, thus hindering the value chain to develop well.

## **2.3. Rules**

According to the M4P terminology, rules are defined as formal (laws, regulations, and standards) and informal (values, relationships and social norms) controls that provide a key input in defining incentives and behaviour in market systems.

### **Informal rules**

For time and language constraints, the mission did not have the opportunity to really dig into informal practices, habits, beliefs linked to post harvest management.

It is clear however that post harvest management has long been practiced in the study region, based on the high number of traditional drying and storage systems which are being transmitted from generation to generation. Regarding improved technologies, all interviewees tend to agree that the silos Tethere and Gorongoza, promoted by different projects, are the best available technologies and the ones that should be promoted. However, both these silos have a standard size (250 kg and 1.5 tons, respectively) and are meant for storing maize seeds for seed bank groups. For a single producer, they are too big for storing seeds, but could suit for storing crops used for sale and consumption. The project should check the possibility to adapt the size of the silos.

There also seems to be a consensus among interviewees that Super Bags, as well as metal silos, are either not available too expensive or both.

The study team found also a consensus around the need to promote natural products for grain conservation, given that synthetic products are dangerous and not available on the market.

Very striking is the expectations from interviewed producers that the state, NGOs or projects will sooner or later provide the needed solution.

Regarding joint storage possibilities, e.g. in warehouses or big silos, some producers admitted that people do not have much trust among each other. This could be a cause for the low adoption of silo Tethere for seed storage.

Climate Change studies predict that rainfall patterns are shifting towards rainfalls later in the year (not less rainfall), when crops are laid out to dry. The higher humidity may prolong the drying process (see report by Tom ... – W4F).

### **Formal rules and controls**

There are no formal norms and standards that regulate or control the market of post harvest technologies and practices and of conservation products. However, as mentioned above, the public services advise producers to use improved technologies and natural conservation products.

According to a civil servant from the SETSAN in Cabo Delgado, food availability is not the root cause for malnutrition, but rather the lack of a diversified diet. The study team got the feeling that above the level of district extension offices, the public entities in charge of rural development at provincial level are not really aware and interested in post harvest losses. They are more concerned about production and sale and therefore, they do not “enforce” the promotion of advice on post harvest management at field level. The official political statement is that food security has been achieved in Cabo Delgado. Now the focus is on nutritional security.

A problem that was often mentioned during the RAS workshop was the occurrence of public holidays during the month of August. When producers have finish drying their crops and are about to store them in silos, no extension worker is around to advise them.

### **Regulation of prices**

Prices of agricultural products are not any more regulated by the state. Free market operates and the lack of information on market prices of basic food and cash crops has been mentioned several times.

---

## **3. The main constraints and bottlenecks in the post harvest market system**

---

According to the analysis of post harvest management practices and technologies presented in section 2, the study team concludes that the main bottlenecks of the system are to be found in the following core and supporting functions, and rules (see figure 1):

1. **Offer of storage technologies:** the study has shown that for small scale producers, the access to storage technologies is not easy, be it through buying or constructing. Super Bags and plastic recipients are not easily available. Metal silos are only available in one size and limited places. Regarding improved silos made out of local, natural products (Tethere and Gorongoza), they are available only in one size, not movable and have a relatively short life span.
2. **Raw material and inputs:** raw material to produce the improved silos is not always available, neither the promoter who could provide advice for the construction. Synthetic conservation products are not easily accessible in small quantities. Natural conservation products are widely known but their efficiency is not clear.
3. **Advisory services:** the study has shown that, although public and private extension services are available, the provision of support and advice on post harvest management and technologies is very variable according to regions and subject on donor funds. Producers who need a rapid advice in a key moment of the post harvest process on, for example, the best moment to harvest, an efficient conservation product or how to build a silo will most probably not know where to get the advice. If they know, the technicians will probably not have the time nor the means to come and producers will not be able to pay for it.
4. **Information and dissemination:** different projects have produced information and technical material explaining post harvest handling, but the target public of these materials are promoters, extension workers or big producers who read and understand Portuguese. Some projects have disseminated information on the radio, but the study team has not found systematic dissemination of information on post harvest technologies and management via media which are accessible and understandable by small scale farmers.
5. **Research and Development:** the public agricultural research institution of

