UK PACT
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AIDER
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AGROFORESTY business models promoted by AIDER in native communities of Ucayali and Madre de Dios

CCPIP

Lima, Peru
2022

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Bosques Amazónicos

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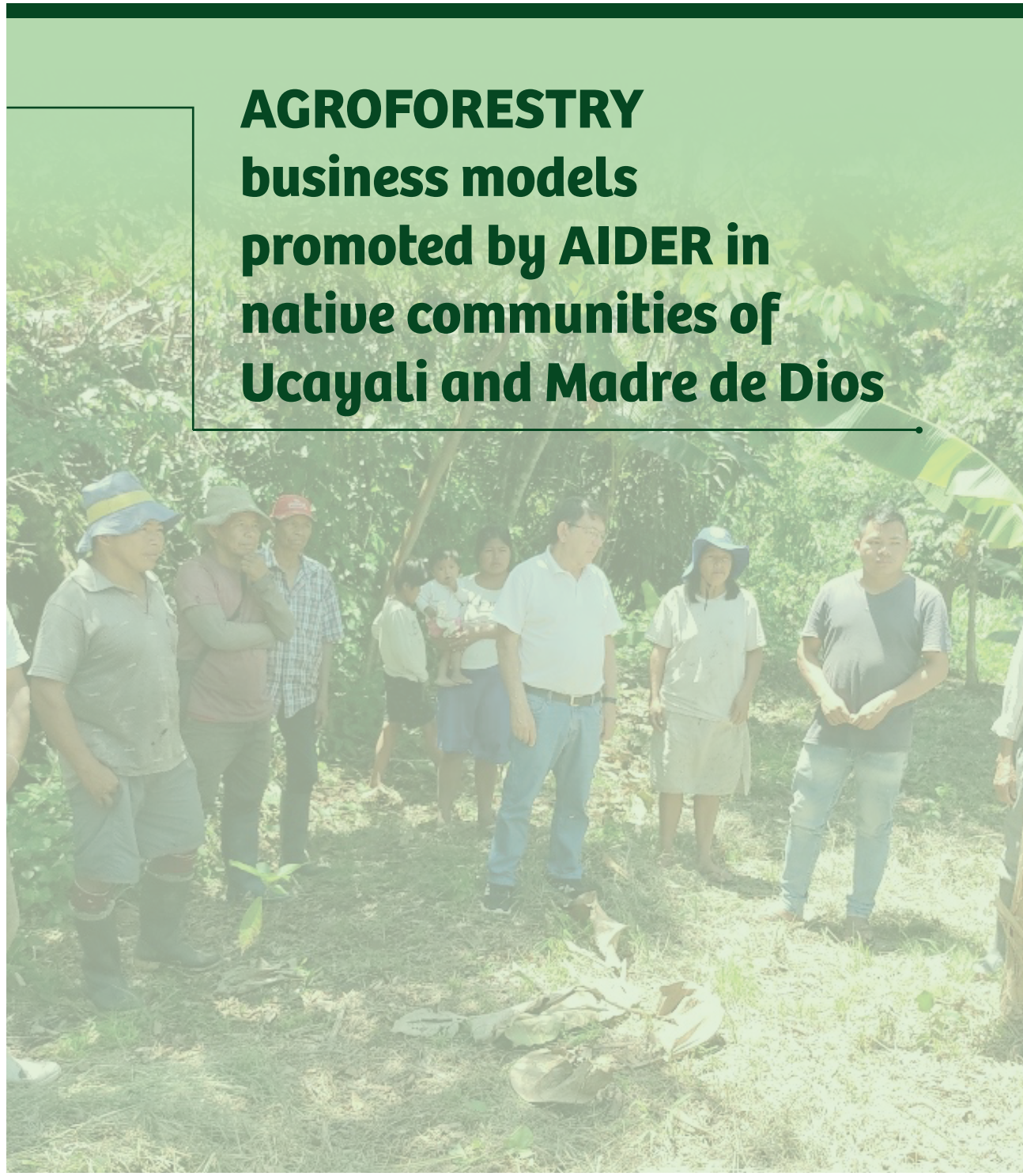

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List of acronyms and abbreviations

°C	Degrees Celsius
ACCA	Amazon conservation
AFP	Agroforestry plot
AFS	Agroforestry system
AIDER	Association for Research and Integral Development
Agrobosque	Agriculture Cooperative of Agroforest Services
Agroideas	Competitiveness compensations Program
B/C	Benefit/cost ratio
BAM	Bosques Amazónicos SAC
B/C	Benefit/cost ratio
BF	Board foot (1 ft. x 1 ft. x 1 in.)
CCIPP	Chamber of Commerce of Indigenous Peoples of Peru
CFM	Communal forest management
CIMA	Center for Conservation, Research and Management of Natural Areas
CITE forestal	Center for Productive Innovation and Forestry Technology Transfer
CONSTEC	National Council of Science, Technology and Innovation
Coopaser	Agricultural Cooperative of Multiple Services Tambopata Candamo
DEVIDA	National Commission for Development and Drug-Free Life
DRA	Regional Directorate of Agriculture
DEVIDA	National Commission for Development and Drug-Free Life
DRAU	Regional Directorate of Agricultura of Ucayali
FOB	Free on Board (agreed loading port)
FSC	Forest Stewardship Council
SWOT	Strengths, opportunities, weaknesses and threats
FSC	Forest Stewardship Council
GORE	Regional government
GOREMAD	Regional Government of Madre de Dios
GOREU	Regional Government of Ucayali
ha	Hectare
IC	International Conservation
IRR	Internal rate of return
INIA	National Institute of Agricultural Innovation
ITC	International Technical Cooperation
MINAM	Ministry of the Environment
m. a. s. l.	Meters above sea level
m3	Cubic meter
MDD	Madre de Dios
MINAM	Ministry of the Environment
N:C.	Native Community
NVP	Net current value
PNCB	National Forest Conservation Program
PP	Period of return on investment
Project	Project: "Climate change mitigation with agroforestry inclusive sustainable businesses that contribute to the development of indigenous peoples "Buen Vivir" in the Peruvian Amazon ".
REDD+	Reduced emissions from deforestation and forest degradation (symbol + implies with forest management)
RNTAMB	Tambopata National Reserve
SENASA	National Agricultural Health Service of Peru
SERNANP	National Service of State Protected Areas
SUNAT	National Customs and Tax Administration Superintendence
SWOT	Strengths, opportunities, weaknesses and threats
UK PACT	UK Partnering for Accelerated Climate Transitions
USA	United States of America
USAID	United States Agency for International Development
US$	U.S. dollar
USDA	United States Department of Agriculture
WWF	World Wide Fund for Nature

Executive overview

- AIDER signed an agreement with the United Kingdom (UK), through the Green Recovery Challenge Fund (PACT), for the implementation of the project "Climate change mitigation with agroforestry inclusive sustainable businesses that contribute to the development of indigenous peoples "Buen Vivir" in the Peruvian Amazon", in alliance with the Chamber of Commerce of Indigenous Peoples of Peru (CCIPP) and the company Bosques Amazónicos S.A.C. (BAM), in the period of January - December of 2022.

As a result of the project, two sustainable agroforestry business models were designed and implemented, aimed at recovering degraded lands in native Amazonian communities and to obtain agricultural and forestry products, carbon sequestration and to integrate into value chains. The models consider plantain and cocoa as agricultural components and shihuahuaco, a timber species, as a forestry component. Agroforestry plots are managed by interest groups created within the communities themselves, where both men and women participate.

In order to contribute to the dissemination and guide replication actions, the project proposed the participatory systematization and socialization of these models. The objective of the systematization is to rescue the experiences of the agroforestry interest groups of the native communities of Yamino and Mariscal Caceres in Ucayali and Infierno and Tres Islas in Madre de Dios, regarding the production of seedlings and installation of agroforestry plots and to know their expectations of this productive activity, as well as to systematically document these business models, the mapping of the agroforestry value chain and SWOT analysis of two business organizations participating in the chain, such as the indigenous company Nii Biri in Ucayali and the Coopaser Cooperative in Madre de Dios.

For the systematization of the models and for the mapping of the value chains of Nii Biri and Coopaser, the methodology proposed by Jara (s.f.) and two of the participatory tools proposed by Lundy et al. (2014) were used. The agroforestry business models, worked on with Nii Biri and Coopaser, were carried out using the Canvas tool. The definition of the agroforestry model was complemented with the analysis of the SWOT matrix.

The systematization was carried out under four axes: agroforestry system design, the agroforestry value chain, Nii Biri and Coopaser business models and the economic analysis of the agroforestry business models. The main sources of information were gathered during the workshops and field visits in the native communities, the knowledge and experiences of the technical teams of AIDER, Nii Biri and Coopaser, secondary information, etc.

The model considers Nii Biri as the main commercial articulator in Ucayali and Coopaser in Madre de Dios, which link chain actors and agroforestry products from native communities with the national market. Potential sources of financing are private investors, with whom the communities channel funds to develop their agroforestry activities; in addition, there are national and international banks, as well as state programs that are also sources of financing; likewise, the communities, through other productive activities, also have funds to invest in agroforestry.

The productive committees carry out the activities of seedling production, installation and maintenance of the agroforestry system. The relationship between investors, clients, Nii Biri (Ucayali) and Coopaser (Madre de Dios) and the native communities, with technical support from AIDER, makes it possible to close the cycle of agroforestry products in which the benefits are distributed equitably throughout the value chain. Prior to the start of the project, the community members had little knowledge and experience in agroforestry practices, and therefore the agroforestry plots installed were not well managed and had minimal cocoa production. With support from the project, communal nurseries were installed for seedling production and 40 agroforestry plots were established at the family level, following the proposed models with a square design system and 3x3 m plant spacing, which allows 1,056 plantain plants, 1,038 cocoa plants and 51 shihuahuaco plants to be planted per hectare.

In general, the agroforestry value chain has the following links: input and service providers, agroforestry production, market, processing, marketing and consumption.

The economic models of the agroforestry system for Ucayali and Madre de Dios are economically attractive for a discount rate of 9.02%; for Ucayali the IRR is 20.82%, B/C of 1.51, with a PP of six years of installed agroforestry plot and positive NPV of S/ 30,703 and for Madre de Dios, the IRR is 17.95%, B/C of 1.58, PP of eight years and positive NCV of S/ 34,940. Therefore, the establishment of agroforestry plots under these two models that demonstrate economic profitability is recommended.

Likewise, it is recommended to promote the establishment of a greater number of agroforestry plantations in native communities on former deforested areas, since in addition to being an economically viable productive activity, it has a positive environmental impact that allows carbon sequestration and the recovery of degraded areas, which contributes to improving the quality of life of native communities. It is therefore necessary to continue with the development of capacities and technical assistance, especially in the areas of maintenance, harvesting and post-harvesting, as well as strengthening business skills to comply with agreements regarding quality, time, opportunity and price, which in turn guarantee the traceability of the agroforestry products and access to fair trade and organic certifications.

It is also recommended to consolidate the agroforestry value chain by integrating the actors of the different links with whom Nii Biri and Coopaser have been working, which creates relationships of trust and allows an exchange of information for the benefit of all actors in the chain, promoting the production of agroforestry products with greater added value, making the business models more attractive.

The members of the native communities are organized in interest groups for the production of seedlings, where men and women participate on equal terms. In the process of installing the agroforestry systems, the members of the interest group participate, with the support of their partners and children in the case of Ucayali; while in the communities of Madre de Dios, the activities are carried out by couples or under contract with third parties, personnel from the area.

Introduction

AIDER signed an agreement with the United Kingdom (UK), through the Green Recovery Challenge Fund (PACT), for the implementation of the project "Climate change mitigation with agroforestry inclusive sustainable businesses that contribute to the development of indigenous peoples "Buen Vivir " in the Peruvian Amazon", in alliance with the Chamber of Commerce of Indigenous Peoples of Peru (CCIPP) and the company Bosques Amazónicos S.A.C. (BAM), for the period of January - December of 2022.

One of the results of the project was that the native communities of Yamino and Mariscal Caceres in the Ucayali region and Tres Islas and Infierno in the Madre de Dios region replicated agroforestry businesses, thus, the technical and socio-organizational capacities of indigenous men and women in these communities for business management, as well as for land and forest management were improved through the implementation of courses-workshops, technical assistance and internships, achieving the establishment of 40 agroforestry plots to obtain agricultural and forestry products, in addition to sequestering carbon and allowing them to remain integrated in the value chains, in an equitable and sustainable manner and in harmony with the indigenous cultural identity.

These four communities received training from indigenous men and women from the native communities of Curiaca, Pueblo Nuevo, Roya, Flor de Ucayali and Sinchi Roca in the Ucayali region, who operate agroforestry plots for commercial purposes, supported by AIDER through the Forestry Alliance Project, and who are prepared to transfer their own skills and experiences.

In each community where agroforestry plots were installed, with the support of the Project, committees or interest groups for agroforestry businesses were formed or strengthened, commercial agreements were made with Nii Biri and Coopaser and agreements were also established with private organizations for agroforestry financing, with the participation of AIDER.

To gather information, four participatory workshops were held in October and November of 2022 with members of the agroforestry interest groups in the native communities of Yamino and Mariscal Caceres in Ucayali and Infierno and Tres Islas in Madre de Dios, in which external actors have intervened with the agroforestry topic were identified, and the activities they carried out during 2022 for the production of seedlings and the installation of agroforestry systems were determined, considering inputs, tools and equipment, labor and time that the community members dedicate to these activities.

Likewise, two workshops were held, one with members of the indigenous company Nii Biri and the other with the cooperative Coopaser, to develop a participatory business model using the Canvas tool, the mapping of the value chain using part of the LINK methodology and a SWOT analysis of the organization.

This document presents the results of the experience of the native communities of Yamino, Mariscal Cáceres, Infierno and Tres Islas in the production of seedlings and the installation of agroforestry systems with cocoa, as reflected in the economic analysis for one hectare of agroforestry system, complemented with the production forecast, costs and income derived from this productive activity; in order to estimate the profitability through an economic analysis, as part of the proposal for the Communal Forest Management promoted by AIDER[1].

Likewise, the results of the workshops with the indigenous company Nii Biri and the cooperative Coopaser, which were conducted in a participatory manner, the business model using the Canvas tool, the mapping of the value chain of each organization and the SWOT analysis, which were inputs to develop the agroforestry business model that involves the native communities, these organizations and all the other direct and indirect actors involved in this business, are presented. These analyses allow the organizations to make a diagnosis of their operations for continuous improvement, which facilitates the process of incorporating the native communities as partners in the business model, and also helps the organizations identify the actors that are relevant to their business and promote strategic alliances that benefit those involved in the value chain.

In each community where agroforestry plots were installed, with the support of the Project, committees or interest groups for agroforestry businesses were formed or strengthened, commercial agreements were made with Nii Biri and Coopaser.

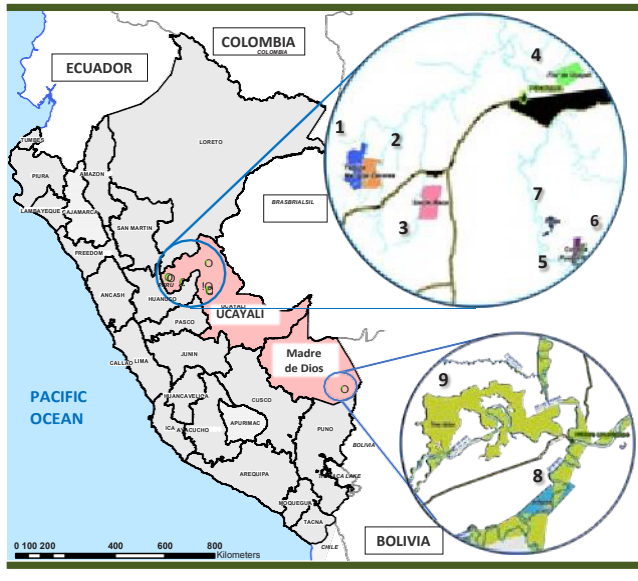
[1]AIDER. 2020. Communal Forest Management: a proposal for forest management and the sustainable development of native communities in the Peruvian Amazon. Lima, Peru. Available at: https://aider.com.pe/publicaciones/Manejo-de-Bosques-Comunales-AIDER.pdf

1 Systematization process

1.1 Location of the project's native communities

The native communities of Curiaca, Pueblo Nuevo, Roya, Flor de Ucayali and Sinchi Roca in Ucayali, which have been implementing the agroforestry business, participated in the project, as well as the communities of Yamino and Mariscal Caceres in Ucayali and Tres Islas and Infierno in Madre de Dios, which have been replicating this experience. In figure 1 the map with the location of these communities is shown.

Figure 1. Location of the project's native communities.



Native communities of Ucayali

Native community	Ethnicity
1. Yamino	Kakataibo
2. Mariscal Caceres	Kakataibo
3.Sinchi Roca	Kakataibo
4. Pueblo nuevo	Shipibo - Conibo
5. Curiaca	Shipibo - Conibo
6. Pueblo Nuevo	Shipibo - Conibo
7. Roya	Shipibo - Conibo

Native communities of Madre de Dios

Native community	Ethnicity
8. Infierno	Ese'eja
9. Tres Islas	Ese'eja - Shipibo Conibo

1.2 Methodology for the systematization

To systematize the agroforestry business models promoted by AIDER with the indigenous company Nii Biri in the Ucayali region and with the Coopaser cooperative in the Madre de Dios region, two methodological tools were used:

A. **Methodology proposed by Jara (n.d.) [2],** used for the systematization of the experience of the agroforestry interest groups of the native communities of Yamino and Mariscal Cáceres in Ucayali and Tres Islas and Infierno in Madre de Dios, for the production of seedlings in nurseries and the establishment of agroforestry plots. This methodology is developed in five stages:

First. The starting point:

a) To have participated in the experience
b) To have records of the experiences

Second. The initial questions:

a) What do we want to do this systematization for? (define the objective)
b) What experience(s) do we want to systematize? (delimit the object to be systematized)
c) What central aspects of these experiences are we interested in systematizing? (specify a systematization axis)
d) What sources of information will we use?
e) What procedures will we follow?

Third. Recovery of the lived process:

a) Reconstructing history
b) Sorting and classifying the information

Fourth. The underlying reflection: why did what happened happen?

a) Analyze and synthesize
b) Make a critical interpretation of the process

Fifth. The points of arrival:

a) Formulate conclusions
b) Communicate the lessons learned

B. **Two participatory tools proposed by Lundy *et al*. (2014)[3] from CIAT were used** for the systematization of the agroforestry business models and for the value chain mapping of the two organizations (Nii Biri and Coopaser), as described below:

- The key questions to describe the business model of the two organizations are:
  - How does the organization work?
  - Is the existing business model viable?
  - What changes to the business model can improve overall performance?
  - What are the strengths and weaknesses of the business model?
  - What environmental influences positively and negatively influence the business model?

[2] Jara,0. n.d. Theoretical-practical guidelines for the systematization of experiences. 16 p. Available at http://148.202.167.116:8080/xmlui/bitstream/handle/123456789/3845/Orientaciones_teorico-practicas_sistematizar_experiencias.pdf?sequence=1&isAllowed=y

[3] Lundy, Mark. LINK methodology: A participatory guide for inclusive business models with small holder farmers / Mark Lundy, Gertjan Becx, Nancy Zamierowski, Alexandra Amrein, Jhon Jairo Hurtado, Erika Eliana Mosquera, Fernando Rodríguez. -- Cali, CO: International Center for Tropical Agriculture (CIAT) 2012. 171 p. (CIAT Publication No. 379). ISBN 978-958-694-115-0 (PDF). Available at: https://cgspace.cgiar.org/handle/10568/49604

- Does the buyer's business model facilitate the inclusion of small-scale producers as suppliers?
- Does the buyer's business model have a two-way value proposal (to its customers and to its suppliers)?
- Does the current model of the producer organization make it attractive as a business partner for a formal buyer?

