

Postharvest management in Sub-Saharan Africa

The overall goal of the project is to increase the food security of smallholder farmers in Sub-Saharan Africa through reduced postharvest losses of staple grains at farm and community level.



Duration

Phase I: 2013–2017 / Phase II: 2017–2020

Geographic focus

Western, Central, Southern and Eastern Africa (Sub-Saharan Africa) Focus countries: Benin, Mozambique

Beneficiaries

15'000 rural households adopting improved postharvest management practices and technologies and 100'000 households sensitized on improved postharvest management options

Key activities

- **On-farm validation** of improved harvesting, drying, threshing and storage practices and technologies for maize and pulses
- **Promotion of suitable public-private business models** to disseminate and market improved PHM technologies
- **Development of methodologies and didactic tools** for dissemination of improved PHM practices
- **Capacity building** of farmers, extension workers, agricultural training institutes, agro-businesses and other relevant market actors in PHM
- **Policy dialogues with local, national and regional decision makers** to embed PHM in policies
- **Broad awareness creation on the importance and benefits of PHM** through media, public events and the mobilization of strategic networks

Funded

by the Swiss Agency for Development and Cooperation (SDC)

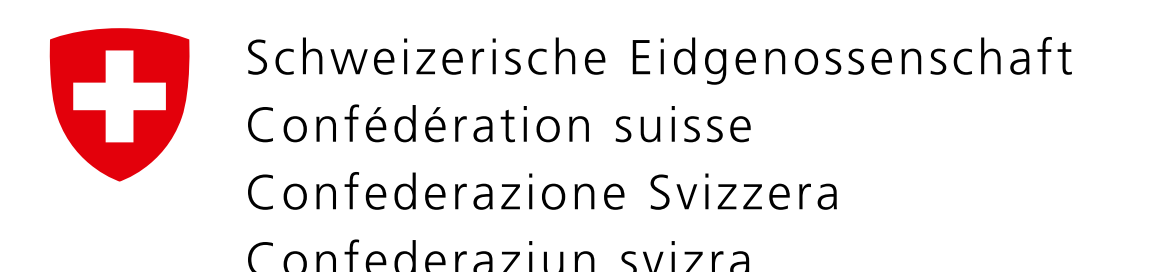
Implemented

by HELVETAS Swiss Intercooperation, the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), the African Forum for Agricultural Advisory Services (AFAAS) and AGRIDEA

Implemented by



Funded by






Swiss Agency for Development and Cooperation SDC

Improved grain and pulses storage systems in Benin and Mozambique

The project validated improved harvesting, drying, threshing and storage options in Benin and Mozambique. Traditional and new technologies were tested on-farm and assessed in terms of postharvest loss reduction, local suitability, economic benefit and social acceptance. Successful PHM options were promoted broadly through extension networks, agricultural training institutions and among agro-entrepreneurs for marketing.