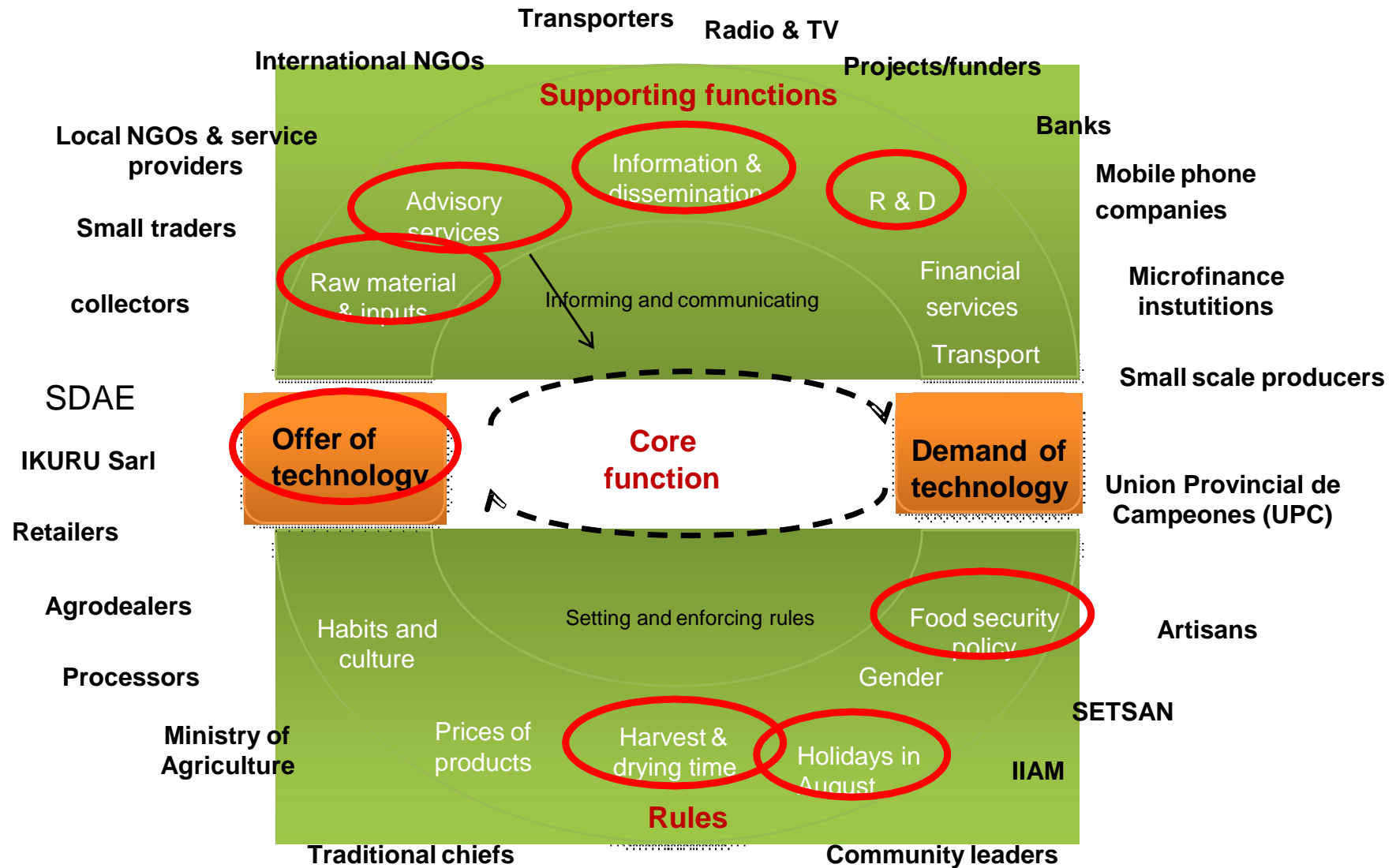
Mozambique (IIAM) admits that their efforts have not concentrated on reducing post harvest losses, but rather on finding improved crop varieties and producing basic seeds. Therefore, relatively little is known about major causes of post harvest losses, how to address the problems and which technology is the most efficient.