- The value chain mapping seeks to answer the following key questions:
  - What are the key actions in the value chain?
  - How is the chain organized?
  - Who are the key actors?
  - How do products, services, payments and information flow in the chain?
  - Who are the key partners?
  - What are the external influences the affect the chain's performance?

The agroforestry business model worked with Nii Biri and Coopaser was developed using the Canvas (Osterwalder, 2010) [4], which allows developing and visualizing business models with nine basic modules that address the value proposition, customer segment, channels and relationships with clients, revenue stream, key resources and activities, key partners and cost structure.

The definition of the agroforestry model was complemented with the analysis of the SWOT matrix (strengths, weaknesses, opportunities and threats) of the two organizations, in order to identify internal and external factors to determine their relevance in the business models and the value chain.

[4] Osterwalder, A.; Pigneur,Y 2010. Business model generation.

1.3 Objectives

a) General objective

Recover and socialize the experience of the interest groups of the native communities and the indigenous company Nii Biri (Ucayali) and the cooperative Coopaser (Madre de Dios) to systematize the proposals of the two agroforestry business models promoted by AIDER.

b) Specific objectives

- Participatory systematization of the agroforestry experience of the native communities of Yamino and Mariscal Caceres (Ucayali) and Infierno and Tres Islas (Madre de Dios), in the production of seedlings in nurseries and installation of agroforestry systems.
- Based on the experiences of the Nii Biri indigenous company and the Coopaser cooperative, develop the agroforestry business models, also using the SWOT matrix, the Canvas tool
- and value chain mapping.
- Identify the direct and indirect actors that participate in the different links of the agroforestry value chain, both of Nii Biri and Coopaser.
- Determine the profitability of agroforestry systems, from the installation of the plots to the sale of products with farm-gate prices and in the case of cocoa, with the company Nii Biri, as a commercial articulator in Ucayali, and with the Coopaser cooperative in Madre de Dios.

1.4 Systematization delimitation

The systematization of agroforestry business models approach is oriented towards the sustainable production of annual or semi-evergreen crops associated with cocoa and native timber forest species under agroforestry systems installed in the territories of native communities and with the participation of their members in the regions of Ucayali and Madre de Dios, with solid business models incorporated into the agroforestry value chains articulated with the indigenous company Nii Biri in Ucayali and the Coopaser cooperative in Madre de Dios.

1.5 Systematization Axes

a) Agroforestry system design

The agroforestry plot design is the axis that represents the basis for the development of a business model that is viable, feasible and profitable. This design considers the technical aspects for a functional system considering the species of the components, agricultural and forestry, spacing, density and distribution of the individuals so that it can be sustainable and profitable over time. It takes into account the activities from the production of the species of interest for the agroforestry system, the good management practices of the system, to its use, taking into account the reality of the communities.

b) Agroforestry value chain

The value chains, in which Nii Biri and Coopaser are immersed, are an important axis, since they allow the identification of the different actors from the provision of inputs to the final consumption of the products. Each organization has formal and informal relationships with the actors in the value chain in its region, which makes it possible to identify the type of companies that are part of the productive chain, the goods or services relevant for the delivery of the value proposal to the clients, making it possible to create strategies to strengthen relationships between actors for the distribution of benefits along the chain.

In addition, by recognizing that native community producers are one of the main suppliers of agroforestry products to these organizations, more horizontal relationships can be generated that contribute to improving the flow of information and resources in which the communities as well as Nii Biri and Coopaser can generate greater incomes, encouraging the replication of this model with other communities.

The agroforestry plot design is the axis that represents the basis for the development of a business model that is viable, feasible and profitable.

c) Nii Biri and Coopaser's business models

The business model of each organization is an important axis because it is directed towards its specific field, cocoa for Coopaser and timber for Nii Biri; however, it is expected that the products of the agroforestry systems can be commercially integrated by these organizations, in their respective areas, to take advantage of the benefits of their positioning in the area, their experience in the commercialization and transformation of products, the potential for resource management and the capacity to contribute to a better productive organization. The SWOT performed on each organization allows the identification of internal and external factors that favor and limit the potential of its business model, making it possible to define ways of enhancing the positive factors and counteract those that affect them.

d) Economic analysis of the agroforestry business models

The economic analysis is a backbone axis for the agroforestry business models, since the confirmation that the economic returns are positive, given that the potential income is known, the need for investment and financial capital for the management of the system, facilitates information and generates confidence to replicate agroforestry activities in other native communities, in addition to allowing Nii Biri and Coopaser to have reliable projections that show the viability and profitability of the business that favors the establishment of commercial agreements.

1.6 Information sources

- Bibliographic documents and internal AIDER reports.
- Representatives of the Nii Biri indigenous company and the Coopaser cooperative.
- AIDER technical team.
- Members of the agroforestry interest groups of the native communities of Yamino and Mariscal Caceres in Ucayali and Infierno and Tres Islas in Madre de Dios.

1.7 Systematization process description

A review of secondary sources, reports, publications and work documents elaborated on agroforestry, business models and value chains was performed to guide the systematization. We reviewed the documents on the "Agroforestry System with Gender Equity model" and the "Management Plan for Agroforestry Systems in five Native Communities", prepared in the framework of the project financed by the UK PACT and executed by AIDER, which contain the technical parameters for the installation of agroforestry systems in the native communities.

Two protocols were developed with key questions for the collection of information with Nii Biri and Coopaser and the native communities, which served as a guide to carry out the workshops.

Two workshops were held, one with Nii Biri and the other with Coopaser, in order to develop the value chain mapping, the business model and the SWOT matrix. A list of the community members who participated in each of the workshops is shown in annex 1.

- Value chain mapping identifies the actors linked to this chain, from the provision of inputs to the marketing, to propose actions that allow the integration of agroforestry business models with the value chain in each region.

- The Canvas model is a tool that allows, among others, to quickly analyze the current situation of Nii Biri and Coopaser for the commercial articulation of the agroforestry products with the business model.

- The SWOT matrix identifies the strengths and opportunities of the two organizations for the agroforestry business models, as well as the weaknesses and threats to determine what kind of actions can be taken to take advantage of the positive factors and counteract the negative factors that limit the scope of the proposed business models.

The workshop with representatives of the indigenous company Nii Biri was held in three virtual sessions in October 2022, while the workshop with representatives of the Coopaser cooperative was held in a single in-person session in November of the same year.

Likewise, in order to systematize the agroforestry models, four workshops were held, one with each agroforestry interest group of the four native communities, and agroforestry plots were visited.

Information was collected on the practices employed, time and resources required, which allows the communities' experience to be incorporated into the implementation of the agroforestry system proposed by AIDER. The workshops and visits to the plots of the four native communities were performed in November 2022.

The information gathered in the workshops was processed, based on the four axes of systematization, to describe the agroforestry business models, the value chain of the products offered by the two organizations and to carry out the economic analysis of the cash flow to determine profitability.

Information was collected on the practices employed, time and resources required, allowing the communities' experience to be incorporated into the implementation of the agroforestry system proposed by AIDER. The workshops and visits to the plots of the four native communities were carried out in November 2022.

Communal nursery - Yamino NC, Ucayali

2 Description of the Agroforestry business model of Ucayali

» Based on AIDER's experience in the implementation of inclusive and sustainable businesses and the information obtained in the workshops with the native communities of Yamino and Mariscal Caceres and the indigenous company Nii Biri, the following agroforestry business model is proposed for the native communities of Ucayali, as shown in Figure 1.

The model considers Nii Biri as the main commercial articulator that links the actors in the chain and the agroforestry products from native communities with the national market.

Potential sources of financing for this model are private investors, with whom the communities channel funds to develop their agroforestry activities. In addition, there are national and international banks, as well as state programs that are sources of financing through which Nii Biri and the native communities can acquire additional capital for their operations. Likewise, the communities, through other productive activities, also have funds available to investment them in agroforestry. As cocoa production levels stabilize, the productive activity becomes sustainable.

Regarding technical assistance, AIDER and the technical cooperation are important actors to provide this service to the communities and the Nii Biri company.

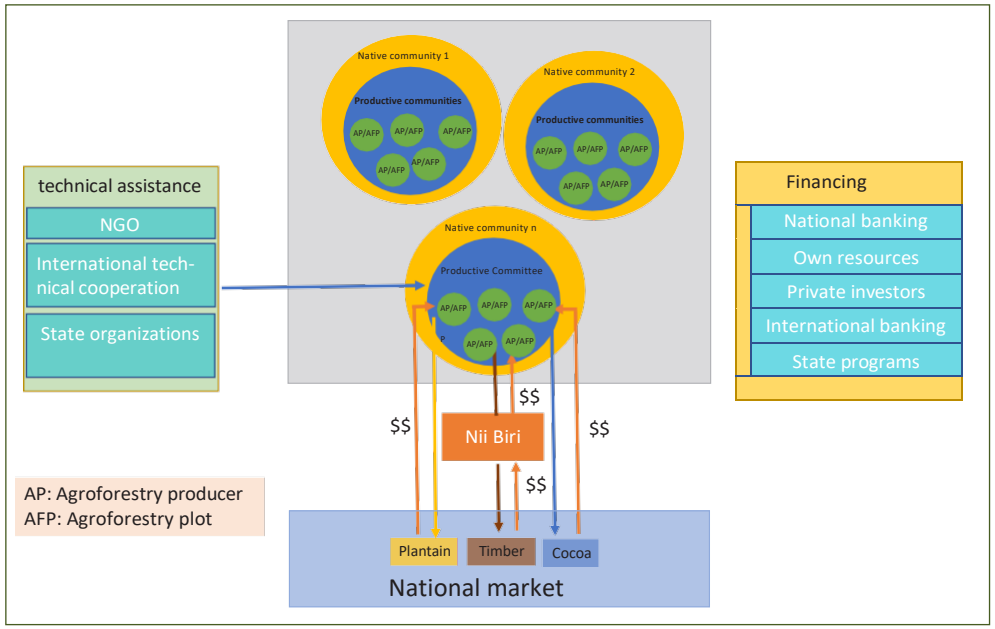
The productive committees, with the technical support from AIDER, carry out activities such as seedling production, installation and maintenance of the agroforestry system in order to produce cocoa and timber. The timber production that comes from the communities is channeled through the indigenous company Nii Biri, which performs the necessary transformation process for each product and places it on the national market. On the other hand, Nii Biri articulates the productive committees with local clients for the commercialization of cocoa. In the case of plantain, the community members place this product directly on the local market.

In this way, it is easier to guarantee the traceability of the product and there is a market for the production of timber and cocoa from the native communities, which favors a fair distribution of the benefits obtained that contribute to the conservation of the forests and a productive diversification of the communities. In the case of timber, the income for the communities is from the sale of raw material and Nii Biri, in turn receives revenue from the final product, with which it covers the transformation process and commercial management. In the case of cocoa, in which Nii Biri intervenes as an articulator, it would be receiving income for the commercial management of this product.

This relationship between investors, clients, Nii Biri and the native communities, with technical support from AIDER, makes it possible to close the cycle of agroforestry products in which the benefits are distributed equitably along the value chain, allowing the agroforestry business model to contribute to the development of native communities and forest conservation. Figure 2 shows the agroforestry business model for the communities of Ucayali.

Workshop with the members of the agroforestry interest group – N.C. Yamino, Ucayali

Figure 2. Agroforestry business model for communities in Ucayali



2.1 Native communities' location

The agroforestry business model promoted by AIDER and Nii Biri is based on a design aimed at the native communities of Ucayali. In this particular case, we have worked with the native communities of Yamino and Mariscal Cáceres, located in the district of Aguaytía, province of Padre Abad. In figure 3 the location of the communities is shown.

2.2 Native communities' climate

Based on data from climate-data.org, the Yamino Native Community is located at an altitude of 296 m. a. s. l. and the Mariscal Cáceres Native Community at 302 m. a. s. l.

To analyze the climograph of these communities, the climate data of the city of Aguaytía, capital of the district of Padre Abad in Ucayali, is used as a reference.

Aguaytía has an "Af" climate, according to the Köppen and Geiger classification. It has a humid tropical climate, with an average annual rainfall of 3,133 mm and over 200 mm per month during October through April, with a dry season from May through September with monthly rainfall of less than 150 mm. The average annual temperature is 24.3°C, reaching its highest temperatures in September, with an average of 25.4°C and a maximum of 31.2°C. The coldest season is in July, with an average temperature of 23.4°C and a minimum of 19.7°C, as shown in Figure 4.

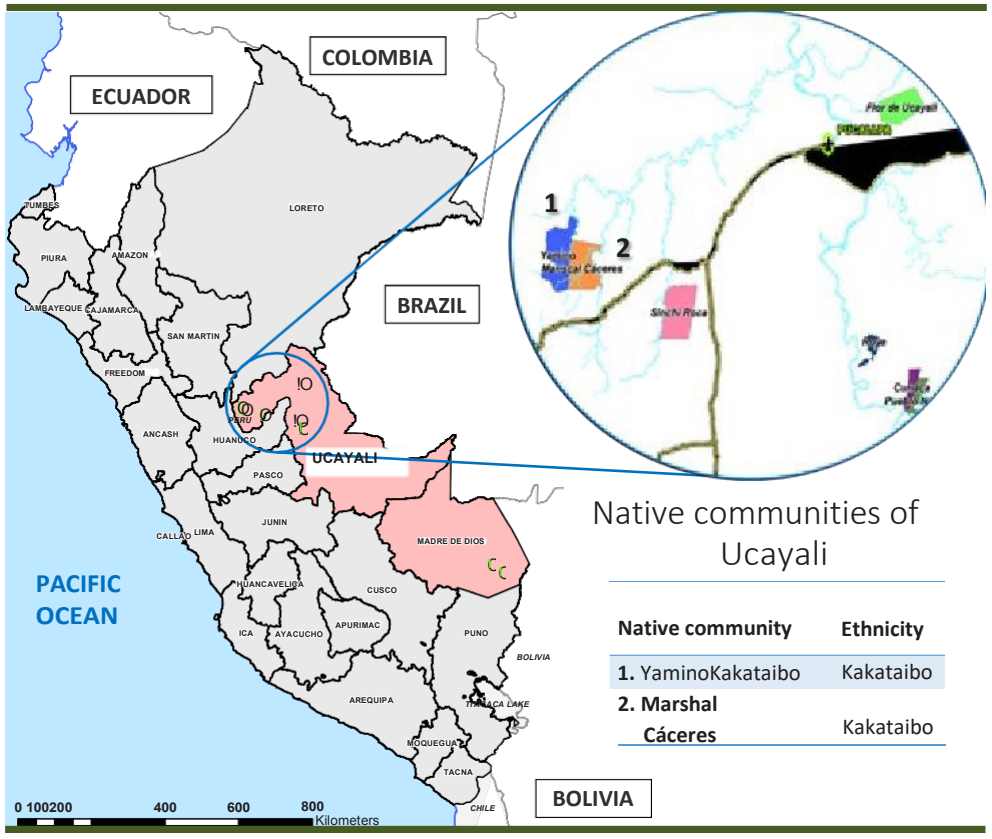
[5]This this classification is based on the relationship between natural vegetation and climate, considering average annual and monthly temperatures and precipitation, as well as their seasonality.

Mr. Sergio Pino sharing his experience on the installation of the AFP - N.C. Mariscal Cáceres, Ucayali

Nursery - N. C. Mariscal Cáceres, Ucayali

Sunshine hours in Aguaytía have an annual accumulation of 2,655.07, with a monthly average of 87.25 hours. During the months of August to October there are more sunshine hours, with a value that exceeds 8 hours per day. On the contrary, during the months of November to June, it does not exceed 7 hours per day, with a minimum of 6.5 hours in the month of May, as shown in Figure 5.

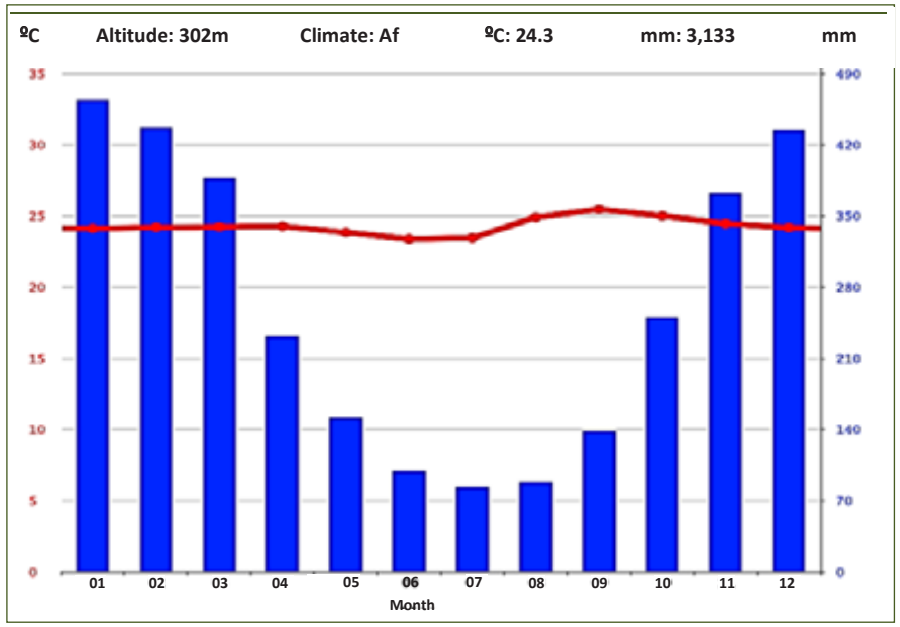
Figure 3. Map of the location of the native communities in Ucayali



Native communities of Ucayali

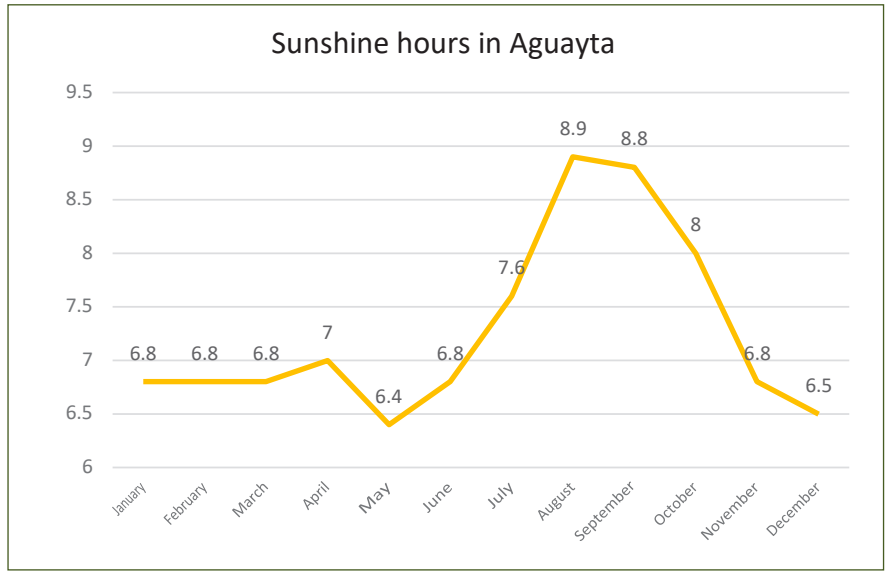
Native community	Ethnicity
1. YaminoKakataibo	Kakataibo
2. Marshal Cáceres	Kakataibo

Figure 4. Climograph of Aguaytía



Source: climate-data.org (https://es.climate-data.org/america-del-sur/peru/ucayali/aguaytia-49507/)

Figure 5. Sunshine hours in Aguaytía



Source: climate-data.org (https://es.climate-data.org/america-del-sur/peru/ucayali/aguaytia-49507/)

2.3 Agroforestry experiences of the native communities

2.3.1 Background on agroforestry production

The participants of the workshops from the native communities of Yamino and Mariscal Cáceres mentioned that they benefited from various organizations, such as CIMA, DEVIDA, and the National Forest Conservation Program (PNCB), for the installation of agroforestry systems, which provided them with inputs and tools. The agroforestry plots installed have not been sufficiently managed, and therefore cocoa production has been minimal.