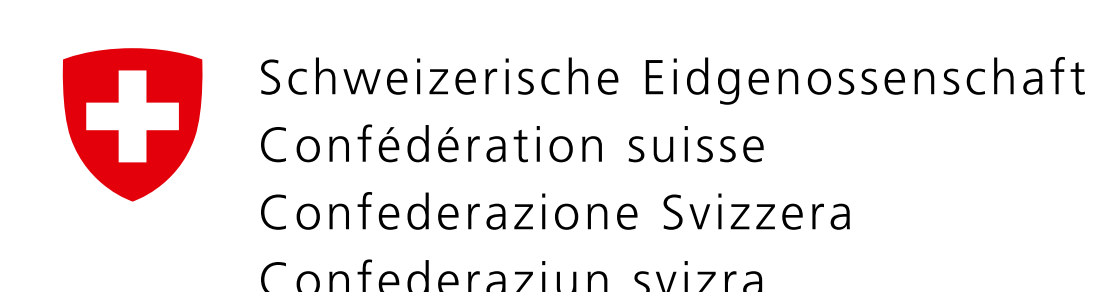
Selected storage systems: main features

Technology	Properties	Advantages	Disadvantages
Hermetic bags PICS, AgroZ, GrainPro 	Size: l = 0.9 m / w = 0.5 m Capacity: 50 kg Lifespan: 1–2 years 3- resp. 2-layer bags with 2 resp. 1 inner plastic bag(s) and 1 outer polypropylene bag, storage of grain, mainly cowpea/pulses.	Hermetic, good protection against pests, no chemical treatment needed, increasingly available on local markets. Proven efficiency for postharvest loss reduction!	Yearly costs relatively high, not safe against rodents, fragile (low tear resistance), plastic waste.
Metal silo 	Capacities: 250 kg / 350 kg / 500 kg / 1000 kg Lifespan: 20 years Cylindrical construction of galvanized, soldered metal sheets, with an inlet on the top and outlet on the bottom, lockable. To be located in a place protected from sun and rain. Storage of grain.	Hermetic, robust, high protection against pests, safe from theft, long lifespan, low yearly maintenance costs. Proven efficiency for postharvest loss reduction! High long-term economic cost-benefit ratio!	High initial investment cost, sound knowhow required to construct and handle properly.
Improved clay silo (Benin) 	Size: h = 2 m, \odot = 1.2 m, Capacity: 1000 kg, Lifespan: 15 years Cylindric construction of clay, based on platform (50 cm) with opening on the top to fill in and a lockable outlet tube on the bottom to withdraw grains. Storage of crops in grain or cob/ear.	Long lifespan, large storage capacity, several compartments for different crops, protection from rodents and birds, safe from theft, efficient in dry climate.	High maintenance and treatment costs, specialized knowhow required for construction, availability of sufficient clay required. No protection against secondary moisture.
Improved conic wooden granary (Benin) 	Size: h = 2 m, \odot = 2 m Capacity: 1000 kg Lifespan: 2 years A wooden construction with straw roof for drying and storage of crops in ears/cobs, placed next to field or house, with metal sheets on stilts to keep away rodents.	Made of local material, large storage capacity, protection from rodents and rains.	Labour cost for construction, no protection against insects and secondary moisture.
Improved elevated granary (Mozambique) 	Size: h = 1.2 m, \odot = 1.5 x 1.2 m Capacity: 300–400 kg Lifespan: 3 years Construction of wood, bamboo and clay, with straw roof, on stilts with rodent protections.	Made of local material, protection against rodents.	Short lifespan, not hermetic, no protection against insects, relatively high construction and maintenance costs.
Improved bamboo silo (Mozambique) 	Size: h = 1.4 m \odot = 1.2 m Capacity: 250–400 kg Lifespan: 3 years Round bamboo construction below a straw roof, based on stilts with rat protections. Storage of crops in ears/cobs.	Made of local material, cheap construction, protection against rodents and birds.	Short lifespan, not hermetic, no protection against insects.