6. **Food security policy:** further analysis is needed in order to understand the position of the government with regard to combating the loss of food during the post harvest process. The study team has the feeling that the government is not fully aware on how much small scale producers loose of their crops or not really interested in the issue. Food security means for the SETSAN advising the population on how to eat better in order to reduce malnutrition. In national household surveys, the question of post harvest technologies and losses should be systematically addressed in order to better understand the issue.
7. **Harvesting time and proper drying:** these two problems have been sited very systematically as being important causes for post harvest losses. It is quite surprising that small producers, from which we expect a lot of indigenous and inherited knowledge, do not know the best harvesting moment in terms of humidity rate of the crop. Crops are maybe harvested too early because families have run out of food and need to eat.
8. **Holidays during August:** in the post harvest management process, August is an important month, when dried crops have to be selected and put into silos. In this key moment, all public extension workers (and probably many NGO staff) are on summer holidays for three weeks!

According to the M4P approach, each of the above mentioned bottlenecks form an interconnected market system which needs further in-depth analysis, as it has been done for the advisory services during the workshop in Pemba. After this, the sustainability matrix should be carefully filled out in order to establish our vision of the future (realistically three years) for the PHM in Mozambique (see annexe 2). Very important in the sustainability matrix are realistic answers to the questions « who will do » and « who will pay » after the project finishes, and a proper reflection about incentives (financial and non financial) to better perform for each and every concerned actor in the system.

Based on the sustainability matrix, the project staff identifies the entry points of project interventions and the actors with whom to work. With the latter, the project staff will have to negotiate a contract or memorandum of understanding. In the collaboration, the project and the partner (market actor) have to provide an offer. Last but not least, the project staff should elaborate results chains (causality model) for each intervention.

**Figure 1** : The post harvest management market system in Cabo Delgado and Nampula and main bottlenecks (in red circles)



---

## **4. Proposal for an intervention strategy**

---

As mentioned in the previous section, the mission has identified eight major bottlenecks. The project team will have to prioritise and decide which bottlenecks it will address and select the suitable actor(s) to do so. The sustainability matrix serves as base for taking this decision. The decision on which bottleneck to address depends also on the available resources of the project and the global intervention strategy of the PHM SSA project. Subsequently, the study team provides recommendations and ideas for setting up detailed systemic interventions.

### **1. Offer of technology**

There is still a need to clarify which are the most efficient technologies, which are most adapted to our target group for storing grains and seeds, how adaptable are they in terms of size, where are they available, what is their cost, and cost-benefit ratio. This should result in a basic selection of two or three technologies to be advised and disseminated. This could be done with the support of IIAM and in coordination with public extension workers and NGOs.

### **2. Raw material and inputs**

The same observation applies for the availability of raw material to produce improved technologies; project partners (NGOs and public extension workers) should make sure that raw material is available in all communities at an affordable cost. For the use of natural products for conservation, a list of used products should be made available to producers, with their respective results and availability. Also the mostly used synthetic product Atelic Super should be checked for its potential risks.

### **3. Advisory services**

Rural advisory services are at the centre of the PHM SSA project and, not surprisingly, important bottleneck in the post harvest management system of the project region. The following steps will be needed:

- A. Based on existing material, develop a curriculum and training material which includes all steps of post harvest management, from handling the product in the field, finding the right moment to harvest, drying, storing, etc.
- B. Based on selected technologies, develop a strategy to ensure promoters are available and accessible to provide advice on construction.
- C. Think of alternative methods for knowledge transfer and advice than demonstration sites (TV spots, radio, theatre, etc.).
- D. Identify the right actors to provide the right advice at the right moment. For example, if public extension workers are not available in August, other « sustainable » providers of advice will be needed.
- E. Develop an offer to collaborate with the actors. It will be important to think about the role of the respective potential partners in the project and the sustainability issue. Who will continue to provide advice beyond the end of the project? What will be the incentives for these actors to provide a good service and continue doing it after the project ends (see figure 2). ?