In addition, the native communities have created internal organizations for the management of their territory, such as control and surveillance committees, handicraft, plantain and cacao associations and committees. Some of these remain operational due to good governance. On the other hand, some organizations such as AIDER, the Subregional Territorial Administration of the Regional Government and CIMA have contributed by providing them with various types of support.

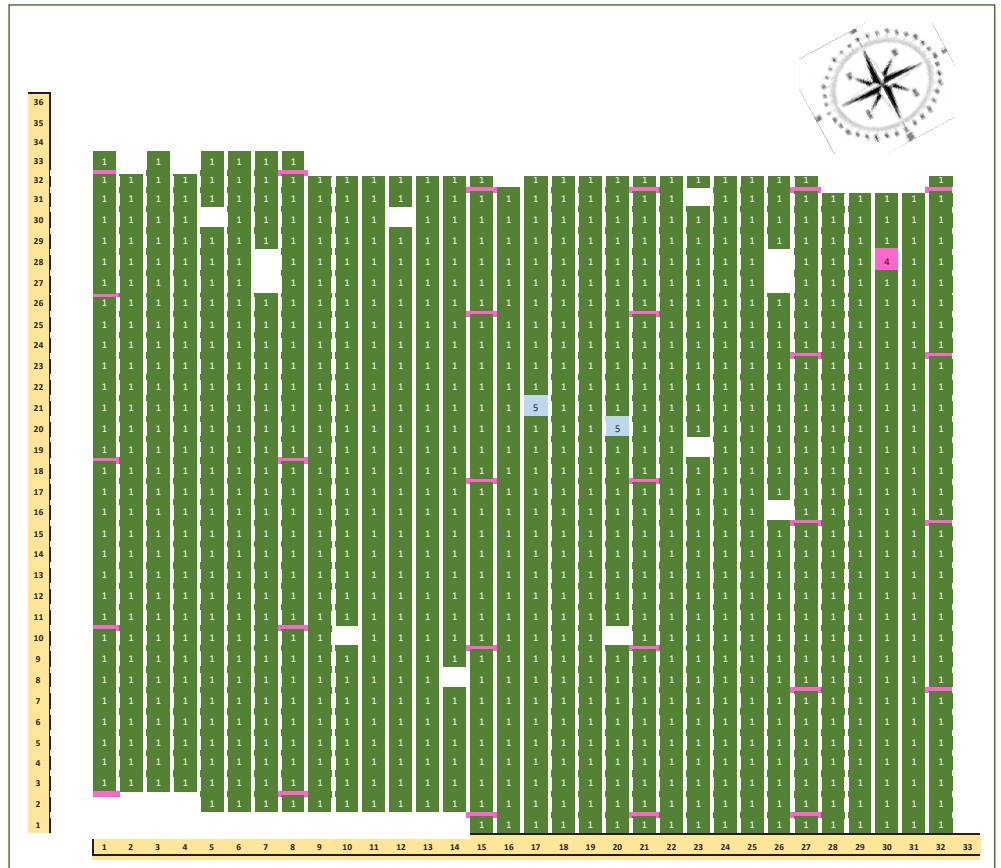
2.3.2 Agroforestry design implemented in the communities

During the interaction with workshop participants in the native communities of Yamino and Mariscal Cáceres, it was determined that in order to take advantage of the land, the community members initially plant short-cycle crops after clearing the land, such as yucca, corn, rice or others, depending on the producer's preferences. Later, the plantain is planted at a 3 x 3 m spacing, although some farmers plant at 3 x 2.5 m. After seven or eight months, cocoa is planted at a spacing of 3 x 3 m (square design) together with the shihuahuaco, with spacings of 21 x 21 m or 15 x 15 m or in some cases, with a spacing of 21 m, when planted on borders.

Agroforestry systems are only installed in areas that have been deforested a long time in advance, corresponding to lands that are resting or fallow, that is, lands in the process of recovery, after having been producing some agricultural crop or pasture, so the recommendation is to perform a soil analysis in order to make a fertilization or remediation plan, if necessary. In addition, in this process of natural regeneration, it is common for timber species of interest to the community members to develop, which is why they are incorporated as part of the agroforestry system. On the other hand, the topography of these lands is irregular and present obstacles or areas that flood, so the design must be adapted to the reality of each plot.

Figure 6 shows the graphic representation of the agroforestry plot of Mr. Rubén Julca of the Yamino Native Community, according to the diagnosis performed in July 2022. This plot, with an area of 0.91 ha, has mostly patterns of growing cocoa (green color) and shihuahuaco plants (fuchsia color). The blank spaces correspond to areas disabled for planting due to adverse natural conditions. The details of the number of individuals and color relationship with Figure 6 are presented in Table 1.

Figure 6. Distribution of plants in Mr. Rubén Julca's agroforestry plot, Yamino Native Community.



Agroforestry systems are only installed in areas that have been deforested a long time in advance, corresponding to lands that are resting or fallow, that is, land in the process of recovery, after having been producing an agricultural crop or pasture, so the recommendation is to perform a soil analysis in order to make a fertilization or remediation plan, if necessary.

Table 1. Description of Mr. Rubén Levi's agroforestry plot, Yamino Native Community.

Native community	Yamino		
Surface area (ha)	0,91		
Community producer	Rubén Levi Julca Cruz		
Symbol	**Description**	**Number of plants**	**%**
0	Obstacle		
1	Growing cocoa pattern	992	97,0
2	Grafting of growing cocoa		
3	Capirona plant		
4	Shihuahuaco plant	29	2,8
5	Empty space	2	0,2
6	Chlorotic growth pattern		
7	Chlorotic cocoa grafting		
8	Cacao in production grafting		
9	Mahogany plant		
10	Citrus		
X	Affected/flooded area		
R	River/drainage		
C	Road/access		
TOTAL		**1 023**	**100,0**

Figure 7 shows the plot of Mr. Juan Picón of the Mariscal Cáceres Native Community. This plot, of 0.44 hectares, consisted mainly of cocoa in growth patterns (green color) and empty spaces (light blue color) in which cocoa and shihuahuaco will be installed, it also has cocoa in production grafts and some capironas and shihuahuacos. Details of the number of individuals is found in Table 2. In December of 2022 the plantation was completed with cocoa and shihuahuaco where it corresponded.

Figure 7. Distribution of plants in Mr. Juan Picón's agroforestry plot, Mariscal Cáceres Native Community.

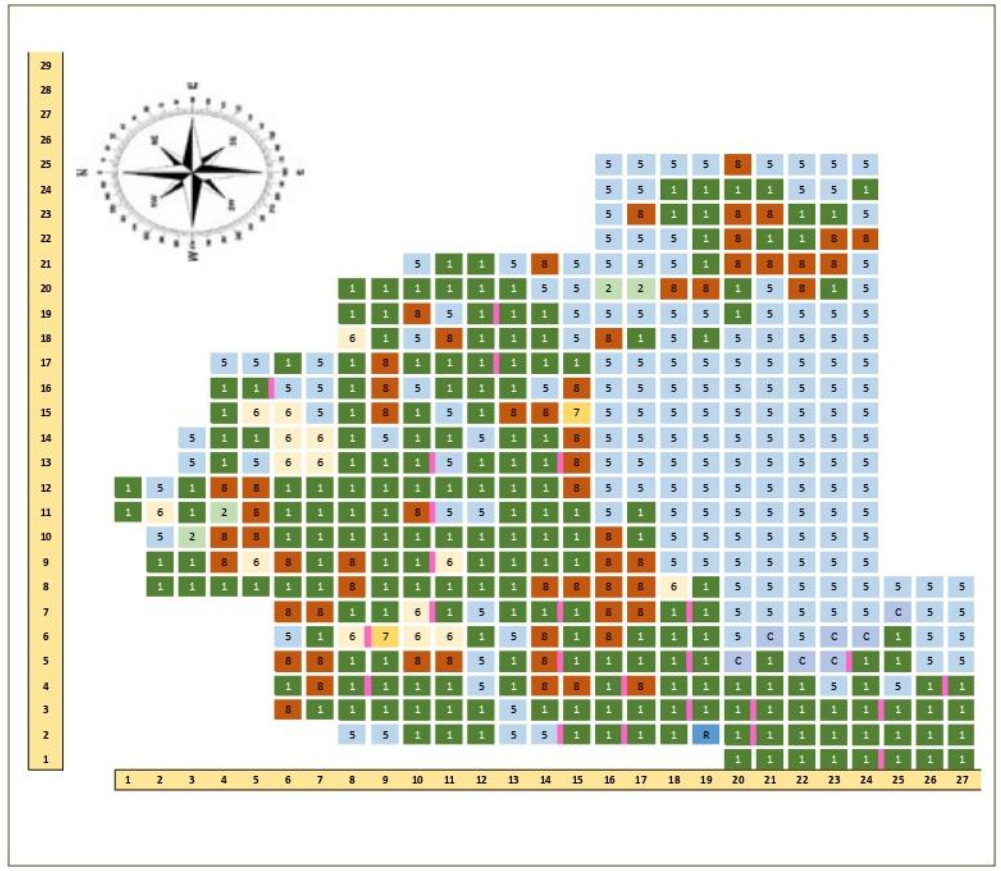


Table 2. Description of Mr. Juan Picón's agroforestry plot.

Community	Mariscal Cáceres		
Surface area (ha)	0.44		
Community producer	Juan Picón Saquiray		
Symbol	**Description**	**Number of plants**	**%**
0	Obstacle		
1	Growing cocoa pattern	204	42
2	Grafting of growing cocoa	4	1
3	Capirona plant		
4	Shihuahuaco plant	24	5
5	Empty space	174	36
6	Chlorotic growth pattern	15	3
7	Chlorotic cocoa grafting	2	0
8	Cocoa in production grafting	60	12
9	Mahogany plant	0	0
10	Citrus	0	0
X	Affected/flooded area	0	0
R	River/drainage	1	0
C	Road/access	7	1
TOTAL		**491**	**100**

2.3.3 Seedling production for the agroforestry system

Community nurseries have been installed during the months of July and August to produce 4,000 cocoa seedlings to be transferred to the definitive land between November and December, months when the rainy season begins in the amazon region.

The activities for the installation of the nursery and production of seedlings are carried out by adult men and women, in a balanced way, there is also participation of minor children, especially during the preparation of substrate and filling and arrangement of bags. Table 3 shows the activities developed and labor costs for the production of seedlings for one hectare of agroforestry system based on information obtained from community members and agroforestry specialists from AIDER. The cost of a day's labor is S/ 40, additionally lunch is provided, which is equivalent to S/ 8 per portion.

Table 3. Activities and labor costs for the installation of the nursery and production of seedlings for one hectare of AFS - Ucayali

No.	Activity	Number of days worked	Cost (soles)
Labor - nursery			**1 565,80**
1	Location of the area for the nursery	0,20	9,60
2	Land preparation	1,50	72,00
3	Pole planting, wiring and mesh laying	1,50	72,00
4	Collection of substrate, mixing and filling of bags	6,25	300,00
5	Bag loading and organazing	1,75	84,00
6	Seed selection and washing	0,50	24,00
7	Cocoa pre-germination and planting	1,25	60,00
8	Shihuahuaco pre-germination and planting	0,15	7,20
9	Micrografting	15,00	720,00
10	Nursery maintenance	4,50	216,00

Among the inputs and materials used by the communities for the production of cocoa seedlings are seeds and fertilizers, as well as different types of insecticides and fungicides that are purchased in case it is necessary to apply them. Table 4 shows the inputs used for the production of seedlings that are used in one hectare.

Table 4. Inputs, materials and costs required for the production of seedlings for one hectare of AFS - Ucayali

No.	Nursery supplies and materials	Unit	Quantity	Cost (soles)
1	Cocoa seed	kg	6,00	60
2	Shihuahuaco seed	kg	3,00	39
3	Cocoa seed rods	unit	240,00	120
4	Hen manure	kg	31,00	28
5	Phosphate rock	kg	15,50	14
6	Dolomite	kg	21,00	15
7	Agricultural plaster	kg	10,00	17
8	Rice husk (50 kg)	Sack	7,00	28
9	Potassium phosphite (foliar)	l	0,25	24
10	Fosetyl aluminum (fungicide)	kg	0,25	5
11	Protexin (fungicide)	l	0,30	27
12	Insecticide (cypermethrin)	l	0,25	16
13	Bayfonal foliar fertilizer NPK 20-20-20	l	0,25	10
14	Magnocal	kg	5,00	4
15	5 micron clear plastic	m	1,00	2
16	5" x 8" LDPE bags	thousand	1,30	35
17	Gasoline for irrigation	gallon	1,00	23
18	Waterproof plastic	m	5,00	20
19	Raschel mesh	roll	1,10	770
20	Tie wire	kg	1,60	4
	Total			**1 260**

The list of tools and costs for the installation and maintenance of the nursery is presented in Table 5.

Table 5. List of tools for the production of seedlings for one hectare of AFS - Ucayali

No.	Nursery tools
1	Machete
2	Straight shovel
3	Digger
4	Shovel
5	Peak
6	Hammer
7	Ruler
8	Watering can
9	Wheelbarrow
10	Cylinder
11	Container
12	Motor pump for irrigation
13	Manual backpack
14	Hose

2.3.4 Agroforestry system installation

The communities have installed agroforestry plots; the community members mention that the work is done at the family level, and in some very particular cases, personnel are hired to do the cleaning work. The effort required to prepare the land ("rozo", chopping, etc.) depends on the state of the plot, such as the fallow period. The "rozo" consists of removing the weeds and small bushes with a machete; in case it is necessary to cut down remaining trees that are of no interest, a chainsaw is used. Chopping is practically cutting the trunks and branches into smaller pieces to then disperse them throughout the plot. Table 6 shows the amount of wages required for each activity.

Table 6. Labor required per activity for the installation of one hectare of AFS - Ucayali

No.	Activity	Number of days worked	Cost (soles)
1	"Rozo" and chopping	25,00	1 200
2	Alignment for the plantains	6,50	312
3	Pruned and planting for plantains	12,00	576
4	Alignment for cocoa - square design	3,00	144
5	Cleaning (5 per year)	60,00	2 880
6	Pruning and planting of cocoa and shihuahuaco	12,00	576
7	Formation pruning	2,00	96
	Total		**5 784**

The inputs used are plantain seedlings and cacao and shihuahuaco seedlings, in addition to fertilizers and fuels needed for land preparation, as shown in Table 7.

Table 7. Inputs and costs required for the installation of one hectare of AFS - Ucayali

No.	Installation inputs and materials	Unit	Quantity	Cost (soles)
1	Plantain seedlings	unit	1 110,00	3 885
2	Hen manure (50 kg)	sack	0,50	25
3	Phosphate rock (50 kg)	sack	2,00	100
4	Dolomite (50 kg)	sack	1,50	75
5	Agricultural gypsum (50 kg)	sack	0,50	25
6	Potassium sulfate (50 kg)	sack	0,25	55
7	Gasoline	gallon	13,50	311
8	Burnt oil	gallon	5,00	50
	Total			**4 526**

The tools required for planting are machete, file, chainsaw, digger, sprayer, cultivator and shovel.

2.3.5 Commercialization of agroforestry products

The members of the agroforestry committees have experience in the sale of plantains; however, there is very little experience with cocoa. Generally, marketing is carried out through intermediaries who are located in the town of Aguaytía. The companies, such as Machu Picchu, buy cocoa in this same town, and the Tropical processor that buys plantains does so in the same community.

The prices paid per kilogram of cocoa have varied between 5.00 and 7.00 soles; while plantains are sold in different presentations, per million the price ranges between S/ 250.00 and S/ 340.00 and per crate (21.5 kg approximately) between S/ 12.00 and S/ 15.00, depending on the quality.

2.4 Proposed agroforestry model

The agroforestry model promoted by AIDER for the Ucayali region is represented for the forestry component by the native timber species shihuahuaco, capirona and mahogany, which are in demand by the local and international market, in addition to the fact that the native communities have the appropriate edaphological and climatic conditions for their development; however, only shihuahuaco has been used for the project. As for the agricultural component, cocoa is a permanent crop because of the growing demand for Peruvian cocoa on the international market. In addition, short-cycle crops such as cassava, corn, rice and others may be included prior to the installation of plantains, the latter of which also provides initial temporary shade for the cocoa plants.

Agroforestry system components

a) Forestry component

This component is represented by the shihuahuaco (*Dipteryx* sp.), a timber species that is in great demand in the national and international markets. It is a leguminous species that has suitable characteristics to be associated with agroforestry systems, it has a high commercial value and it results attractive for establishment; additionally, it has been selected because it is a native species of the Amazon, with good growth results in forestry and agroforestry plantations. AIDER has the knowledge and experience of the technological package for silvicultural management. It is a species that is well known to local people and grows in natural habitats similar to cocoa. Also included are the remaining trees of natural regeneration of this species or others with commercial value and those previously planted.

b) Agricultural component

The predominant agricultural component of the agroforestry system is the permanent cultivation of cocoa (*Theobroma cocoa*) in association with plantain as a temporary shade crop. At the discretion of the producers, other crops can be included in the installation stage, either for commercial or food security purposes. such as corn, cassava, rice, among others. Similarly, other previously established agricultural plants, such as citrus and fruits trees, could also be considered.

Cocoa is a product of great economic importance with a presence in 16 departments of Peru. This crop requires average temperatures of 27.5°C and rainfall of 1,200 to 2,600 mm and needs deep, well-drained lands with a pH of 4.5 to 5.5 and high amount of organic matter. Depending on its phenological stage, cocoa requires a certain amount of shade. In its initial stage it requires more shade, while during the productive period, this should be reduced so as not to affect the yield. Shade also contributes to the regulation of ground humidity and the microclimate around the plants, creating an appropriate environment for the development of the crop.

c) Agroforestry system design

The shihuahuaco is the forest species that accompanies the cocoa as permanent shade for 30 years, at which time the timber is taken advantage of. During this period, the species provides the shade conditions according to the needs of the cocoa plant. The main development characteristics are good growth, a single straight trunk,

deep roots, a canopy greater than 7 meters, leaves that degrade quickly and light fruit, and, as a leguminous species, it provides nitrogen to the soil, among other benefits. The orientation of the planting lines of shihuahuaco is directed from north to south, in order to provide adequate shade to the cocoa.

The plant distribution design of the agroforestry system is squared, with a spacing of 3 x 3 m, which allows the establishment per hectare of 1,056 plantain plants, 1,038 cocoa plants and 51 shihuahuaco plants. The spatial distribution of this design is shown in Figure 8.

This method consists of placing each plant at the vertex of a square, whose length of the side corresponds to the distance determined for planting. The implementation in the field was done using the triangulation system 3, 4 and 5 (Figure 9).

Figure 8. Spatial distribution model of the species in the square agroforestry plantation design.