Implemented by



Funded by

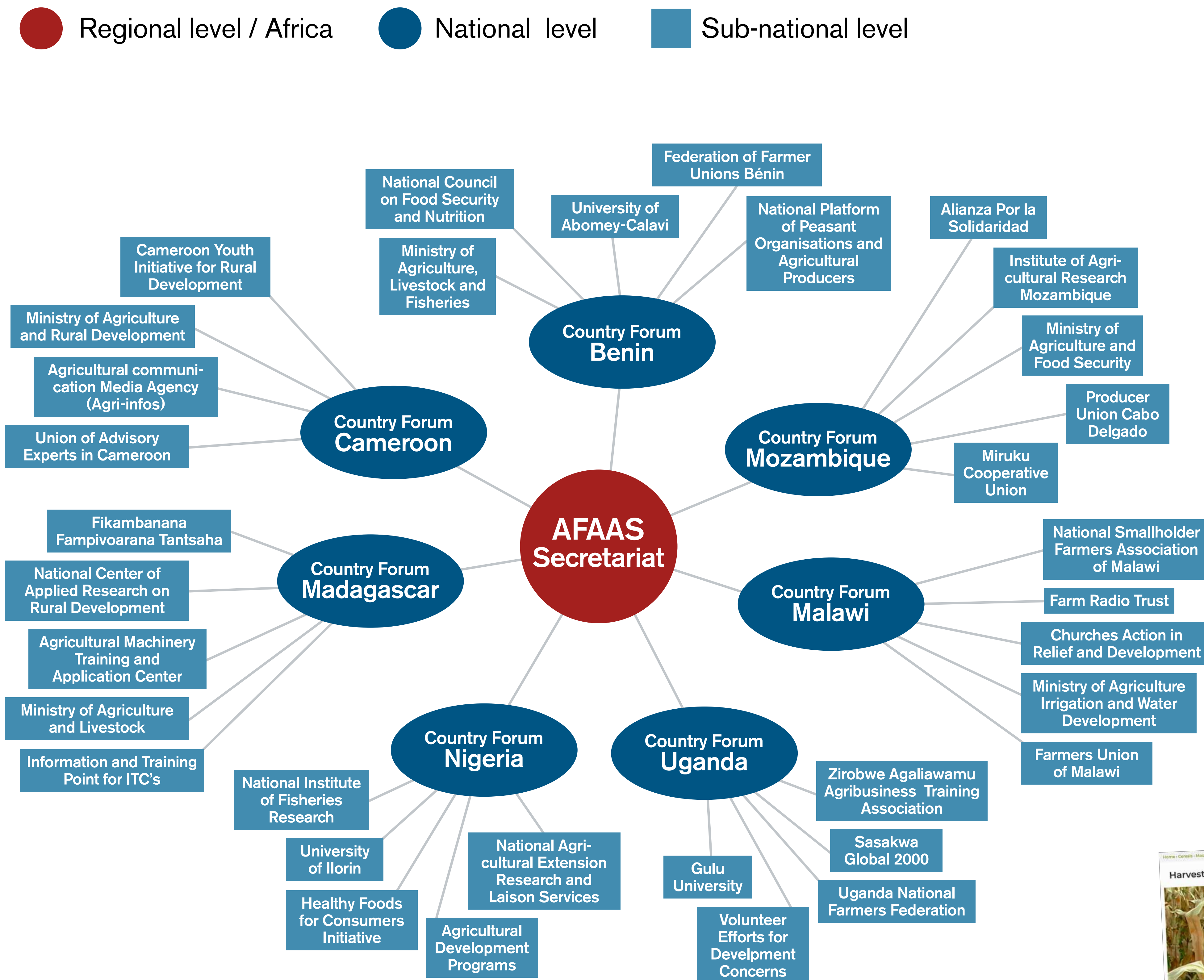


Swiss Agency for Development and Cooperation SDC

Multiplication of good postharvest management practices through an Africa-wide network

Through its network of country fora, the African Forum for Agricultural Advisory Services (AFAAS) supports multiple stakeholders across Africa in promoting improved PHM handling options and technologies. Until today, it has reached over 300 partners in 8 countries through trainings and technical advise. Over 3000 extension workers, researchers and agro-entrepreneurs were reached through virtual and social platforms all over Africa.

The AFAAS Partner Network on Postharvest Management



Multiple training and communication materials

Please visit us!

on good postharvest management (PHM) are available.

Find these and other materials on the following online platforms:

Training manuals

- Training manuals for PHM of maize and beans (Benin, French)
- Training manual for PHM of maize, groundnut and beans (Mozambique, Portuguese)

Factsheets and posters

- **Warrantage systems** (Benin, French)
- **Postharvest management of maize** (French / English) Harvesting / threshing, sorting, drying / pre-storage in cobs / storage in grain
- **Postharvest management of beans** (French / English) Harvesting / solar drying / hermetic storage
- **Cost-benefit analysis** of storage options (French / English)
- **Markets and extension services** for PHM options (Portuguese)

Videos

- **4 didactic videos on PHM of maize in Benin:** Harvesting / threshing, sorting, drying / storage / warehouse management (multiple languages)
- **Documentary on PHM practices in Tanzania** (Kiswahili)
- **PHM traditional dance, Tanzania** (Kiswahili)

AFAAS' Postharvest Management Extension and Advisory Services



<https://afaas-network.innodev.org/group/post-harvest-management-extension-and-advisory-services>