### **4. Information and dissemination**

Based on the selected technologies (see point 1 above), the project partners shall develop strategies for disseminating information which are adapted to the education level of the target group and

available in local languages. The information should contain clear messages about the cost-benefit of better post harvest handling and storage technologies (evidence based dissemination). Evidence based dissemination can be done through simple technical leaflets, radio programs, embedded services of technology or input supply. For example the silo artisan who advises on the right conservation product and how to properly seal the silo. The propylene bag which shows important information on the bag, etc.

**Figure 2 :** Key principles, questions and points of compromise for developing our interventions

<b>Getting the offer right</b>	
<b>Key Principals</b>	<b>Key Questions</b>
<ul style="list-style-type: none"> <li>• Clear</li> <li>• Specific (context &amp; partner)</li> <li>• Credible</li> <li>• Distinctive</li> <li>• Presented Appropriately</li> <li>• Developed with partners</li> </ul>	<ul style="list-style-type: none"> <li>• Who is the offer aimed at?</li> <li>• Why should they want what we have to offer?</li> <li>• What could they expect to get?</li> <li>• What do we expect in return?</li> <li>• How can we lock our side down?</li> <li>• How can we build in measurement?</li> </ul>

**Engagement**

- Meet on their terms, in their place
- Don't rush to the offer
- Be open to suggestions
- Manage serendipity
- It's not all about money: look for the social entrepreneur

*Source: Tim Steward (MercyCorps), 2011*

**5. Research and development**

Ensure that the study done by the HAFL student is widely presented and disseminated. Promote further research on post harvest management via lobbying at ministry level.

**6. Food security policy**

As for the research institutions, it is a question of convincing government officials that current post harvest management of crops in Mozambique represent a major economic loss for the country, besides creating food insecurity of the target population. This can be done by promoting research on the volumes of losses and their impact at different levels.

Activities on food security policy should be closely coordinated with FANRAPAN and their activities on postharvest policy evaluations. This study shall start soon (get in touché with Joao and Bellah).

**7. Harvest time and proper drying**

This is an important issue to take up in the curriculum for training and advice on post harvest management (see point 3A above). But it should also be further checked what are the reasons for harvesting too early and too late and how to address them rightly.



## 8. Holidays in August

The PHM SSA will not be able to influence on public holidays but it might ensure a diversified set of actors providing advice in order to ensure that producers have access to advice when needed.

---

## 5. Next steps

---

### **Other information and aspects to be integrated in the intervention strategy**

Although interviewees mentioned that men and women are equal in the post harvest management process, a special attention should be given to the work load distribution and ensure that through our intervention we do not overload women with work or overestimate their handling capacity.

The following aspects will need further clarification:

- Check the availability of metal silo artisans and their capacity to produce different sizes and prices.
- Check the availability of other potential technologies, like Super Bags, triple bags, among others, in the Mozambique and neighbour countries.
- Gather technical material and trainings from other projects (IFAD, FAO, GiZ, Aga Khan, etc.)
- Make interviews with small traders, wholesalers and processors to complement the mapping of actors.

### **Next steps for the project team in Mozambique**

- Develop the sustainability matrix for each core function, supporting function and rule which does currently underperform (September).
- Select the entry point, aspect on which the project will intervene, and develop the intervention strategy; develop the offer in negotiation with actors (September).
- Establish results chains based on the intervention strategy and exchange with the Rural Economy Team in Berne (Raphael, Isabelle). October
- Visit of Raphael in November.
- Establish MOU with main actors (November)

---

**Annexe 1 : List of actors visited in Cabo Delgado and Nampula provinces**

---

---

**Annexe 2 : Sustainability matrix (the future vision or «what we would like to reach in 2016»)**


---

Functions	Actors		Actors		Why?
	Who does?	Who pays?	¿Who will do?	¿Who will pay?	
<b>CORE FUNCTIONS</b>					
<b>SUPPORTING FUNCTIONS</b>					
<b>RULES</b>					



**Annexe 3 : Example of a poster on the different steps of the maize value chain**