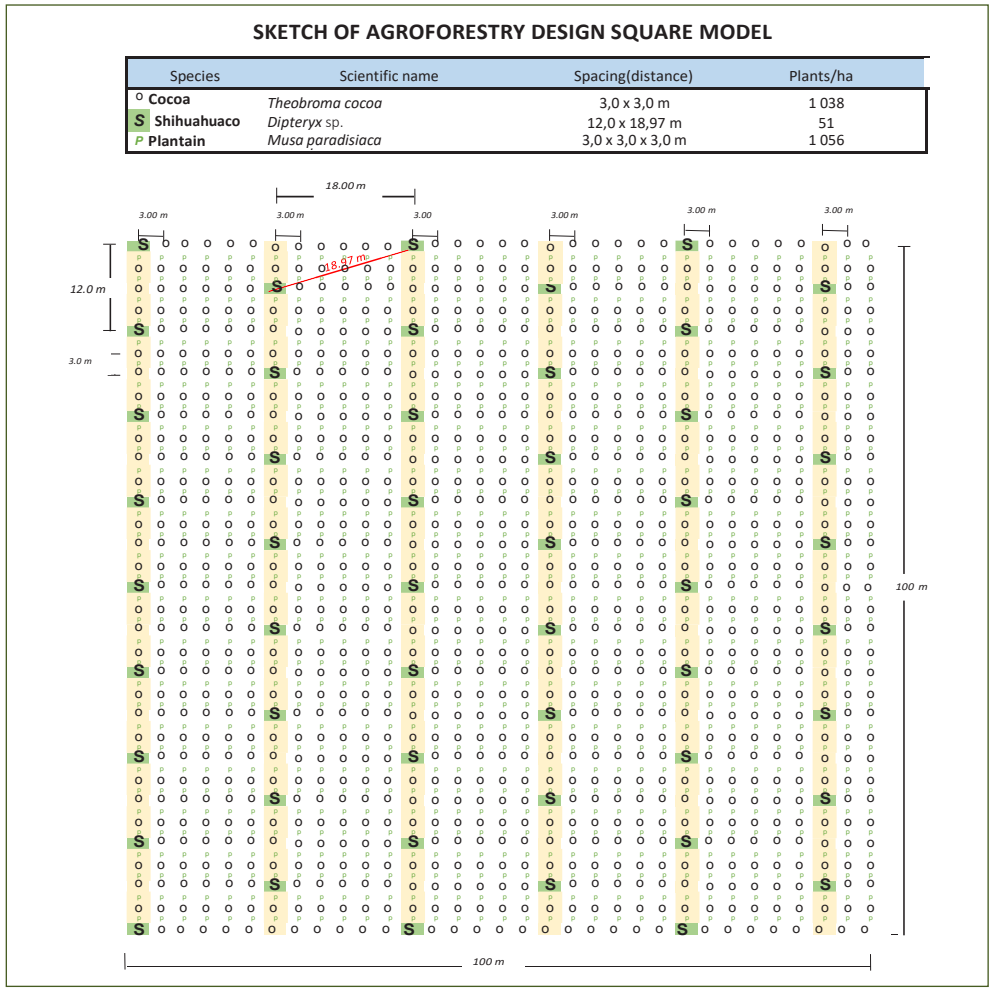
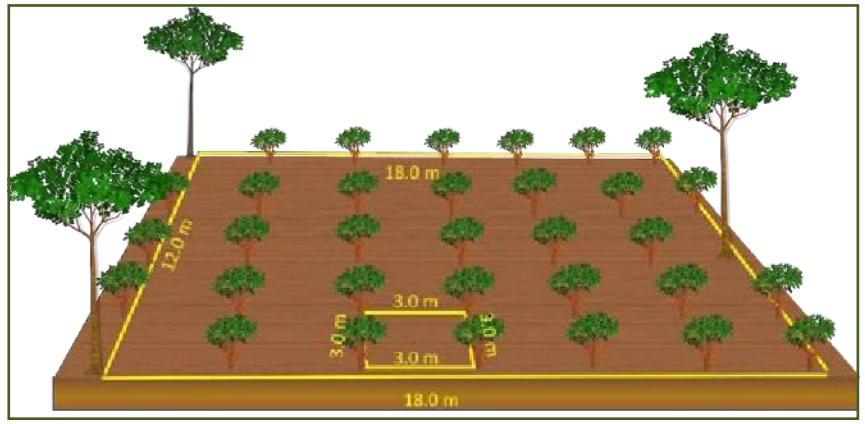


Figure 9. Panoramic representation of the the distribution of plants in the squared design.



2.5 Agroforestry value chain

The analysis of the value chain starts from the input and service providers, the agroforestry production in the field, the market, the processing and marketing, until consumption. In each of these links, the most relevant activities and the direct and indirect actors in the chain are identified. Figure 10 shows the diagram of the agroforestry value chain, and each link is described below.

a) Input and service suppliers link

This link analyzes those organizations that are the main suppliers of inputs, such as cocoa and timber species seedlings, plantain seedlings, inputs and tools for the establishment of agroforestry plots, as well as those that provide Nii Biri with inputs.

The Yamino and Mariscal Cáceres native communities, as well as the communities of Roya, Flor de Ucayali, Sinchi Roca, Curiaca, Pueblo Nuevo, are direct actors in this link, which have commercial agreements with Nii Biri, currently being the main suppliers of timber. Nii Biri plans to link the production committees with potential clients for marketing cocoa and plantains. In addition, there are suppliers of inputs and equipment for the communities to install and maintain agroforestry plots, such as hardware stores and agro-veterinaries in the local market. Cacao seeds and seed rods are being obtained from local producers in the areas of Iparía, Utiquinía and Alto Shiringal.

On the other hand, there are the suppliers of inputs for wood transformation, such as Promart and CITEforestal in Pucallpa, which provide Nii Biri with goods and services, correspondingly. Additionally, there are transportation service providers, which

are key for moving inputs and tools to the agroforestry plots.

Likewise, Indirect actors include organizations such as AIDER, DEVIDA, the National Forest Conservation Program of the Ministry of the Environment (MINAM) and CIMA, which provide technical assistance and resources such as seedlings, inputs and tools so that communities can implement agroforestry plots.

On the other hand, the National Council of Science, Technology and Innovation (CONCYTEC) has provided Nii Biri with financing to implement a strategy to increase its sales, and there is a Compensation Program for Competitiveness (Agroideas) that offers counterpart financing to for the improvement and technification of the production of any agricultural business.

Likewise, there are institutions such as SENASA that contributes with the diagnosis of pests and diseases in crops, issuing phytosanitary certificates and the INIA that contributes with scientific knowledge, production of seeds and seedlings, etc.

b) Agroforestry production link

The agroforestry production link identifies the activities necessary for plantains, cocoa and timber production in the native communities, such as the production of seedlings in the communities themselves, land preparation, planting, fertilization, pruning and maintenance of the agroforestry plots, up to the harvest and post-harvest.

The direct actors are the members of the native communities that are part of the agroforestry committees, who are working under this system. The producers of the native communities of Yamino and Mariscal Cáceres, who have started with the agroforestry activity, and have an average of half a hectare of agroforestry plots established. Due to the nature of these communities, the productive system is based on family labor and in some particular cases people from the communities themselves are hired.

The main characteristic of plantain production in some of these communities is that it is done in a traditional manner, i.e., it is not adequately managed, they do not have technical assistance for this crop, and it is grown with their own resources. regarding current timber production, it comes from the communities' managed forests, one of which has the Forest Stewardship Council (FSC) certification.

Indirect actors include AIDER, DEVIDA, PNCB, CIMA, the National Agricultural Sanitary Service of Peru (SENASA) and the National Institute for Agricultural Innovation (INIA), which at different times provide training and technical assistance for agroforestry management. AIDER, for its part, has contributed through the Forestry Alliance Project, with training and technical assistance on agroforestry systems. On the other hand the Regional Forestry Authority is the one that approves the forest management plans and grants harvesting permits, as well as registers forest plantations and gives authorization for the mobilization of forest products. Furthermore, transportation service providers are key to transporting production to the companies and cooperatives in the area.

c) Processing link

In the processing link first and second timber transformation companies participate, depending on the market segment to which the products are directed. The first transformation companies are sawmills and the second transformation companies are those that carry out additional processing in addition to sawmilling. Regarding cocoa, the processing link refers to cocoa processing - fermentation, drying and bagging.
- and in some cases the transformation of the dried bean into chocolate and other by-products. For plantains, this link includes the process of transformation into chifles(platain chips).

The direct actors for timber processing include transformation companies such as Nii Biri, carpentries and cabinet shops that produce laths and furniture and utility items. There are also companies that offer timber drying and preparation services for local consumption and export. It is also important to highlight that there are skilled laborers in the region that provide services such as ennablers, wood turners, and cabinetmakers for timber transformation. For dry cocoa bean processing, there are companies such as Norandino, Sumac Cacao, Machu Picchu and Culcao, and for chocolate production there are companies such as Piri Piri, Ukaw, the Association of women of Nolvert hamlet, the Association of Produers of alto Ucayali and the Colpa de Loros cooperative. For plantains, only the Tropiselva company was identified.

The native communities with which we have relationships normally sell the timber in sawn quarters; however, there are communities that sell the timber in logs at the port of Pucallpa. Regarding the cocoa, the community of Roya is installing a fermentation and drying module to market dried cocoa beans.

Indirect actors identified are service provider companies such as Electro Ucayali S. A. for electricity, Movistar and Claro for internet and telephone service, and private banks that provide fund transfers and financing services.

d) Commercialization link

The commercialization link includes sales and commercializing activities of the region's value-added agroforestry products, both in the local and international markets. In this link are also the actors present in the processing link for cocoa, plantains and timber and organizations such as the Regional Directorate of Agriculture of Ucayali (DRAU) and the Ministry of the Environment, which organize local and regional fairs to promote the area's products.

The main characteristic of plantain production in some of these communities is that it is carried out in a traditional manner, i.e., it is not adequately managed, they do not have technical assistance for this crop and it is grown with their own resources.

The direct actors are the timber transformation companies, which commercialize the products in the same plant or in other regions of Peru. Nii Biri, in its case also commercializes the utilitarian products at local and regional fairs and in association with specialized stores such as Las Polleras de Agustina and consignment stores such as Pruébalo and Raíces that sell in the cities of Pucallpa and Lima. The indigenous company Nii Biri is in the timber business within the agroforestry value chain; however, it plans to participate in the commercialization of cocoa from the agroforestry systems of the native communities with which it has agreements, acting as a commercial articulator and eventually as a buyer-seller.

In the case of dry cocoa beans, it is exported by Norandino, Sumac Cacao, Machu Picchu and Culcao to European countries, the United States and Japan, while chocolate bars are produced and sold by three organizations, represented by the the Association of women of Nolvert hamlet, Piri Piri and Ukaw, through supermarkets, fairs and minimarkets. Nii Biri projects, in its planning, to incorporate cocoa into its product portfolio, but in the role of market articulator.

For the plantain, the community organizations, created with the support of DEVIDA, sell this product in the same native communities, in local markets and to national companies. In order to deliver the product to any department of Peru, land transportation services are required, and in the case of exports, coordination is made with shipping companies and customs agents for sea transportation.

Indirect actors include the National Superintendence of Customs and Tax Administration (SUNAT), the Regional Forestry Authority of Ucayali, private banks, among others.

Informal timber harvesting creates disloyal competition and affects the prices of this product in the region. In addition, cocoa and plantain producers who are not organized commercialize their products at a disadvantage, causing most of the profits to remain in the hands of third parties, reducing the producers' profitability.

e) Market

The purchase of timber from native communities is generally done in blocks or quarters, depending on the point of sale. This timber is used for carpentry, laths, and boards for construction. Nii Biri aims its products on more specific niches, as it receives product orders from its customers.

Regarding cocoa production, Nii Biri representatives have observed that about 1% of cocoa beans are sold at expo fairs and 99% of cocoa from native communities is sold to intermediaries in the port of Pucallpa. In the case of communities such as Roya, most of their production goes to the district of Iparía. Regarding the plantain produced in the native communities, it is believed thtat 100% is sold in the port of Pucallpa to intermediaries for local consumption. Regarding plantain producers in the district of Padre Abad, they believe that almost 90% of their production is sold in Aguaytía since there is a company called "Tropiselva" that manufactures plaintain chips,

leaving the remaining 10% for the internal consumption of the local market.

There are no known plantains exporter companies, and on the other hand, there are references that the native communities do not export timber neither. In the case of timber from natural forests, there are timber companies that make agreements with the communities for harvesting, and local carpentries normally buy the timber at the port or through intermediaries.

f) Consumption link

Nii Biri commercializes value-added wood products such as furniture, utilitarian products and laths. It has exported slats to the United States and has also sold school furniture to the State; however, lately its sales are aiming to customers upon request and at local and regional fairs.

The direct actors in this link are international companies from Europe, Asia and the United States that demand cocoa in dry beans, and those local and national companies that demand chocolate, and in the case of plantains, the local population of Pucallpa is the main consumer in the region.

Group work in the workshop
N. C. Mariscal Cáceres, Ucayali

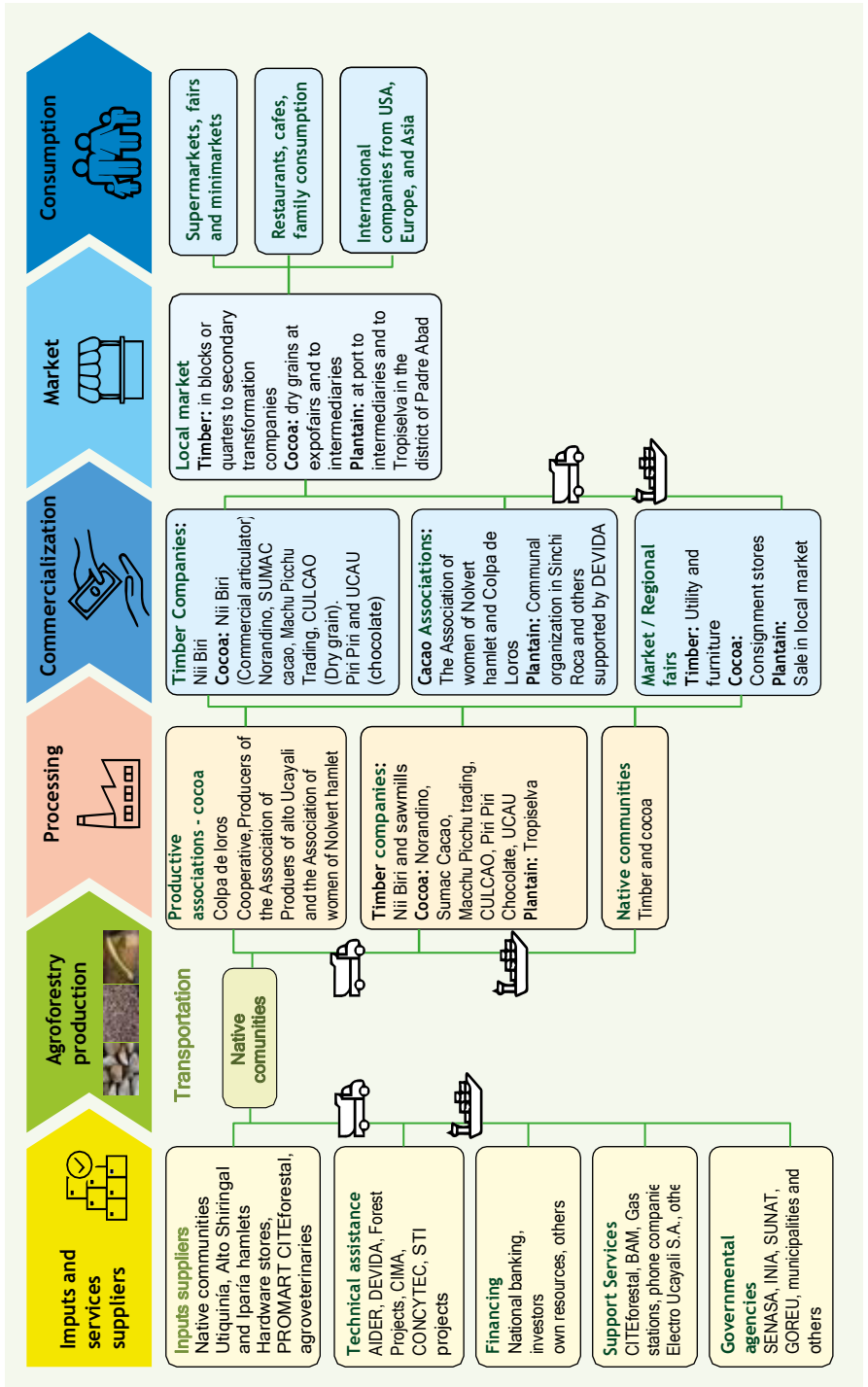


Figure 10. Agroforestry value chain - Ucayali

Timber from the native communities value chain proposal - Ucayali

The value chain for timber from native communities of Ucayali is made up of the following links:

- Production link in agroforestry plots. This consists of installing the shihuahuaco forest species that accompanies the cocoa as permanent shade for 30 years, at which time the timber will be harvested. The direct actors are the native communities of: Roya, Sinchi Roca, Curiaca, Pueblo Nuevo, Yamino, Mariscal Cáceres and others, who carry out the timber harvesting.

- Primary transformation link. comprises the sawmilling of logs for the production of quarters, which performed in the native communities.

- Transportation link. The quarters are transported by river from the community to the Pucallpa port and from this port to the Nii Biri transformation plant.

- Processing link. Brushing, trimming and boarding are performed for subsequent molding, packaging and labeling.

- Foreign trade link. Consists of the production of molded laths for export purposes, packaging and labeling for destination to the United States and other countries.

- Cross-cutting chain support actors. Throughout the process, actors that provide technical, management and commercialization support are identified, such as AIDER, Proyecto Bosques, CIMA, CONCYTEC, BAM, SUNAT, GOREU and others.

In figure 11 this value chain is shown.