Global Community of Practice on Food Loss Reduction



www.fao.org/food-loss-reduction/en/

Access Agriculture – for videos



• Harvesting maize in a good way
www.accessagriculture.org/harvesting-maize-good-way



• Good shelling, sorting and drying of maize
www.accessagriculture.org/good-shelling-sorting-and-drying-maize



• Good storing and conserving maize grain
www.accessagriculture.org/good-storing-and-conserving-maize-grain



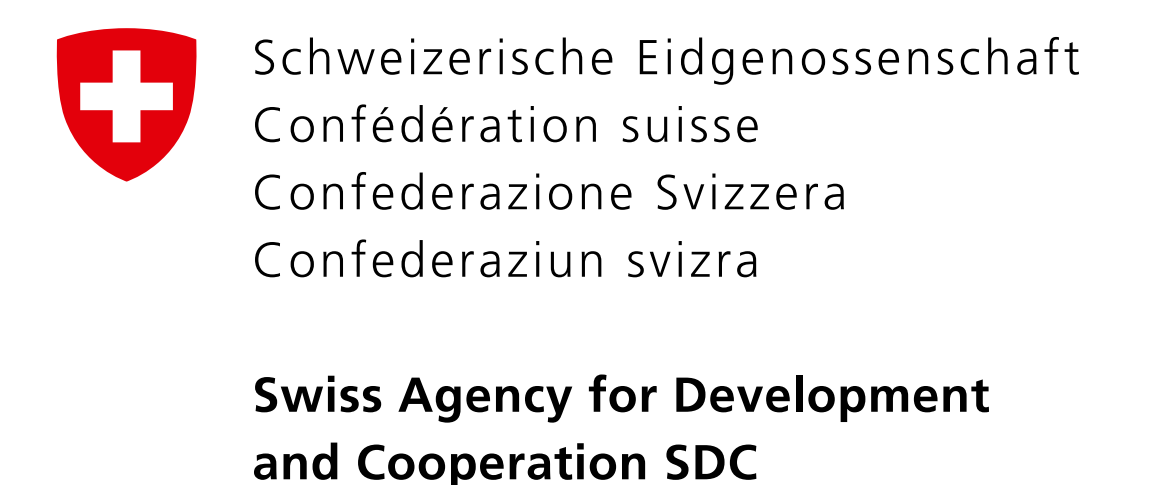
• Storing and managing maize in warehouses
www.accessagriculture.org/storing-and-managing-maize-warehouse



• Postharvest management of cereals
www.accessagriculture.org/category/44/cereals

Implemented by

Funded by



WARRANTAGE – for postharvest loss reduction, access to finance and empowerment of smallholders

