



#### Location

Tena, Napo Province, Ecuador

#### Implementation Period

01/2022 to 12/2022

#### Contribution to SDGs

2, 5, 7, 9, 13

## Reinforcing Ancestral Kichwa Production Systems in Ecuador Through a WEF Nexus Approach

### Fostering clean energy in agricultural processes through implementation of a Solar Cocoa Dryer for the Kallari Association in Tena, Ecuador

#### LOCAL CONTEXT

Tena is the capital city of the Napo Province and is located in the Amazonian rainforest of Ecuador. Here, around 1500 indigenous Kichwa families and the Kallari Association practice sustainable agriculture by producing, processing, and marketing local products such as cacao, improving community living conditions and preserving biodiversity. Drying of grains and beans has historically relied on solar energy through open-air, outdoor practices. However, this requires much labour, increases the risk of bacterial exposure, and results in uneven end products, leading to a 10-25% worldwide loss in harvested grains. Fossil fuels are currently the primary energy source for drying grains, resulting in a significant increase in energy consumption, local pollution, and greenhouse gas emissions. By replacing fossil-fuel with renewable solar energy in the drying process, the Nexus approach will improve community welfare, eliminate GHG emissions and pollution, and ensure proper drying of beans to guarantee much higher quality of the chocolate bean end-product.

#### OBJECTIVE

The overall objective of Tena WEF Nexus project is to improve the process of cocoa bean drying using innovative and energy-efficient solar technology, replacing fossil fuels and avoiding the subsequent GHG emissions and pollution. In turn, this will improve the production, processing and marketing of cocoa beans (by producing a higher value-added product, thus benefiting farming families and improving their quality of life.

#### EXPECTED IMPACT

The use of an innovative and energy efficient solar powered process will reduce the overall drying time and allow for better control of moisture content of the processed cocoa. The process will avoid exposure to bacteria and therefore reduce the loss of cocoa beans due to degradation. In addition to improving the quality of the dried cocoa bean, it will generate economic benefits for smallholder farmers and will reduce greenhouse gas emissions by using renewable and cleaner energies.

## KEY ACTIVITIES

1) Manufacture and installation of the thermal equipment for the solar dryer:

- 1 Solar Collector
- 2 metal drying tables with an area of 15m<sup>2</sup> each with thermally insulated walls and a capacity of 1.25-2 tons of cocoa
- A centrifugal fan and axial fans to conduct the air from the solar collector to the drying tables and extract the humid air from the greenhouse.
- Air distribution ducts
- Electric backup heating

2) Development of:

- Technical guide of the prototype: The prototype will help public and private sector stakeholders to replicate the technology in other places where grain or bean drying is needed
- Solar dryer manual to ensure proper operation, cleaning and maintenance by project beneficiaries

3) Training of Kallari Association staff on operation and maintenance of the solar dryer system.

## KEY EXPECTED RESULTS

- The drying time can be controlled according to the quality of the cocoa beans.
- Drying period is more controlled and there is no risk of damage to the cocoa beans due to exposure to high temperatures (damage due to overly high temperatures can occur with fossil-powered systems).
- Drying time of cocoa beans is reduced from twelve days or even 15 days (during rainy periods) to six days.
- Increase cocoa production by 23.66 tons per year (739.6 kg per batch).
- Potential reduction of approximately 18.4% in CO<sub>2</sub> emissions.
- The 24 m<sup>2</sup> solar collector will have an average thermal efficiency of approximately 50%.
- The average annual solar radiation at the Collection Center is 4.2 kWh/m<sup>2</sup>/day, which represents an annual energy generation of 9,580.8 kWh (drying 32 batches of cocoa beans).



## BENEFICIARIES

- Direct beneficiaries: The solar dryer will improve the well-being of 900 Kallari members
- Indirect beneficiaries: Legal and commercial partners in the community of Tena, Ecuador.

## LESSONS LEARNED

- A little more than half of the respondents (60%), 18 out of 30, acknowledged that their economic situation in 2022 was better than in 2021 due to increased profits from the sale of cocoa and better sales of the products planted. However, external factors such as COVID 19, together with lack of employment opportunities, have negatively affected the lives of some families. Due to these factors, 37% of respondents, 11 out of 30, rated their current situation as "worse" than the previous year.
- Despite generating economic income, the benefits are still generally insufficient to meet the needs of the families. No family rated the income generated during 2022 as sufficient to cover their needs. Just over half (57%) of respondents considered that the income partially covered their needs, while 42% indicated that they had not covered their family's needs with the income generated.