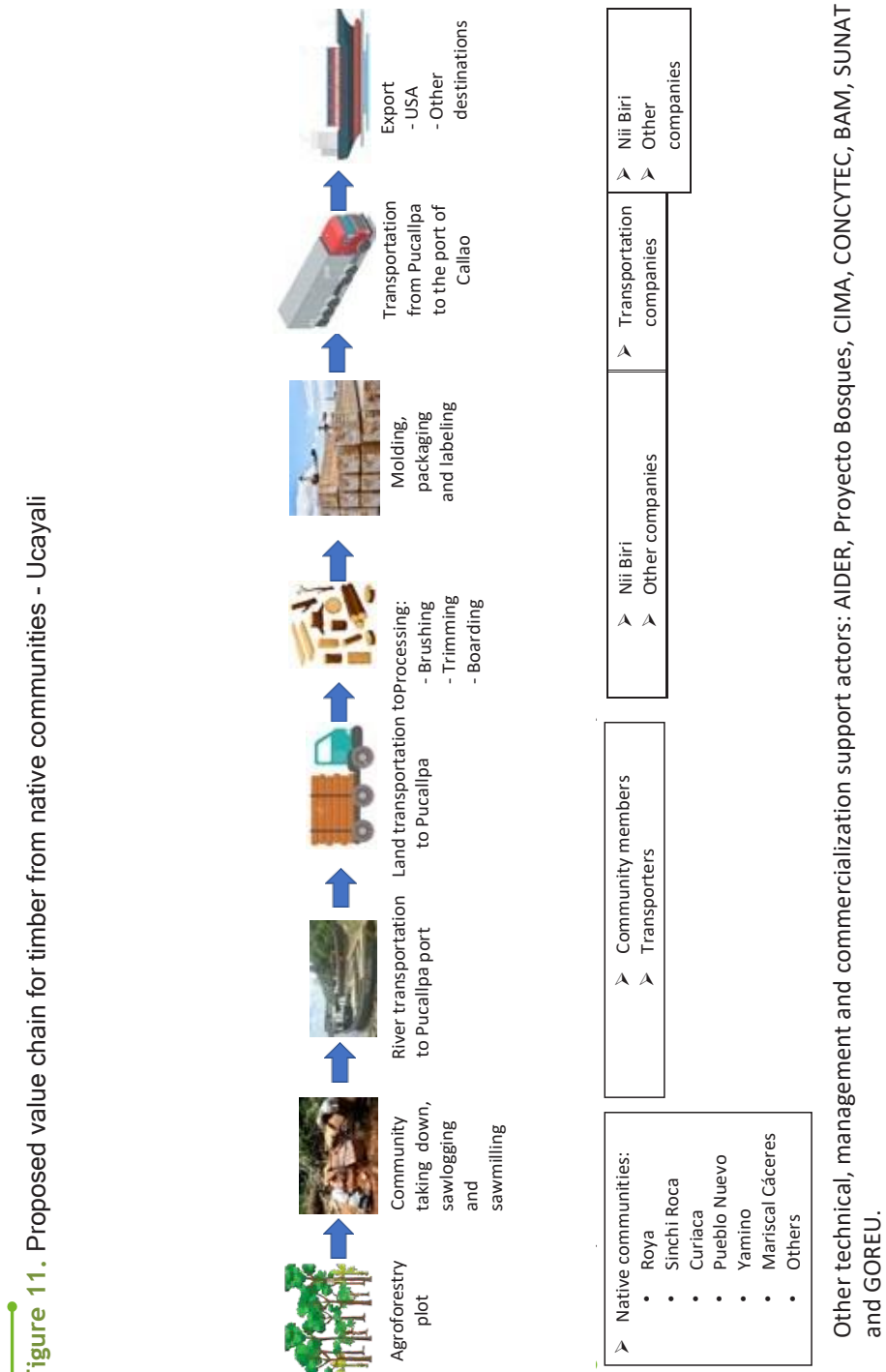


Figure 11. Proposed value chain for timber from native communities - Ucayali

2.6 Analysis of the business model of the indigenous company Nii Biri using the Canvas tool.

During the process of designing the company Nii Biri's business model, it was identified that the organization has good relationships with its suppliers and clients. Since its creation, Nii Biri has gone through different moments of transformation and is currently in the process of consolidation. It is necessary to increase its productive capacity, diversifying it by including agroforestry products such as cocoa, as well as focusing its efforts on building alliances with new clients. The products offered by Nii Biri are oriented towards consumers who value products from native communities and sustainably managed areas, which contributes to the conservation of natural resources and avoids deforestation and forest degradation, so promotion should be strengthened to attend to this consumer group. Nii Biri's agreements with the native communities facilitate their inclusion in the agroforestry value chain; Likewise, it is important to generate a two-way value proposal with the clients. Nii Biri, as a formal company and with an interesting track record in the sale of products from native communities, has the potential to attract other companies to form strategic alliances and improve product commercialization.

With the participation of its representatives and AIDER's technical team, a workshop was held and the Nii Biri company's Canvas tool was developed. Figure 12 shows the company's business model with the use of the Canvas tool.

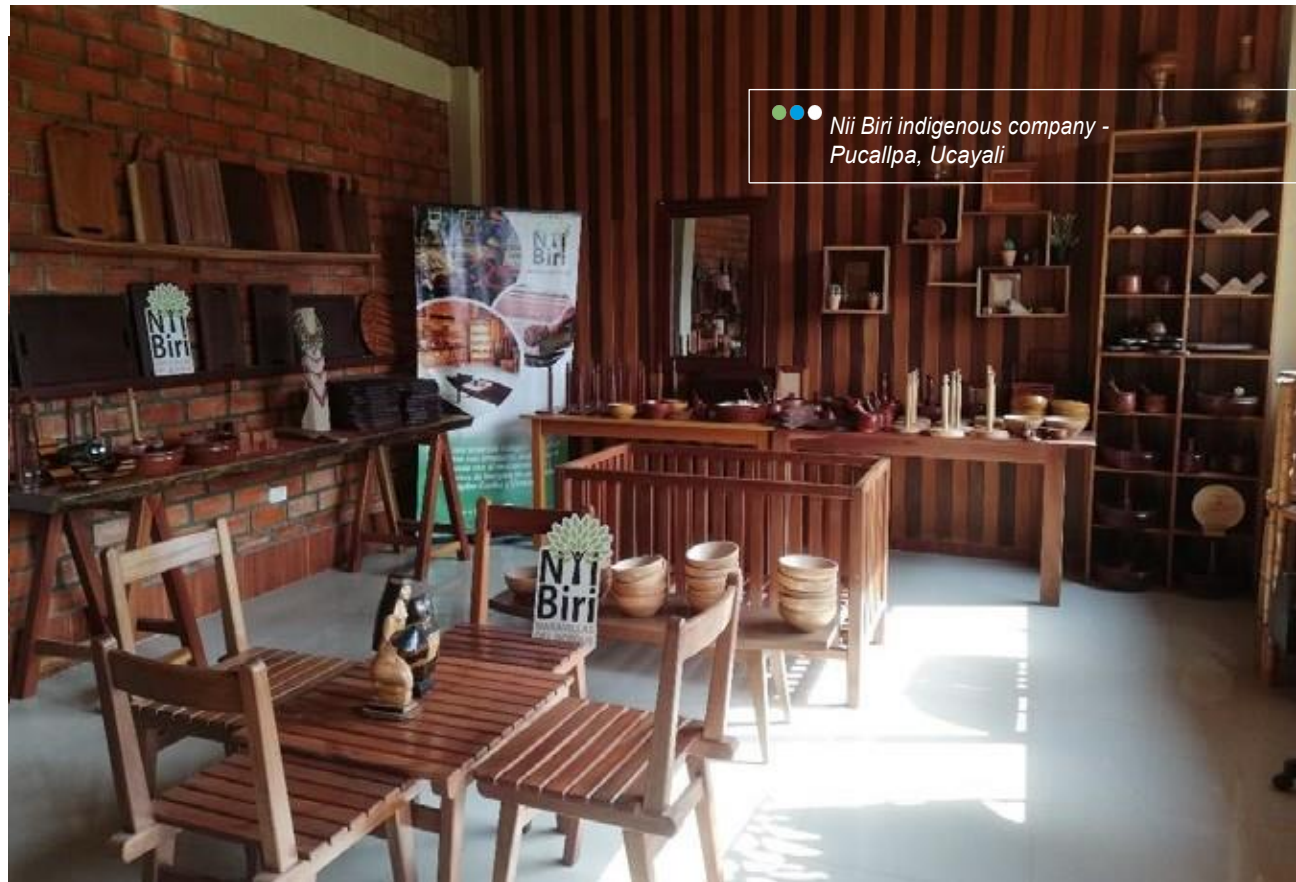


Figure 12. Nii Biri's Canvas business model

<table>
<tr>
<td rowspan="2">Key partners

Producer native communities: Roya, Yamino, Mariscal Cáceres, Sinchi Roca, Curiaca and Pueblo Nuevo.

AIDER: technical support

Regional Directorate of Agriculture: Participation in fairs

Specialized stores: Polleras de Agustina

Consignment stores: Raíces y Pruébalo

Technical cooperation: USAID and United Kingdom

Service providers: transporters, sawmills, drying kilns, etc.</td>
<td>Key activities

Administrative: Business management, personnel management, orders reception, quotes, contracts, production orders, commercial articulation, billing, others.
Plantain: commercialization support
Cocoa: Drying (7 - 8.5%), quality control, bagging
Timber: Planking or resawing, drying (12 - 14%), enabling, final product
Sales: Presentation at fairs, commercial agreements
Production: Receipt of production order, product processing, final finishing, packaging and dispatch.</td>
<td rowspan="2">Value proposition

Dried cocoa beans from agroforestry systems of native communities with traceability

Wooden plank, tongue and groove wood, wood for flooring and utilities</td>
<td>Customer relationships

Consignment stores: Personalized relationship, communication via mail, WhatsApp, phone call. Good relationship. Participation in commercial events
Final customers: Personalized relationship at trade fairs and production plant. Sweepstakes and raffles have been conducted through social media.
Specialized stores: Relationship is usually when they require products via email and phone call.
Social media: Virtual relationship through publications on Instagram and Facebook. Interaction for raffle events</td>
<td rowspan="2">Customer segment

The main market segment of timebr products are final customers who order tables, chairs, utilities, among others, made of capirona, quina quina, ututcuro, shihuahuaco, etc.

Specialized companies that receive on consignment: Raíces, Pruébalo and Polleras de Agustina.

Particular clients: who purchase handicrafts and utilitarian products at fairs

Cocoa export segment: ICAM Company, potential buyer of dry cocoa beans</td>
</tr>
<tr>
<td>Key resources

Infrastructure: processing plant and warehouse
Personnel: Manager, assistant manager, administrative and production assistant, administrator, accounting, lathe operator and casual workers
Machinery and equipment: Circular saw, band saw, planer, trimming machine, hand plane, tongue-and-groove machine, long-neck scale, guillotine, gram scales, etc.
Inputs: Timber, cocoa and plantains
Certifications: FSC, Custody chain
Working capital
Trademark registration: in process</td>
<td>Channels

Fairs: DRAU Fair (1 per month), ExpoAmazon (1 per year)
Negotiation and promotion tables: Occasional events, such as with CCIPP.
Tenders with the State: School furniture, rural housing
Specialized stores: Polleras de Agustina in Lima
Consignment stores: Pruébalo in Pucallpa and Raíces in Lima
Events: Open Plaza with Pruébalo (one per month) and promotional events with USAID and UK.
Social media: Instagram and Facebook with posts and photos
Production plant: Customer visits</td>
</tr>
<tr>
<td colspan="3">Cost structure

Fixed costs: Personnel, property taxes and excise, utilities (water, electricity, internet), machinery and equipment maintenance (per time of use/failure).

Variable costs: Use of machinery, hiring of production personnel, raw materials (cocoa, timber), wood finishing inputs, specialized sharpening and other services, fuel, packaging for sales outside Pucallpa.

Cost of sales: Payment for stand at fair, security, transportation from plant to fair, tavel tickets and expanses for events outside Pucallpa, packaging, management and logistics.</td>
<td colspan="2">Revenue streams

Sales upon orders: Home furniture
Sales at trade fairs: Utility items, handicrafts
Consignment sales: Utility items, handicrafts
Sales of dried cocoa beans through articulation and commercialization services</td>
</tr>
</table>

a) Customer segment

The customer segment to which Nii Biri's products are directed are final customers who place orders for products such as tables, chairs and utilities. These customers can be families of economic strata A, B and C, national processing companies, consignment commercializing companies and international companies.

Commercializing companies such as Pruébalo and Raíces are an interesting customer segment; however, their participation in the business model is as intermediary companies, since they receive the products on consignment.

On the other hand, a percentage of the commercialized products are sold to final clients in the local market, thanks to Nii Biri's participation in local and regional fairs.

b) Value proposition

Nii Biri offers value-added timber products under the FSC forestry certification and intends to commercialize cocoa with organic certification and promote the sale of deforestation-free plantains from native communities' agroforestry systems.

c) Communication and commercialization channels

The main commercialization and communication channels through which Nii Biri reaches clients are as follows:

- Fairs organized by the Regional Directorate of Agriculture of Ucayali and ExpoAmazonica.
- Negotiation and promotion roundtables and conferences carried out by the Chamber of Commerce.

of Indigenous Peoples of Peru (CCIPP) supported by the United States Agency for International Development (USAID) and the United Kingdom (UK).

- State tenders.
- National and international specialized stores such as Polleras de Agustina.
- Regional and national consignment stores such as Pruébalo and Raíces.
- Regional events in shopping malls such as Open Plaza.
- Social networks and website.
- Nii Biri´s production plant in Ucayali.

The social networks used by Nii Biri are not yet an exploited means for the promotion and commercialization of its products.

d) Customer relationship

Nii Biri uses digital communication means such as WhatsApp, email, Instagram and Facebook to offer its products and coordinate sales with customers, providing personalized attention. It maintains good relationships with managers, consignment store personnel, distributors and final consumers.

It also establishes a personal relationship between sales promoters and customers during the participation in local and regional trade fairs and on the occasions when customers come directly to the production plant.

Nii Biri promotes and seeks to encourage customers with draws and raffles of different products through social media. It is recommended that this type of draws be held more frequently to keep the attention of clients.

e) Revenue stream

Nii Biri's income ins constituted by the sale of products under different modalities: sales by order, at fairs and on consignment. Likewise, it is considering the generation of income through the provision of articulation and commercialization services for products such as cocoa and plantains. All income is on a pay on delivery after invoicing.

Another option being explored for income generation is the provision of wood processing services; however, it has not yet been possible to develop this line of business.

The products have a profitability margin ranging from 30 to 50%.

f) Key resources

It is highlighted that the main key resource of Nii Biri is the human resource, the staff is in charge of business management, product transformation and personalized or virtual attention and interaction with clients.

In addition, Nii Biri's infrastructure consists of a processing plant and a warehouse and is equipped with the necessary machinery and equipment for the processing of various products.

On the other hand, it could be considered that thanks to the agreements with native communities, it has a supply of raw material from FSC certified forests; in addition to having the FSC chain of custody certification itself, which represents a differentiating factor with regards to the competition. The dried cocoa bean being from native communities and with traceability, gives it an additional value for its commercialization.

g) Key activities

Of the key activities that Nii Biri carries out to deliver its value proposition to clients, the following stand out:

- The reception of raw materials from native communities.
- The process of planking or resawing, drying, and enabling to transform the timber into the final product to serve the market.
- For the production on demand, the administration area receives the orders, analyzes the characteristics of the requested product, makes the quotation and places the production order. It follows up from the order to the delivery of the product to the final client.
- It participates in trade fairs and business conferences and seeks to make agreements with commercial partners and the organizations that organize these events.

For the cocoa and plantain business lines, the company foresees the collection process in the native communities and articulating it with the local or export market, depending on the case. For the cocoa, it is considering the drying, bagging and quality control processes, integrating itself with the market.

h) Key partners

Among Nii Biri's main key partners are the native communities of Mariscal Cáceres, Yamino, Sinchi Roca, Curiaca, Pueblo Nuevo, Roya and Flor de Ucayali, agroforestry producers with whom it has commercial agreements, and other communities, also with agroforestry products, with whom new agreements will be established to be incorporated into the business model.

Companies with specialized stores such as Polleras de Agustina and consignment stores such as Pruébalo and Raíces are important partners to channel product sales and promote Nii Biri. The Regional Directorate of Agriculture of Ucayali, as organizer of local fairs, also contributes to this purpose.
On the other hand, organizations such as USAID and UK, through AIDER, contribute with technical support.

For the sale of products to other departments, the transportation service providers allow Nii Biri to reach customers outside of Ucayali.

i) Cost structure

In Nii Biri's cost structure, a distinction can be made between fixed and variable costs.

Fixed costs include the salaries of administrative and accounting personnel, the payment of water, electricity, telephone and internet services, the corresponding property taxes and excises, and the preventive maintenance of machinery and equipment.

Variable costs are mainly due to the timber production and transformation process, including: i) raw material purchases; ii) purchase of inputs, such as wood finishing products; iii) subcontracting of specialized services, such as sharpening blades and saw teeth at CITEforestal; iv) use and rental of machinery and equipment; v) hiring of personnel under production demand; vi) subcontracting of packaging services for sales outside of Pucallpa; and vii) fuel.

In addition, fixed and variable sales costs are considered, which fluctuate depending on the events in which Nii Biri participates, for example in trade fairs, it must cover the costs of guardianship, tickets, product transportation, packaging, management and logistics.

Companies with specialized stores such as Polleras de Agustina and consignment stores such as Pruébalo and Raíces are important partners to channel product sales and promoting Nii Biri. The Regional Directorate of Agriculture of Ucayali, as organizer of local fairs, also contributes to this purpose.

2.7 Nii Biri's SWOT Matrix

In the process of constructing Nii Biri's SWOT matrix, shown in Figure 13, the company's participants consider that there are several points for improvement, highlighting that their main concern is to reach the financial equilibrium point. However, they also highlight that they have strengths and strategic allies that represent opportunities to take advantage of.

Among its main strengths are its good relations with its suppliers and clients, since they have agreements with the communities as suppliers of raw materials and agreements with specialized stores for the placement of products. In addition, due to its track record, it is recognized by public and private organizations in the region. Another of its strengths is that it has its own facilities and machinery that allow it to operate with current volumes; however, it should be considered that if agreements are made with more communities, it will probably require a larger area for gathering and also, if it is the case, for the processing of agroforestry products.

AIDER is supporting producers with technical assistance and guiding them toward organic cacao production, for which there is an opportunity to certify this production as organic, which would allow access to markets with differentiated prices. The international market demands shihuahuaco timber and dry cocoa beans, and there are no market limitations, therefore, greater efforts must be made to connect with more international buyers.

on the other hand, in the region there is specialized labor force for timber work, which facilitates the hiring of cabinetmakers or artisans to meet the demands of clients. It also has strategic allies that can provide support with the strengthening of business capabilities and there is the capacity to apply for public technical and financial support programs, as well as to participate in state tenders.

Nii Biri's weaknesses include the fact that, despite its experience and recognition in the area, it still has limited access to direct financing due to low production and sales volumes, and it is necessary to strengthen its management, business, and commercial capacities, since it needs to increase product sales, reduce inventory time, and improve its income. On the other hand, it is important to consider that the plant does not have adequate infrastructure for storage and/or processing agricultural products, therefore a strategy must be proposed to incorporate these products into its business model. In addition, a warehouse needs to be set up within the plant for storing finished wood products.

In turn, the main threats identified are the fluctuations in international prices of shihuahuaco timber and cocoa beans, which affect local prices; therefore, market behavior must be analyzed prior to commercial agreements with native community producers.

Figure 13. SWOT Matrix of Nii Biri

SWOT MATRIX	
Strengths	**Weaknesses**
1. Own facilities, plant with warehouse, workshop, machinery and administrative office in Yarinacocha to attend to the current small volumes of production (microenterprise). 2. Experience with an export of shihuahuaco timber to USA, in alliance with a private company. 3. Available reports of studies and consultancies carried out for Nii Biri 4. Agreements with native communities for the supply of raw materials, such as FSC-certified wood. 5. Agreements with specialized consignment stores, such as Pruébalo and Raíces 6. Nii Biri's geographic location in the Yarinacocha district presents advantages in access to raw materials. 7. Recognition from public and private organizations, such as DRAU, MINAM and CRESETMU. 8. Nii Biri is FSC Chain of Custody (COC) certified. 9. Experience with participation in product fairs 10. Compliance with orders delivery dates	1. timber is worked in a humid state 2. Production and marketing levels are not sufficient to generate profitability. 3. Limited access to financial resources 4. High personnel turnover 5. Limited infrastructure for cocoa processing 6. Lack of staff capacity to prepare production budgets to quote orders 7. No experience in the agricultural products market. 8. Nii Biri brand positioning has not been prioritized. 9. Undefined commercial strategy 10. Little knowledge and experience of business and commercial management 11. Low product turnover 12. High production costs and high legal raw material (timber) prices 13. Unsuitable storage of finished products
Opportunities	**Threats**
1. Local, regional and national trade fairs are organized on a regular basis to establish commercial relationships. 2. USDA organic certified cocoa production by native communities 3. Skilled workforce available in Pucallpa (cabinetmakers and craftsmen) 4. Local timber market prices are stable, which allows for accurate cost analysis. 5. It has AIDER as a strategic ally in technical aspects. 6. There is an international market for shihuahuaco and cacao 7. Possibility of participating in public tenders with wood products 8. Access to public funding/advisory programs 9. Availability of wood processing service providers	1. Fluctuations in international market prices for shihuahuaco wood and cocoa 2. The plant is located in an area that can be considered non-industrial. 3. The price of cocoa depends on the international market. 4. Current world conditions (recession, war, pandemic, climate change) 5. Inflation increases raw material and operations costs 6. Informality in the forestry sector creates disloyal competition

2.8 Economic Analysis

2.8.1 Production assumptions

The main assumptions of the economic model are based on the expertise of AIDER's technical team, secondary sources and the results of the workshops held. During the workshops carried out with the community members and the project's technical team, information on agroforestry plot size, density and spacing of the plantation, estimated mortality, productivity and price per product was extracted, which are described in Table 8.