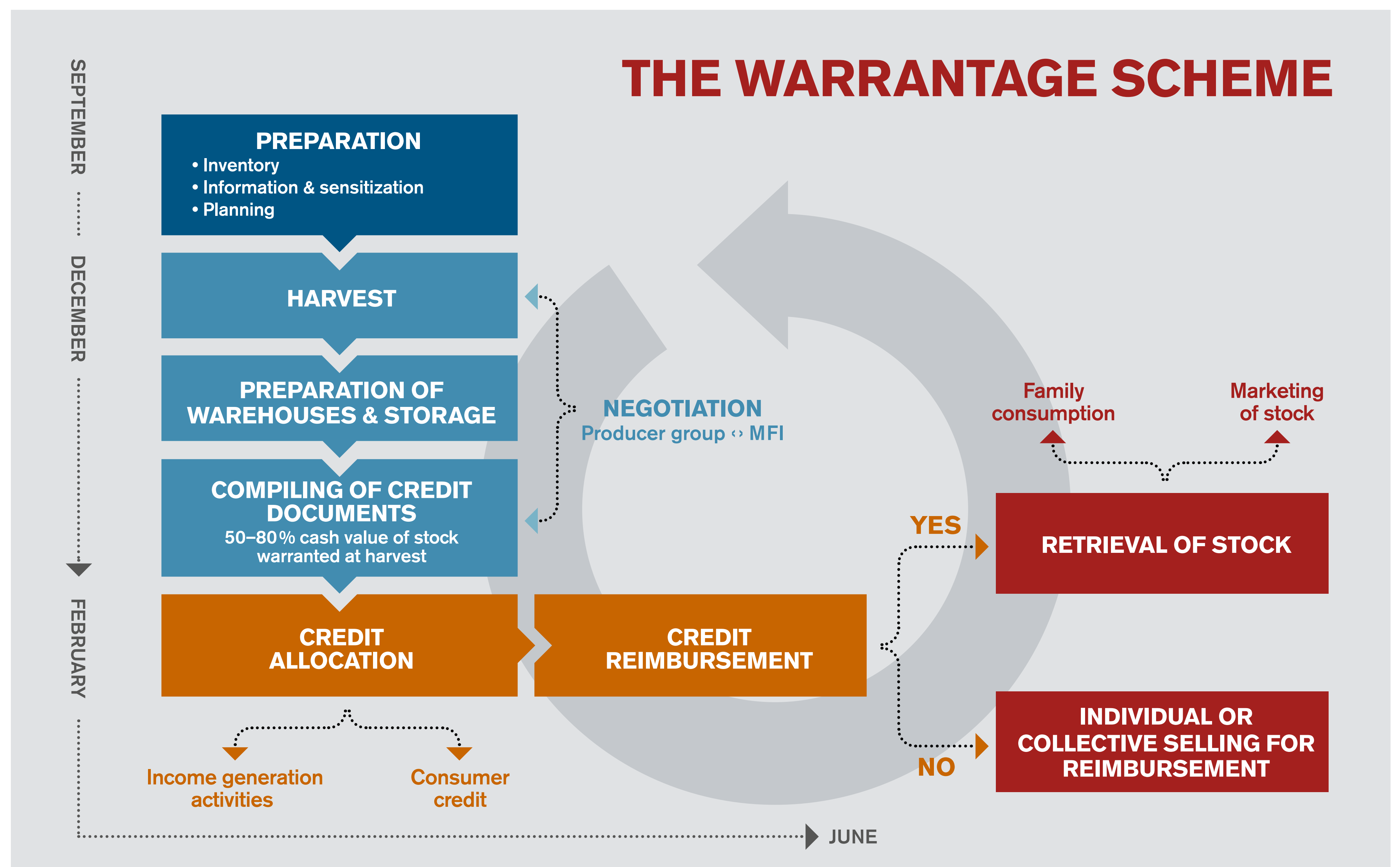
Since 2015, the project “Postharvest Management in Sub-Saharan Africa” – funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by HELVETAS, FANRPAN and AFAAS – has been promoting warrantage systems in Central and Northern Benin. The results are promising and call for wider replication: Warrantage reduces postharvest loss, provides smallholder farmers with access to credit and income, and fosters the professionalization of their organizations.

How does warrantage work?

Warrantage is a system in which stocks of conservable agricultural produce, e.g. maize or rice, are used as a collateral for a short-term credit (1–9 months).

In Benin, smallholder farmers organize to store their harvest jointly in warehouses and apply for small credits from micro-finance institutes (MFI). The credit granted is max. 80% of the actual market value of the stocks.

Typically, the value of the stock rises over time: After a few months, farmers sell their stocks at a higher price. For MFI to grant credits, a sound system of quality control and stock administration must be in place. Local service providers train and advise the warrantage groups on good post-harvest management, financial administration and organizational aspects.



Adapted graph based on illustration from FAO Burkina Faso / Project Capitalisation, 2012

«Out of 49 bags of maize harvest I warranted 17 to get a credit of 360'000 FCFA (620 US\$), which allowed me to buy two bulls and a plough for the work in the field»

Adam Adjahounka,
farmer from Coffè-Agbala, Savalou

The benefits of warrantage

Warrantage provides farmers with multiple benefits:

- Prevents farmers from selling off their crop at a low price.
- Fosters good postharvest management and reduces losses.
- Allows for grain conservation without pesticides thanks to systematic stock management.
- Provides access to finance, especially to women.
- Creates additional income due to the price differential between harvest and lean season.
- Allows families to invest in small businesses, agricultural inputs and to cover family needs (e.g. schooling, health).
- Enhances negotiation power of farmer groups vis-à-vis buyers (higher volumes, higher grain quality).
- Secures food stocks over a longer period (food security).
- Fosters the professionalization of producer organizations.
- Strengthens the cohesion and trust among farmers.

«Thanks to warrantage, our family does not get into dept anymore to pay the health care and schooling of our three children»

Martine N'Sare,
farmer from Koukongou, Boukombé

Replicating warrantage systems

In view of the multiple benefits, warrantage has a big potential to be replicated in Benin and other African countries. A key condition to upscale warrantage is the establishing of suitable credit schemes from micro-finance institutes.



Warehouse of farmer group "Diwpare" in Boukombé, capacity: 250t

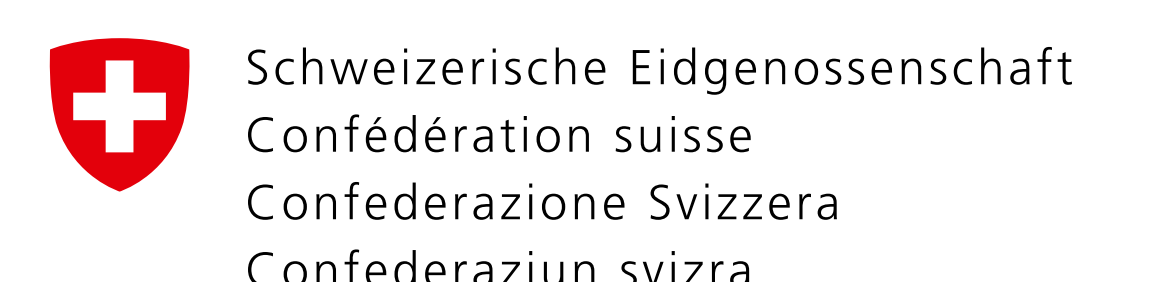


Diwpare group in Koutchaté community, holding a training session on cooperative management

Implemented by



Funded by



Swiss Agency for Development and Cooperation SDC

Cost-benefit analysis of post harvest man- agement technologies in Mozambique

A national cost-benefit analysis of storage technologies was conducted in Mozambique to support the government in defining policies for cost-efficient postharvest management. Hermetic bags and metal silos were shown to be economically viable alternatives to traditional storage. Depending on the type of crop, farmers increase their income 2.77 to 3.87 times by using hermetic storage.

Background

- Annually, Mozambique experiences about 400,000 MT of food deficit, much of which is attributed to postharvest loss.
- In Mozambique, postharvest losses are estimated between 20 and 30% of harvest. (FAO)

Main causes:

- poor handling practices during harvesting, threshing, and transporting
- bio-degradation caused by pests including insects, moulds and fungi, rodents and birds

Impacts:

- Low quality of final product due to limited management and inadequate storage
- Reduced monetary income from low sales stocks due to postharvest losses
- Threat to household food and nutrition security

Cost-benefit analysis (CBA) methodology

To undertake a CBA, streams of incremental costs and benefits associated with the adoption of the metal silo and hermetic bag technologies were constructed, based on the knowledge available on postharvest loss management practices of farmers in Mozambique. Net cash-flows were calculated based on the expected lifespans of the metal silos and hermetic bags (20 years and 2 years, respectively). An 0,3% loss was assumed for hermetic bags.

Discounting of the cash flows

Cash-flows were discounted at a rate of 12% for the base case, 10% for the best case and 14% for the pessimistic scenario rate determined by the Ramsey equation.



Traditional bamboo silo, Mozambique



Metal silos of different sizes

Findings

Sensitivity analysis

Rigorous sensitivity analysis assumed the following four main scenarios: 20% less benefit from base case; 20% more benefit from the base case; 14% discount rate (assuming a more risky environment than base case of 12%); and 10% discount rate (assuming less risky environment).