Table 8. Agroforestry productive assumptions - native communities of Ucayali

Assumptions		
Shihuahuaco	Installed planting density (plants/ha)	51
	Estimated annual mortality (%)	2
	Productivity (pt/ha)	11 242
	Price - community dock (soles/pt)	5,80
	Harvest age (years)	30
Cocoa	Planting density (plants/ha)	1 038
	Price of dry bean in community (soles/kg)	7
	Productivity year 3 (kg/ha) Productivity years 4 and 5 (kg/ha/year) Productivity years 6 - 14 and 17 - 30 (kg/ha/year) Productivity years 15 and 16	500 850 950 850
Plantain	Planting density (plants/ha)	1 056
	Price placed in community (soles/bundle)	6
	Productivity year 1 (kg/ha) Productivity year 2 (kg/ha)	1 800 900

2.8.2 Costs structure

The cost structure, presented in Table 9, is based on the results of the workshops held in the communities of Mariscal Cáceres and Yamino and the expertise of AIDER's technical team regarding the production of plantain, cocoa and shihuahuaco. Prices were validated with information obtained from previous quotations made in the city of Pucallpa.

Table 9. Cost structure for the installation, maintenance and harvesting of one hectare of AFS - Ucayali

Cost structure	Cost (soles)
Construction of nursery and production of seedlings	
Labor	1 564,80
Inputs and materials	1 260,40
Tools	408,60
Installation of the agroforestry system	
Labor	5 784,00
Inputs and materials	4 525,50
Tools	1 541,00
Maintenance of the agroforestry system	
Labor year 1	2 040,00
Labor year 2	2 136,00
Labor starting year 3	2 424,00
Inputs and materials years 1, 6, 11, 16, 21 and 26	766,00
Inputs and materials years 2 to 5, 7 to 10, 12 to 15, 17 to 20, 22 to 25, 27 to 30	466,00
Tools variable per year	From 31.00 to 1,541.00
Agroforestry system harvesting	
Annual AFS cocoa harvest	580.00 to 1,284.00
Use Year 30 - shihuahuaco	5 833,54

2.8.3 Budget

The budget required for the establishment and harvesting activities of a one-hectare agroforestry plot, without considering the plantain crop harvest, is presented in Table 10. The AFS period is 30 years.

Table 10. Budget for one hectare of AFS - Ucayali

No.	Agroforestry systems budget	Cost (soles)
1	Installation and production of seedlings	3 234
2	Installation of AFS	11 851
3	AFS maintenance variable per year	From 2,633 to 3,731
4	AFS cocoa harvest variable per year	From 580 to 1,284
5	Timber harvesting and processing	5 834

The installation of the nursery and production of seedlings is performed only once at the beginning of the AFS establishment. The cost of tools necessary for the installation of the nursery and seedling production for one hectare amounts to 409 soles, as shown in Table 11.

Table 11. Cost of tools used for the construction of the nursery and production of seedlings for one hectare of AFS - Ucayali.

No.	Tools for the nursery	Unit	Quantity	Cost (soles)
1	Machete	unit	0,20	3
2	Straight shovel	unit	0,20	5
3	Digger	unit	0,20	13
4	Shovel	unit	0,20	24
5	Axe	unit	0,20	9
6	Hammer	unit	0,20	4
7	Measuring ruler	unit	0,20	7
8	Watering can	unit	0,20	15
9	Wheel barrow	unit	0,20	40
10	Cylinder	unit	0,20	40
11	Container	unit	0,20	9
12	Motor pump for irrigation	unit	0,20	90
13	Manual backpack	unit	0,20	90
14	Hose	m	20	60
	Total			**409**

On the other hand, investment in tools and equipment is required for the installation and maintenance of one hectare of the agroforestry system. The frequency of this requirement depends on the useful life of these items. The pruning shears and the curved saw are purchased every three years, the cultivator every five years and the backpack sprayer every six years. The total cost of the tools for field activities in the year of installation amounts to 1,541 soles, as shown in Table 12.

Table 12. Cost of tools used for the installation and maintenance of one hectare of AFS - Ucayali

No.	Installation and maintenance tools	Unit	Quantity	Cost (soles)
1	Machete	unit	1	15
2	File	unit	1	16
3	Hand pruning shears	unit	1	85
4	Curved pruning saw	unit	1	45
5	Fumigator backpack (jacto)	unit	1	380
6	Cultivator	unit	1	500
7	Digger	unit	1	50
8	Chainsaw	rent/day	9	450
	Total			**1 541**

On the other hand, labor is required for the installation and maintenance of the agroforestry system. For the construction of the nursery and the production of seedlings, labor costs 1,349 soles; for the installation of the one-hectare plot of AFS, an investment of 5,784 soles is needed. From the third year on, when the maintenance and harvesting tasks are carried out, the annual cost varies from 2,904 to 3,528 soles, as shown in Table 13.

Table 13. Labor cost for one hectare of AFS - Ucayali

No.	Activity	Number of days worked	Cost (soles)
	Nursery labor		**1 565**
1	Location of the area for the nursery	0,20	10
2	Land preparation	1,50	72
3	Pole planting, wiring and mesh laying	1,50	72
4	Collection of substrate, mixing and filling of bags	6,25	300
5	Bag loading and unloading	1,75	84
6	Seed selection and seed washing	0,50	24
7	Cocoa pre-germination and planting	1,25	60
8	Shihuahuaco pre-germination and planting	0,15	7
9	Micrografting	15,00	720
10	Nursery maintenance	4,50	216
	AFS installation labor		**5 784**
1	“Rozo” and chopping	25,00	1 200
2	alignment for the platain	6,50	312
3	Pocking and planting for the plantains	12,00	576
4	Alignment for the Cocoa - square design	3,00	144
5	Cleaning (5 per year)	60,00	2 880
6	Pocking and sowing of cocoa and shihuahuaco	12,00	576
7	Training pruning	2,00	96
	Maintenance and harvesting of AFS cocoa		**From 2,904 to 3,528**
1	Weeding (3 times per year) annually	36,00	1 728
2	Annual phytosanitary control	2,00	96
3	Training pruning year 2	4,00	192
4	Training pruning year 3	6,00	288
5	Maintenance pruning starting from year 4	12,00	576
6	Annual cocoa sowing	0,50	24
7	Variable cocoa harvest per year	23,00	From 480 to 1,104

Starting in the fourth year, the agroforestry system's production costs fluctuate between 2,633 and 3,731 soles, due to the replacement of tools. For the year of timber harvesting and processing, 5,833.54 soles are required to be able to execute this activity, as shown in Ucayali's cash flow (Annex 2).

2.8.4 Projected revenue

The agroforestry system begins to generate income from the first year with the production of plantains with 1,800 bunches, then the second year with 900 bunches per hectare. Cocoa, on the other hand, starts producing beans in year 3, after its installation, with a production of 500 kg in the third year, 850 kg in the fourth year and 950 kg starting in the fifth year, when it reaches its maximum production. The shihuahuaco timber is projected to be harvested in year 30, with a potential of 11,242 board feet (21.5 m^3).

2.8.5 Cash flow analysis

For the cash flow analysis, it is taken into consideration the income and expenses of plantain, cocoa and shihuahuaco production, thus obtaining the cash flow generated by the productive activity, allowing the determination of the main economic indicators that serve as a basis for decision making.

In year zero, an investment of 17,910 soles is made for the installation; in the first year, income is generated, which allows for a profit of 7,963 soles from the sale of plantains. In the second year, the production of this product decreases and generates a profit of 2,767 soles; in the third year, there is no more income from plantain production and cocoa production begins, obtaining a profit of 83 soles. From the fourth year on, the profits are significantly higher due to cocoa production, so in the fourth year the profit is 2,459 soles, which generally increases every year, reaching a maximum profit of 120,194 soles in year 30, where the sale for the production of shihuahuaco timber is added.

In year zero, an investment of 17,910 soles is made for the installation; in the first year, income is generated, which allows for a profit of 7,963 soles from the sale of plantains. In the second year, the production of this product decreases and generates a profit of 2,767 soles; in the third year, there is no more income from plantain production and cocoa production begins

Table 14. Agroforestry system cash flow - Ucayali

Year	0	1	2	3	4	5	6	7	8	9	10
Revenues	0	10 800	5 400	3 714	6 440	7 342	7 489	7 639	7 792	7 947	8 106
Costs	17 910	2 837	2 633	3 631	3 981	4 705	4 935	4 125	4 205	4 255	4 625
Utility	-17 910	7 963	2 767	83	2 459	2 637	2 554	3 514	3 587	3 692	3 481

Year	11	12	13	14	15	16	17	18	19	20
Revenues	8 268	8 434	8 602	8 775	4 711	9 129	9 312	9 498	9 688	9 882
Costs	4 505	4 635	4 125	4 205	4 131	4 281	4 205	4 635	4 125	4 705
Utility	3 763	3 799	4 477	4 570	580	4 848	5 107	4 863	5 563	5 177

Year	21	22	23	24	25	26	27	28	29	30
Revenues	10 079	10 281	10 486	10 696	10 910	11 128	11 351	11 578	11 809	130 153
Costs	4 555	4 125	4 205	4 635	4 625	4 505	4 255	4 125	4 205	9 959
Utility	5 524	6 156	6 281	6 061	6 285	6 623	7 096	7 453	7 604	120 194

Based on this cash flow and applying a discount rate of 9%, a benefit/cost ratio of 1.51 is obtained, which means that for each sol invested, S/. 1.51 is recovered. Likewise, an IRR of 20.8% is obtained, which represents the profitability of the project's cash flows. The current net value has a positive value and equal to S/ 30,703, which indicates that the project is profitable according to the opportunity cost.

Table 15. Economic indicators of the agroforestry system - Ucayali

Economic indicators	
Discount rate	9%
B/C	1,52
IRR	20,82%
VAN	30 703
PP	6 years

3 Description of the agroforestry business model of Madre de Dios

Based on AIDER's experience in the implementation of inclusive and sustainable businesses and the information obtained in the workshops with the native communities of Infierno and Tres Islas and the Coopaser cooperative, the following agroforestry business model is proposed for the native communities of Madre de Dios, as shown in Figure 14.

The model considers Coopaser as the main commercial articulator that links the actors of the cocoa chain from native communities and individual producers, partners and non-partners of the cooperative, with the international market.

The potential sources of financing for this model are private investors, with whom the communities channel funds to develop their agroforestry activities. In addition, there are national and international banks, as well as state programs that are sources of financing through which Coopaser, the partners and non-partners producers of the cooperative and the native communities can acquire additional capital for their operations. Likewise, the communities and the producers, through other productive activities, also have funds to invest in the agroforestry. As the level of cocoa production stabilizes, the productive activity becomes sustainable.

Another means, by which funds could be channeled is through the Management Contract of the Tambopata National Reserve and the Bahuaja Sonene National Park in Madre de Dios, in which AIDER, in alliance with the National Service of State Protected Areas (SERNANP), has a project to reduce emissions derived from deforestation and forest degradation (REDD+), where income is obtained from the carbon credits generated in these two protected natural areas (NPA) and makes possible the financing of sustainable productive activities in buffer zones.

Regarding technical assistance, AIDER and projects executed with technical cooperation funding are important actors in providing this service to the communities, associated producers and the Coopaser cooperative.

The productive committees, with technical support from AIDER, perform the activities of seedling production, installation and maintenance of the agroforestry system, in order to produce cocoa and timber. Likewise, AIDER provides technical assistance to the Coopaser partner producers. The cocoa production by the native communities and the partners and non-partners producers is channeled through the cooperative, which collects the cocoa in the agroforestry plots and in the processing plant, where the cocoa is fermented, dried and bagged, as well as exported. In the case of plantains and timber, the native communities sell these products directly; however, AIDER hopes to link the native communities with companies or cooperatives that demand these products in the national market.

The cooperative obtains working capital through national and international banks, buys the cocoa from the producers, carries out the transformation and exportation process and receives payment for the product. The price is set according to the New York Stock Exchange and, considering the organic certification and fair trade, differentiated prices are accesed. The income is used for the repayment of working capital and for Coopaser's operation, the income from organic production is distributed between the cooperative and the producers that have this certification, and the income from fair trade is distributed among the partners or is invested in the cooperative, as decided by the assembly.

The agroforestry business model has two channels for the sale of the products; the first that corresponds to cocoa, which is commercialized with the cooperative, and the second, with plantains and timber products, which will be commercialized with recognized companies in the national market. For the native communities, productive diversification allows them to increase their income while contributing to the recovery of degraded areas, reducing pressure on the forests and sequestering forest carbon.

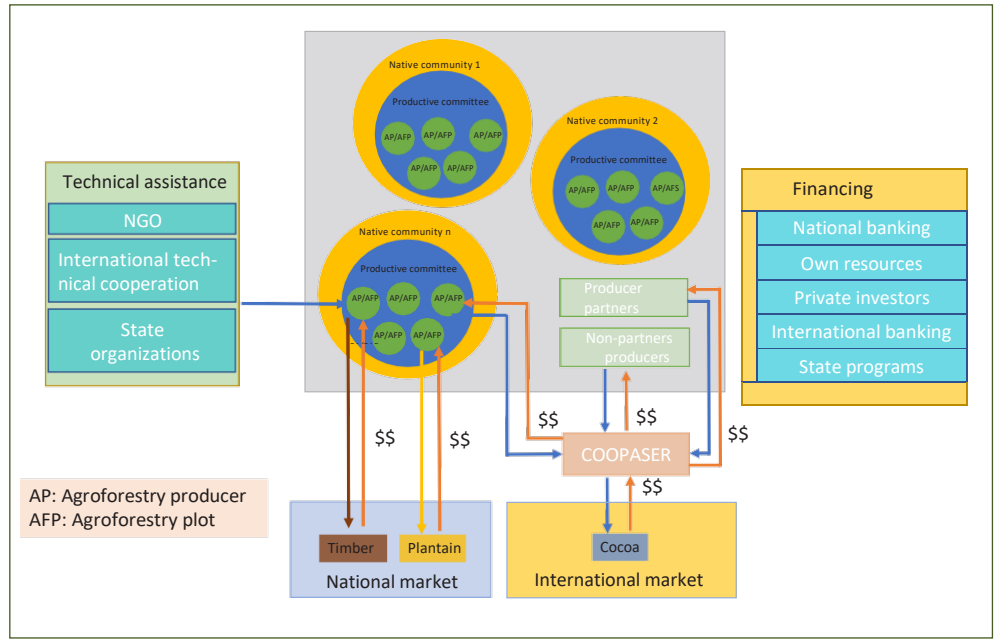
The potential sources of financing for this model are private investors, with whom the communities channel funds to develop their agroforestry activities.

Mr. Artemio Limachi's AFP - N.C. Infierno, Madre de Dios

Technical assistance visit to the AFP of Mr. Artemio Limachi - N. C. Infierno, Madre de Dios

This relationship between clients, Coopaser, partner producers and the native communities, with technical support from AIDER, makes it possible to incorporate the native communities as partners of the cooperative and articulate with the plantain and timber market in Madre de Dios, contributing to the sustainability of the agroforestry business model, with an equitable distribution of benefits along the value chain. Figure 14 shows the agroforestry business model for the native communities of Madre de Dios.

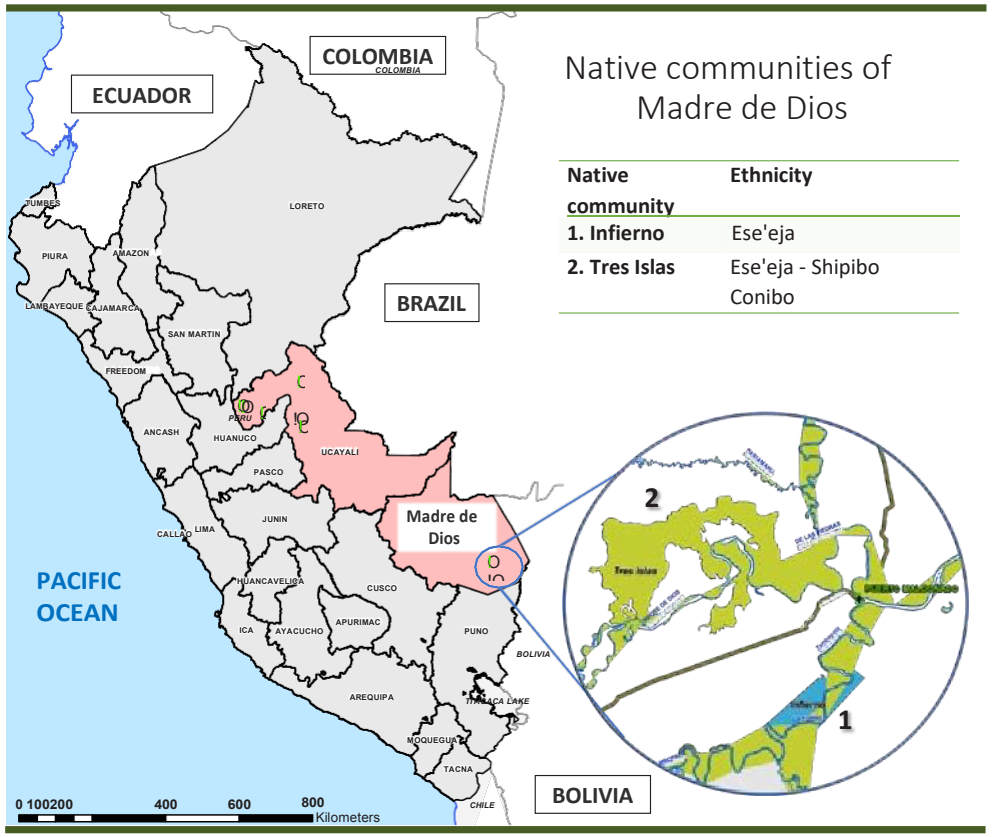
Figure 14. Agroforestry business model for the native communities of Madre de Dios



3.1 Native communities' location

The agroforestry business model, promoted by AIDER and Coopaser, is based on a design aimed at the native communities of Madre de Dios; in this particular case, we have worked with the native communities of Infierno and Tres Islas. Figure 15 shows the location of the communities.

Figure 15. Location map of the native communities in Madre de Dios.



3.2 Native communities' climate

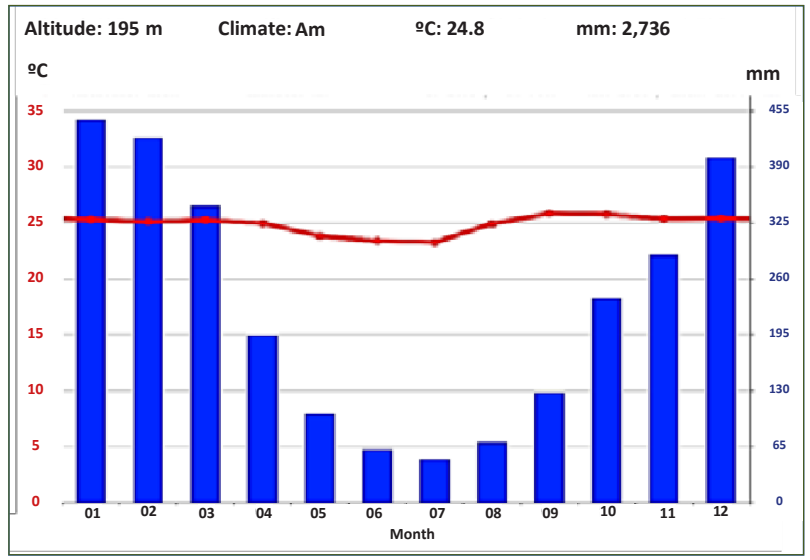
Based on data from climate-data.org, the Infierno Native Community is located at an altitude of 200 m a. s. l. and the Tres Islas Native Community at 225 m a. s. l.

In order to analyze the climograph of these native communities, the climatic data of the Infierno Native Community in the Tambopata district of Madre de Dios are used as a reference.

The Infierno Native Community has an "Am" climate, according to the Köppen and Geiger's classification, it has a tropical climate, with an average annual rainfall of 2,736 mm and over 195 mm per month during the months of october through april and a short dry season from may through september, with monthly rainfall of less than 70 mm. The average annual temperature is 24.8°C, reaching its highest temperatures in september with an average of 25.8°C and a maximum of 31.2°C. The coldest period is in July, with an average temperature of 23.2°C and a minimum of 19.7°C, as shown in Figure 16.

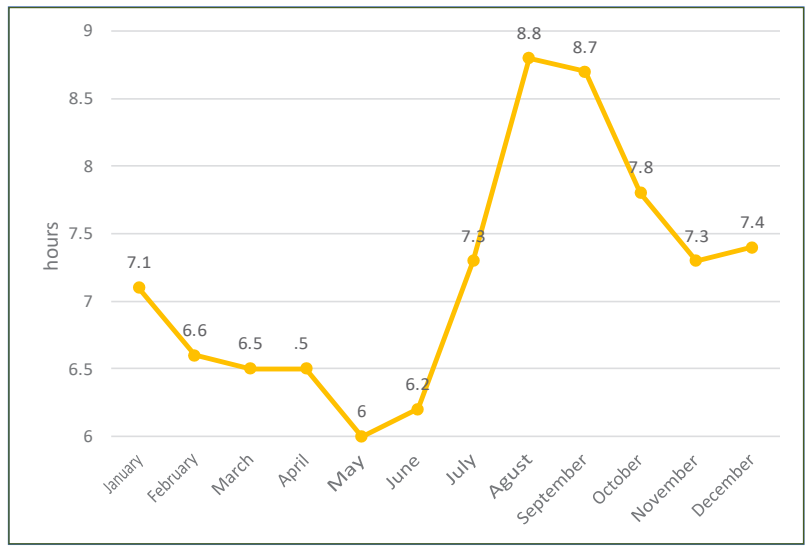
Sunshine hours in the Infierno Native Community present an accumulation of 2,624.78 sunshine hours per year, with a monthly average of 86.23 hours. During the months of august and september, there are more sunshine hours, with a value that exceeds 8.8 hours per day; on the contrary, during the months of january to july, it does not exceed 7.2 hours per day, with a minimum of 6 hours in the month of May, as shown in Figure 17.

Figure 16. Climograph, of the Infierno Native Community



Source: climate-data.org (es.climate-data.org/america-del-sur/peru/madre-de-dios/comunidad-nativa-de-infierno-487789/)

Figure 17. Sunshine duration, in the Infierno Native Community



Source: climate-data.org (es.climate-data.org/america-del-sur/peru/madre-de-dios/comunidad-nativa-de-infierno-487789/)

Mr. César Estánico sharing his experience in the installation of the AFP - Tres Islas N. C., Madre de Dios

Workshop with AIDER's technical team and members of the agroforestry committee - Tres Islas N. C., Madre de Dios

3.3 Agroforestry experiences of the native communities

3.3.1 Background on agroforestry production

Workshop participants from the native communities of Tres Islas mentioned that in 2015, Amazonian Conservation (ACCA) provided seedlings and tools for the installation of nurseries and agroforestry plots, but due to lack of assistance, the vast majority of producers abandoned the activity.

On the other hand, the native communities have created internal organizations for the management of their territory and agroforestry interest groups have been formed to initiate this activity in a sustainable manner. Likewise, organizations such as AIDER and the Regional Directorate of Agriculture of Madre de Dios have been contributing by providing diverse technical support. It is important to note that the producers themselves have been investing their own capital and labor for the installation and maintenance of the agroforestry plots.

3.3.2 Agroforestry design implemented in the communities

During the interaction with workshop participants in the native communities of Infierno and Tres Islas, it was determined that in order to take advantage of the land, the community members initially plant short-cycle crops, such as corn, after clearing the land, such as corn, cassava, sesame or others,

according to the producer's preferences. Subsequently, the plantain is installed, generally at a distance of 3 x 3 m, although there are those who install at 4 x 4 m and 3 x 4 m. They also mention that they are interested in associating copoazú, eugenia stipitata and coconut in the agroforestry system. At seven and eight months, cocoa is planted at a distance of 3 x 3 m with a square design, along with the shihuahuaco at a distance of 20 x 20 m or in some cases, at a distance of 15 m, when planted along the borders.

Like the native communities of Ucayali, the agroforestry systems are installed in areas that have been deforested a long time in advance, corresponding to lands that are resting or fallow, that is, lands in the process of recovery, after having been producing some agricultural crop or pasture, so the recommendation is to perform a soil analysis to be able to make a fertilization or remediation plan, if necessary. In addition, in this process of natural regeneration, it is common for timber species of interest to the community members to develop, which is why they are incorporated as part of the agroforestry system. On the other hand, the topography of these lands is irregular and presents obstacles or areas that flood, therefore, the design must be adapted to the reality of each plot.

On the other hand, native communities have created internal organizations for the management of their territory and agroforestry interest groups have been formed to initiate this activity in a sustainable manner.

Figure 18 shows the graphical representation of Mr. César Estánico's plot, from the Tres Islas Native Community, according to the diagnosis carried out in July 2022. This plot, with an area of 1.14 hectares, has mostly growing cocoa patterns and grafts (green and light green) and chlorotic cocoa patterns and grafts (brown and pastel yellow). Details of the number of individuals and color relationship with Figure 18 are presented in Table 16. This plot did not have forest species, therefore, shihuahuaco plants were installed in borders with a distance of 15 meters; in addition, it had empty spaces in which cocoa plants were installed in December 2022.

Figure 18. Distribution of plants in Mr. César Estánico's plot, Tres Islas Native Community.

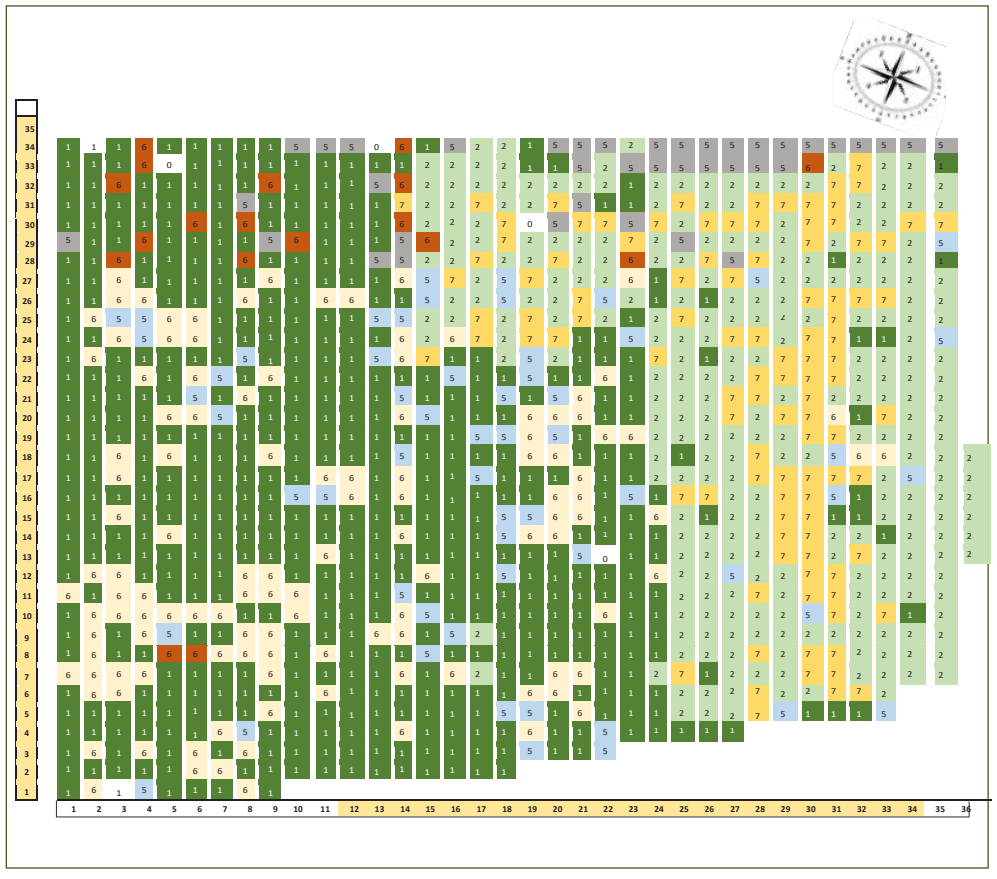


Table 16. Description of Mr. César Estánico's agroforestry plot.

Native community	Tres Islas		
Surface area (ha)	1,14		
Community producer	César Estánico		
Symbol	**Description**	**Number of plants**	**%**
0	Obstacle	4	0,38
1	Growing cocoa pattern	516	48,41
2	Grafting of growing cocoa	215	20,17
3	Capirona plant		
4	Shihuahuaco plant		
5	Empty space	92	8,63
6	Chlorotic growth pattern	137	12,85
7	Chlorotic cocoa grafting	102	9,57
8	Cacao grafting in production		
9	Mahogany plant		
10	Citrus		
X	Affected/flooded area		
R	River/drainage		
C	Road/access		
TOTAL		**1 066**	**100.0**

Figure 19 shows Mr. Artemio Limachi's plot from the Infierno Native Community. This plot of 1.29 hectares consisted mainly of cacao grafts (light green), growing cacao patterns (green) and chlorotic patterns and grafts (brown and pastel yellow color). The details of the number of individuals are shown in table 17. In December 2022, the planting was completed with shihuahuacos on the borders with a distancing of 15 meters.

Figure 19. Distribution of plants in Mr. Artemio Limachi's plot, Infierno Native community.

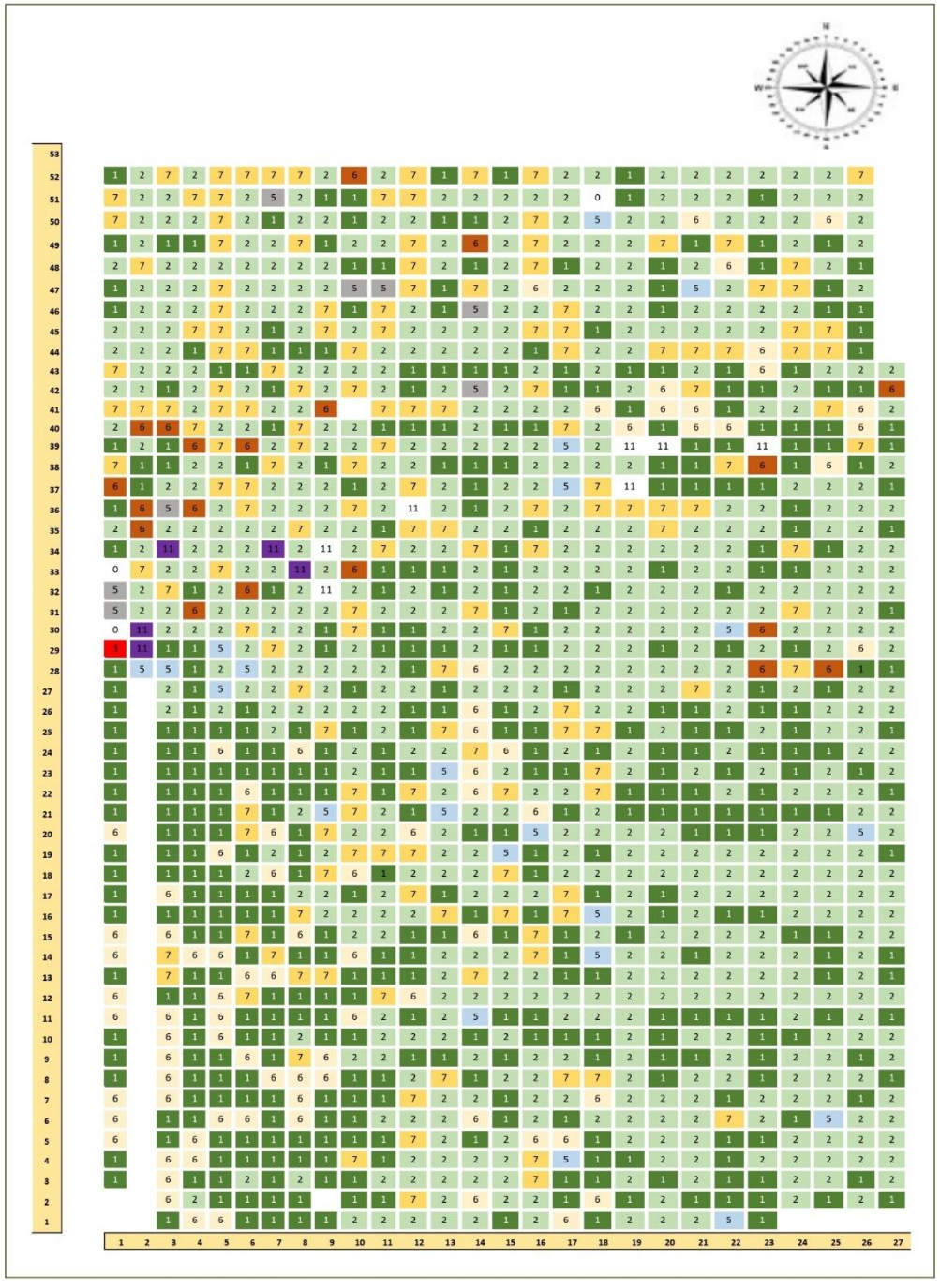


Table 17. Description of Mr. Artemio Limachi's agroforestry plot.

Native community	Infierno		
Surface area (ha)	1,29		
Community producer	Artemio Limachi Navarro		
Symbol	**Description**	**Number of plants**	**%**
0	Obstacle	3	0,22
1	Growing cocoa pattern	443	32,86
2	Grafting of growing cocoa	609	45,18
3	Capirona plant	1	0,07
4	Shihuahuaco plant		
5	Empty space	30	2,23
6	Chlorotic growth pattern	101	7,49
7	Chlorotic cocoa grafting	161	11,94
8	Cacao grafting in production		
9	Mahogany plant		
10	Citrus		
X	Affected/flooded area		
R	River/drainage		
C	Road/access		
TOTAL		**1 348**	**100,0**

3.3.3 Seedlings production for the agroforestry system

For the installation of the agroforestry plots, 50% of the seedlings were provided by the DRA of Madre de Dios and the remaining 50% by the community members. However, due to the interest of the Tres Islas community members, a nursery has been installed in the community to produce 10,000 cacao seedlings that will be used for the installation of new areas and the renovation of their plots, which was installed in August for the final field installation in December.

The activities for the installation of the nursery and production of seedlings are carried out by men and women, with a greater participation of women in the activities of substrate preparation, bag filling, seed handling and irrigation. Table 18 shows the activities developed for the production of seedlings for one hectare of agroforestry systems based on information obtained from the community members and AIDER agroforestry specialists. The cost of a worked day is S/ 60, and lunch is also provided, which is equivalent to S/ 10 per portion.

Table 18. Activities and labor costs for the installation of the nursery and seedlings production for one hectare of AFS - MDD.

No.	Activity	Number of days worked	Cost (soles)
Labor - nursery			**3 632**
1	Location of nursery area	0,20	14
2	Land preparation	1,50	105
3	Pole planting, wiring and mesh laying	1,50	105
4	Collection of substrate, mixing and filling of bags	6,25	438
5	Bag loading and unloading	1,75	123
6	Seed selection and washing	0,50	35
7	Cocoa pre-germination and planting	1,25	88
8	Shihuahuaco pre-germination and planting	0,15	11
9	Micro-grafting (160 soles is the equivalent cost of this day's work including lunch).	15,00	2 400
10	Nursery maintenance	4,50	315

Among the inputs and materials used by the communities for the production of cocoa seedlings are seeds and fertilizers, as well as different types of insecticides and fungicides that are purchased if necessary. Table 19 shows the inputs used for the production of seedlings for one hectare and their respective costs.

Table 19. Inputs and costs for the production of seedlings for one hectare - MDD

No.	Nursery supplies and materials	Unit	Quantity	Cost (soles)
1	Cocoa bean	kg	6,00	120
2	Shihuahuaco seed	kg	3,00	59
3	Cacao seed rods	unit	240,00	360
4	Hen manure	kg	31,00	28
5	Phosphate rock	kg	15,50	17
6	Dolomite	kg	21,00	27
7	Agricultural gypsum	kg	10,00	40
8	Rice husk (50 kg)	Saco	7,00	21
9	Potassium phosphite (foliar)	l	0,25	29
10	Fosetyl aluminum (fungicide)	kg	0,25	6
11	Protexin (fungicide)	l	0,30	32
12	Insecticide (cypermethrin)	l	0,25	20
13	Bayfonal foliar fertilizer NPK 20-20-20	l	0,25	15
14	Magnocal	kg	5,00	5
15	5 micron clear plastic	m	1,00	2
16	5" x 8" LDPE bags	thousand	1,30	91
17	Irrigation gasoline	gallon	1,00	23
18	Waterproof plastic	m	5,00	35
19	Raschel mesh	roll	1,10	990
20	Tie wire	kg	1,60	8
	Total			**1 927**

The list of tools and costs for the installation and maintenance of the nursery are presented in Table 20.

Table 20. List of tools for the production of seedlings for one hectare of AFS - MDD

No.	Nursery tools
1	Machete
2	Straight shovel
3	Digger
4	Shovel
5	Peak
6	Hammer
7	Measuring Tape
8	Watering can
9	Wheelbarrow
10	Cylinder
11	Container
12	Motor pump for irrigation
13	Manual backpack
14	Hose

3.3.4 Agroforestry system installation

The communities have carried out the installation of agroforestry plots, they mention that the work is done individually, with the participation of the couple on very few occasions, the vast majority of producers hire personnel to prepare the land, plant plantains and cocoa and clean the land. The effort required for land preparation such as "rozo", "shunteo", etc. depends on the state of the plot, such as the fallow period. The "rozo" consists of eliminating grass and small bushes, and if it is necessary to cut down remaining uninteresting trees, a chainsaw is used. The "shunteo" or chopping is practically cutting the trunks and branches into smaller pieces and then dispersing them throughout the plot. Table 21 shows the amount of labor required for each activity.