Viability indicators

To assess viability of the investments in post-harvest loss management technologies, five indicators were computed using the various scenarios of risk, farmer post-harvest management preferences and technology type, standardizing the quantity stored as 500kg. These indicators were: Net present value (NPV) (of the net cash flows); Internal rate of return; Benefit-to-cost ratio; Payback period; and Breakeven point.

MAIZE				
Indicator	Metal Silo		Hermetic Bag	
	Sells	Stores	Sells	Stores
Net Present Value (sum of all discounted future cash flows, US\$)	37.97	56.83	27.31	43.36
Benefit to Cost Ratio	6.05	8.59	2.5	3.55
Internal Rate of Return (effective interest rate)	> 50,000	200	> 50,000	> 50,000
Payback Period (years)	2	1	3	3

BEANS				
Indicator	Metal Silo		Hermetic Bag	
	Sells	Stores	Sells	Stores
Net Present Value (sum of all discounted future cash flows, US\$)	54.57	163.26	43.92	152.6
Benefit to Cost Ratio	8.26	22.72	3.42	9.4
Internal Rate of Return (effective interest rate)	>100,000	>200,000	>50,000	>500,000
Payback Period (years)	1	1	3	1

COWPEAS				
Indicator	Metal Silo		Hermetic Bag	
	Sells	Stores	Sells	Stores
Net Present Value (sum of all discounted future cash flows, US\$)	23.53	67.21	12.87	67.25
Benefit to Cost Ratio	4.13	4.7	1.71	4.7
Internal Rate of Return (effective interest rate)	100	>200,000	>50,000	>500,000
Payback Period (years)	2	2	7	2

Implications of the findings

- Hermetic bags and metal silos are viable storage technologies
- Viability varies depending on the type of crop
- Metal silos are more viable in the long-term
- Start-up costs of metal silos are 1,5 to 3 times higher in the short term
- Farmer incomes increase 2,77 to 3,87 times as a proportion of Agri-GDP compared to traditional methods
- There is a vast potential for the private sector to produce and supply technologies



PICS bag

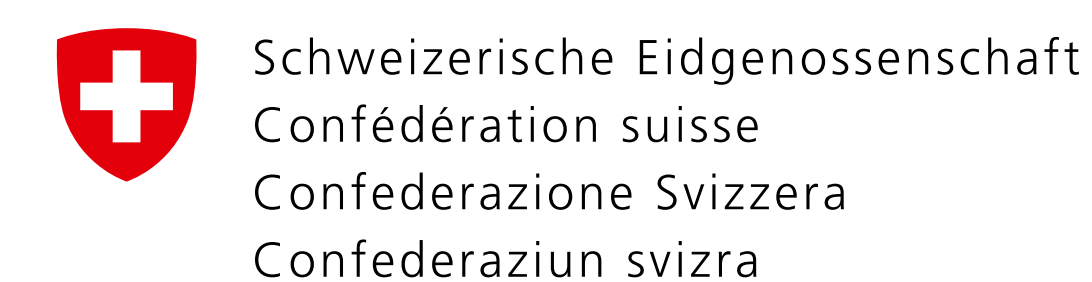
Conclusion

- PHM in Mozambique is affected by lack of infrastructure, transportation, local oriented food industries, policy gaps
- There is general lack of adequate knowledge of PHM among stakeholders.
- Storage losses force farmers to sell their produce early to avoid physical losses thereby reducing opportunities to sell at favourable prices.
- Average returns to storage of maize are very low in Maputo and Southern region (22%) where there is low production and low seasonal price variation and very high in the Northern region which is characterised by high production and high seasonal price variability.
- Small scale farmers who constitute 99% of the farmers prefer super bags and metal silos but only a few afford them because of high costs.

Implemented by



Funded by



Swiss Agency for Development and Cooperation SDC

Institutionalization of postharvest management in local markets and extension services of Mozambique

How can the dissemination of proven postharvest management (PHM) practices and technologies be integrated permanently into institutions and markets in Mozambique? The project “Postharvest Management in Sub-Saharan Africa” focused on two strategies: 1. Building up of knowhow and experience in national research centers and integrating PHM into the curricula of agricultural training institutes; and 2. Fostering business linkages between agro-entrepreneurs to boost local supply of improved postharvest technologies (e.g. hermetic bags).

How the project inserted PHM into Mozambique’s training and extension system:

On-farm testing of PHM options (harvest, threshing, sorting, drying, storage) under the lead of Mozambique’s Institute of Agricultural Research (IIAM), together with extension services (SDAE), producer organizations (UPC) and students.

Documentation of promising PHM options (manuals, fact-sheets, videos)

Demonstration sites at research centres, public extension services and technical schools.

Training of Trainers by IIAM to extension agents and technical school teachers.

Joint **revision of training modules** of agricultural training institutes (Cabo Delgado, Nampula) by IIAM and trainers.

Experience used to advocate with Ministry for **revision of national agricultural extension curricula**.

How the project fostered markets and services for hermetic bags:

Results of hermetic bag tests: $\leq 0.3\%$ of quantitative loss reduction during months of storage, compared to storage in silos and improved granaries.

Identification of interested **local market actors**

Developing of business models for the broad promotion and marketing of hermetic bags.

Facilitation of **business linkages** between:

- **A to Z Textile Mills Ltd** – Producer of AgroZ hermetic bags (Tanzania)
- **Casa do Agricultor** – National agro-input distributor with outlet shops in various provinces.

Facilitation of **linkages** between **bag suppliers** (e.g. Casa do Agricultor) and **other initiatives**, e.g. World Food Programme; strengthening of agro-dealer and sales agent **networks** – focusing on community level markets.

- **Training materials are today used and disseminated broadly** by Ministry of Agriculture, Agricultural Training Schools, Extension services and NGOs.
- **Five agricultural training institutes** have integrated PHM exten-

sively in their training modules, two other institutes are expected to do so by 2020.

- IIAM is recognized as **PHM knowledge centre**, providing advice and trainings to trainers.

- Today, various **local distributors** are supplying hermetic bags: Casa Agraria MMB, Loja de Insumos Chiure.
- Distributors inform buyers about the **handling and benefits** of bags (integrated service).

- **AgroZ bags are available** at community level and farmers are confident on their benefits.
- **Sales** in Northern Mozambique were at 10’000 bags in 2018 and are expected to reach 20’000 bags by the end of 2019.



Group of teachers trained in the use of AgroZ hermetic bags



Training session on the use of metal silos



Practical training session on AgroZ hermetic bags

“Today, as a teacher, I treat postharvest management in a holistic and interconnected way with a more solid practical component.”

Antonio Napaua,
teacher at the Agrarian Institute of Ribaue
– Nampula Province

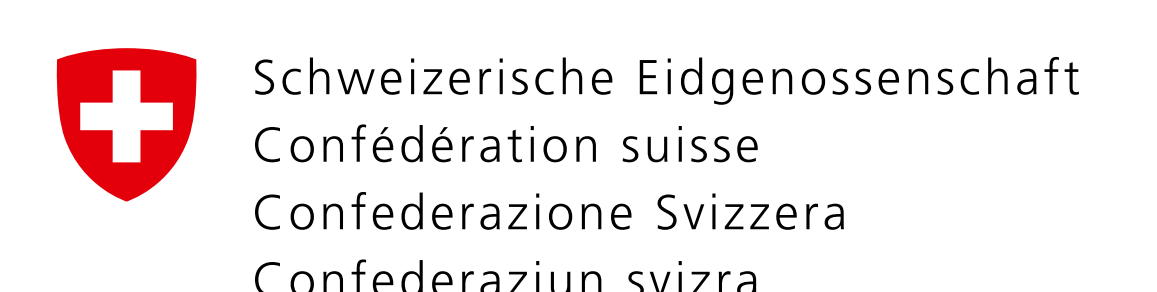
“As an agro-dealer, I advise farmers that one of the best ways to store production is using hermetic bags because you can keep the product for a long time and you do not need to use chemicals to protect the grain.”

Nheta Adamo,
agro-dealer

Implemented by



Funded by



Swiss Agency for Development and Cooperation SDC