Table 21. Labor work required per activity for the installation of one hectare of AFS - MDD

No.	Activity	Number of days worked
AFS installation labor		
1	"Rozo" and chopping	25,00
2	Alignment for plaintain	6,50
3	Pocking and planting for plantains	12,00
4	Cocoa lining - square style	3,00
5	Cleaning (5 per year)	60,00
6	Pocking and planting of cocoa and shihuahuaco	12,00
7	Formative pruning	2,00

The inputs used are plaintain, cacao and shihuahuaco seedlings, in addition to fertilizers and fuel necessary for land preparation, as shown in Table 22.

Table 22. Inputs and costs for the installation of one hectare of AFS - MDD

No.	Installation supplies and materials	Unit	Quantity	Cost (soles)
1	Plaintain seedlings	unit	1 110	3 885
2	Hen manure (50 kg)	bag	0,50	30
3	Phosphate rock (50 kg)	bag	2,00	116
4	Dolomite (50 kg)	bag	1,50	78
5	Agricultural gypsum (50 kg)	bag	0,50	75
6	Potassium sulfate (50 kg)	bag	0,25	55
7	Gasoline	gallon	5,00	115
8	Burnt oil	gallon	2,00	20
	Total			**4 374**

The list of tools used in this process is presented in Table 23. The pruning shears and the curved saw are used for training and maintenance pruning of the AFS plot.

Table 23. List of tools for the installation and maintenance of one hectare of AFS - MDD.

No.	Installation and maintenance tools
1	Machete
2	File
3	Hand pruning shears
4	Curved pruning saw
5	Backpack (jacto)
6	Cultivator
7	Digger
8	Chainsaw

3.3.5 Commercialization of agroforestry products

Agroforestry committees members have limited experience selling plantain and cacao to different collectors in Puerto Maldonado. Plaintain is sold to resellers, although they also mention that there is an annual agricultural fair which is organized in Puerto Maldonado, and there is also a plantain flour buyers association in Laberinto, where this product can also be sold.

On the other hand, the community members of Infierno emphasize they have been able to reach a marketing agreement for cocoa, while the Tres Islas Native Community has become a partner of the Coopaser cooperative for the marketing of this product.

The price traded per kilogram of dry cocoa beans has been as high as S/ 8.00, but there is also mention that there are also collectors who pay between S/ 3.00 to 12.00 per kilogram, depending on the place of sale. The price of plantains is around S/ 6.00 per bunch at the farm.

3.4 Proposed agroforestry model

The agroforestry model promoted by AIDER for the Madre de Dios region is represented for the forestry component by the native timber species shihuahuaco, capirona and mahogany, which are in demand by the local and international market, in addition to the fact that the native communities have the appropriate soil and climatic conditions for their development; however, only shihuahuaco has been used for the project. As for the agricultural component, cacao is a permanent crop because of the growing demand for Peruvian cocoa on the international market. In addition, short-cycle crops such as cassava, corn, rice and others may be included prior to plantain installation, which also serves to provide initial temporary shade for the cacao plants.

Components of the agroforestry system

a) Forestry component

This component is represented by the shihuahuaco (*Dipteryx* sp.), a timber species that is in great demand in the national and international markets. It is a leguminous species that has suitable characteristics to be associated with agroforestry systems, has a high commercial value and is attractive for establishment; it has also been selected because it is a native species of the Amazon, with good growth results in forestry and agroforestry plantations. AIDER has the knowledge and experience of the technological package for silvicultural management. It is a species that is well known to local people and grows in natural habitats similar to cacao. Also included are the remaining trees of natural regeneration of this species or others with commercial value and those previously planted.

b) Agricultural component

The predominant agricultural component of the agroforestry system is the permanent cultivation of cocoa (*Theobroma cacao*) in association with plantain as a temporary shade crop. At the producers' discretion, other crops can be included in the installation stage, either for commercial or food security purposes, such as corn, cassava, rice, among others. Other previously established agricultural plants, such as citrus and fruit trees, could also be considered.

Cocoa is a product of great economic importance with a presence in 16 departments of Peru. This crop requires average temperatures of 27.5°C and rainfall of 1,200 to 2,600 mm and needs deep, well-drained soils with a pH of 4.5 to 5.5 and with high amount of organic matter. Cocoa, depending on its phenological stage, requires a greater amount of shade. In its initial stage, it requires shade, while during the productive period, it should be reduced so as not to affect yields. Shade also contributes to soil moisture regulation and the microclimate around the plants, creating a conducive environment to the development of the crop.

c) Agroforestry system design

The shihuahuaco is the forest species that accompanies the cocoa tree as permanent shade for 30 years, at which time the wood is harvested. During this period, the species provides shade conditions according to the needs of the cocoa plant. The main development characteristics are good growth, a single straight trunk, deep roots, a canopy greater than 7 meters, leaves that degrade quickly and light fruit, and, as a leguminous species, it provides nitrogen to the soil, among other benefits. The orientation of the shihuahuaco planting lines is directed from north to south, in order to provide adequate shade for the cocoa.

The plant distribution design of the agroforestry system is square, with a spacing of 3 x 3 m, allowing the establishment per hectare of 1,056 plantain plants, 1,038 cocoa plants and 51 shihuahuaco plants. The spatial distribution of this design is shown in Figure 20.

This method consists of placing each plant at the vertex of a square, the length of the side of which corresponds to the distance determined for planting. The implementation in the field is done using the triangulation system 3, 4 and 5 (Figure 21).

Figure 20. Spatial distribution model of species in the square agroforestry plantation design.

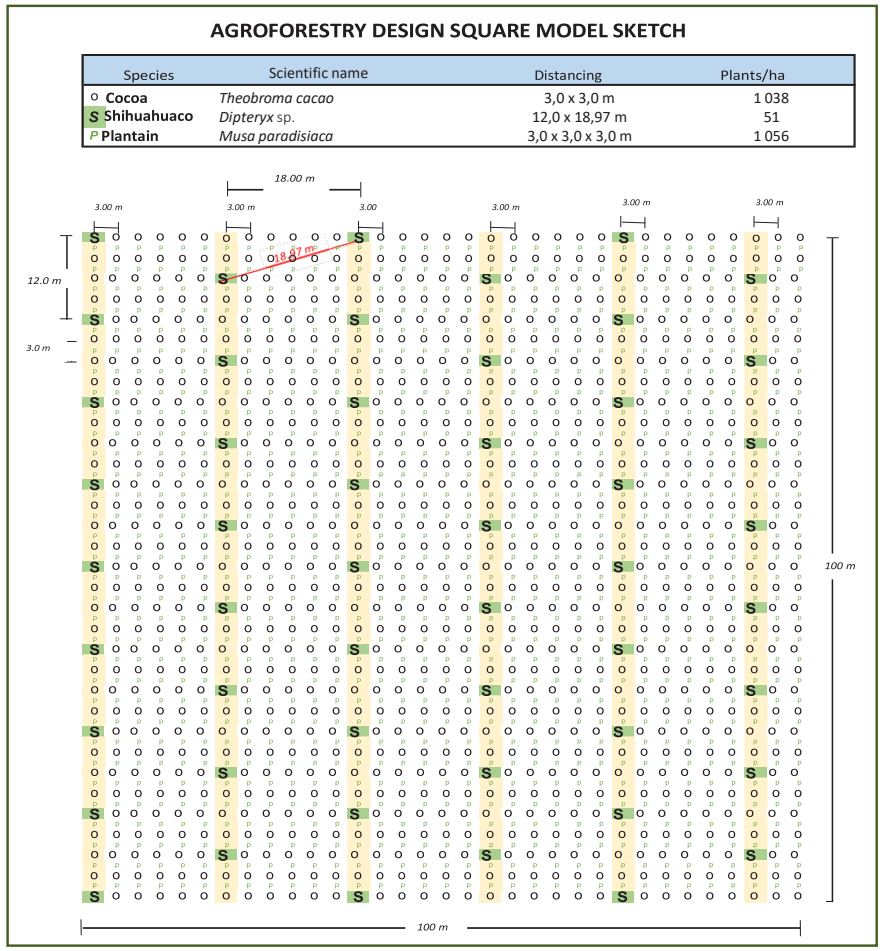
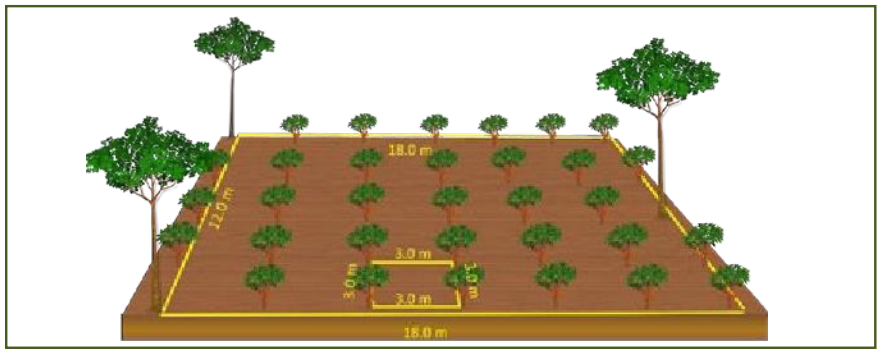


Figure 21. Panoramic representation of the distributions of plants in the square design.



3.5 Coopaser's agroforestry value chain

The value chain analysis begins with input and service providers, agroforestry production in the field, the market, processing and marketing, up to consumption. The most relevant activities and the direct and indirect actors in the chain are identified in each of these links. Figure 22 shows the diagram of the agroforestry value chain, followed by a description of each of the links.

a) Input suppliers and service providers link

This link in the chain analyzes those organizations that are the main suppliers of goods and services, such as cocoa seedlings and plantain seedlings, inputs and tools for agroforestry production, as well as those that supply inputs to Coopaser.

Direct actors include the native communities of Infierno and Tres Islas, and the cooperative's member and non-member agroforestry producers, who are currently the main suppliers of cocoa to Coopaser. In addition, there are suppliers of inputs and equipment for managing the agroforestry plots, such as Agrorural, hardware stores and veterinarians in the local market, as well as suppliers of blankets and bags for processing cocoa.

Likewise, indirect actors include organizations such as AIDER, the Regional Directorate of Agriculture of Madre de Dios and Coopaser, which provide technical assistance to agroforestry producers. Nevertheless, SENASA provides phytosanitary analyses to diagnose diseases in the region's crops. In addition, transportation service providers are key to transporting inputs and tools to the agroforestry producers' plots.

On the other hand, international financial institutions such as Rabobank and national financial institutions such as Agrobanco and Caja Cusco provide working capital to the cooperative for the collection and export of cocoa. Aditionally, Agroideas has contributed counterpart capital for the installation of cacao agroforestry systems and offers financing for the improvement and technification of any agricultural activity in the country.

b) Agroforestry production link

The agroforestry production link identifies the activities carried out in the field for the production of agroforestry systems in native communities and with other producers, such as seedlings production in nurseries, installation of the agroforestry system, management, harvesting and post-harvesting, the latter with cocoa fermentation and drying activities.

The direct actors are native communities, individual producers and members of cooperatives that produce cocoa in agroforestry systems. Coopaser has 205 active members who are agroforestry producers with an average of five hectares of established agroforestry plots. The Tres Islas Native Community recently became a member of the cooperative and the Infierno Native Community entered into a marketing agreement with Coopaser.

These communities have begun the process of installing agroforestry systems and cocoa grafting. They normally carry out the cultural work with the participation of the couple or by hiring labor.

Indirect actors in this link include AIDER, the Regional Directorate of Agriculture of Madre de Dios, and Coopaser, which provide training and technical assistance to agroforestry producers in installation, pruning, maintenance, and post-harvest. In addition, transportation service providers are key to moving the products to the storage centers of the companies and cooperatives in the area.

c) Processing link

This link involves cooperatives and companies that process cocoa. The cocoa collection activities at the plant, the processing of cocoa, which consists of fermentation, drying, bagging for storage and bagging for export. Some organizations process cocoa by-products such as chocolate, cocoa powder and butter.

Direct cocoa processing companies include Sumaqao and Machu Pichu and cooperatives (Coopaser) that produce dry cocoa beans, Agrobosque that produces chocolates and cocoa powder, Coopssur Oriente that produces cocoa powder, and Coopaidi that produces cocoa paste. Indirect stakeholders include service providers such as Electro Sur Este (electric power), Manu gas station (fuel), Autosuro (equipment maintenance), and equipment importers located in Lima (equipment and equipment spare parts), as well as national and international private banking.

d) Marketing link

This link includes the sale, distribution and marketing of processed cocoa from the Madre de Dios region for the national and international markets. This link also includes the actors present in the processing and organization link such as the Regional Directorate of Agriculture of Madre de Dios, which promotes local fairs.

The direct actors are the same companies and cooperatives that collect, process and market the cocoa: the companies Machu Picchu and Sumaqao and the cooperatives Coopaser, Agrobosque, Coopssur Oriente and Coopaidi, as well as European companies that buy the product.

Coopaser constantly participates in regional fairs to connect with potential clients. The agreements made with buyers for the international market are at FOB prices and are formalized through contracts that specify the volumes and characteristics of the cocoa. Delivery of the product requires land transportation services and coordination with shipping companies for maritime transportation.

Indirect actors include companies that provide bagging services for export, SENASA, SUNAT, among others.

It is important to note that national customers can not compete on price with customers in the international market, so Coopaser's marketing is export-oriented.

e) Market

Coopaser representatives believe that 78% of cocoa from the Madre de Dios region is destined for export, 20% goes to other departments in Peru for consumption and approximately 2% remains in the regional market.

Coopaser representatives believe that companies such as Machu Picchu SAC and Sumaqao account for 14% of Madre de Dios' cocoa production, while other cooperatives such as Agrobosque, Copaidi, and Coopssur account for 30% and the remaining 56% is held by the Coopaser cooperative. There are also local intermediaries that buy from producers in the field and resell to companies and cooperatives in the area.
It is important to consider changes in European regulations in order to be able to comply with them and continue with that target market.

f) Consumer link

Coopaser offers dried cocoa beans for the international market and chocolate bars for the local market. The main destinations for the dried beans are Italy and France, where the cocoa beans are processed into chocolate for the final customer. The chocolate bar is oriented towards domestic consumption, so it is available to the final customer in stores, ecolodges and airports, as well as at the cooperative's headquarters.

The direct actors are international companies, specifically European, that demand dry cocoa beans, which can be conventional or certified organic, both under the fair trade seal. These companies are located in Italy, France and Switzerland and can be intermediaries or companies that process the cocoa beans.

Representatives of the Coopaser cooperative at the systematization workshop

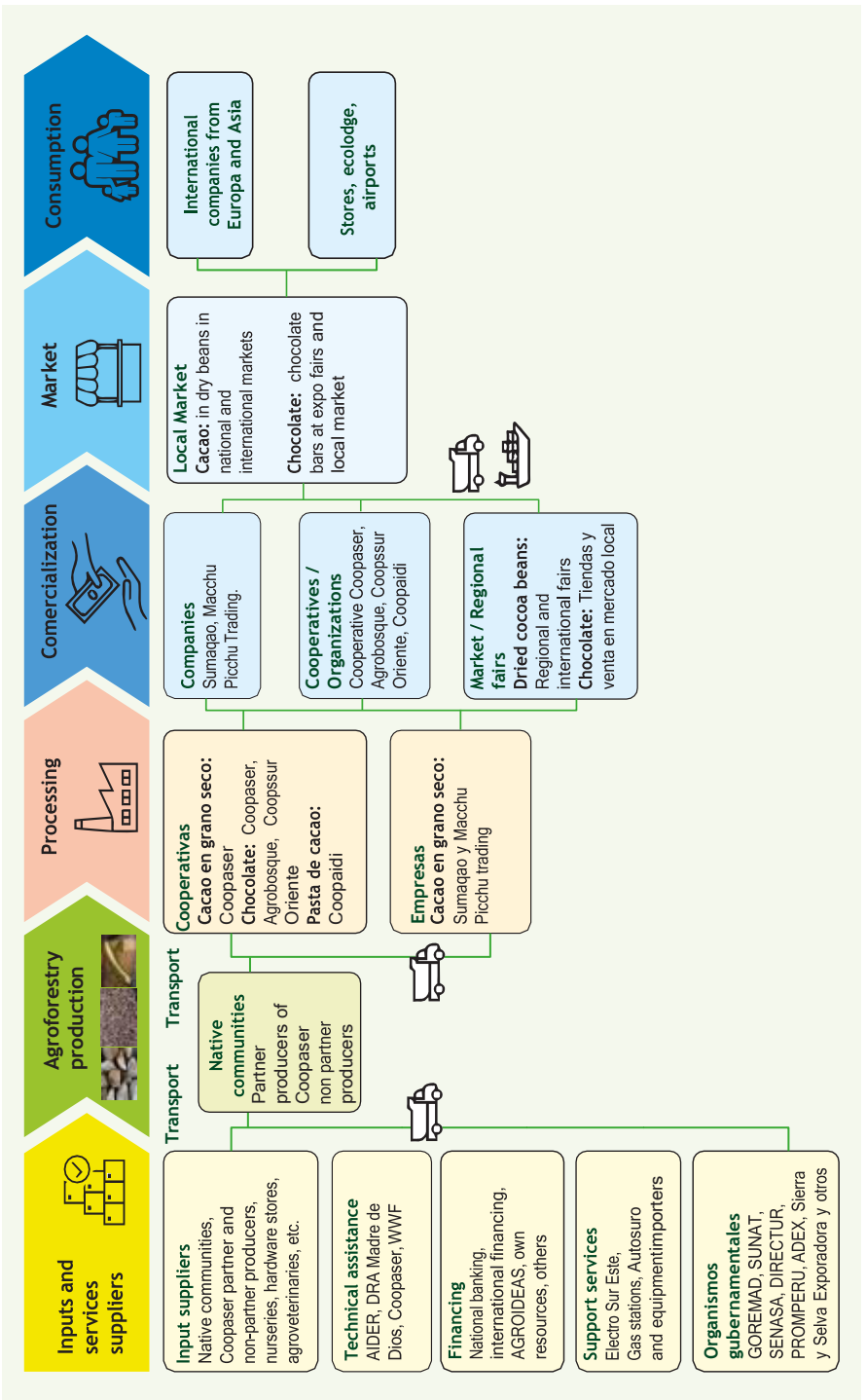


Figure 22. Agroforestry value chain - Madre de Dios

Value chain proposal for the export of dry cocoa beans - Madre de Dios

The value chain of cocoa from native communities and individual producers in Madre de Dios consists of the following links:

- **The production link in agroforestry plots.** This consists of the installation of agroforestry systems whose predominant agricultural component is cacao, which is installed and maintained by native communities and individual producers. The direct actors are the native communities of Tres Islas and Infierno and the cocoa producers, who harvest the cocoa from the fourth year of installation and sell it in slurry or dry beans to Coopaser.

- **The processing link.** This link begins with the transportation of the cocoa beans to the processing plant, an operation that is carried out by Coopaser, where it receives the cocoa production, and performs the fermentation, drying, quality control and bagging process for cocoa storage.

- **The foreign trade link.** This consists of bagging cocoa for export to the European market or other countries.

- **Cross-cutting chain support actors.** Throughout the process, actors that provide technical, management and marketing support are identified, including AIDER, DRA Madre de Dios, AGROIDEAS, Rabobank Working Capital and Back Bone, SENASA, Electro Sur Este, taps, Autosuro, GORE Madre de Dios, Produce, Tourism, SUNAT, DIRCETUR, PROMPERU, ADEX, Sierra y Selva Exportadora, Agrobosque, Coopssur oriente, Coopaidi, Sumaquao and Macchu Picchu Trading.

Figure 23 shows this value chain.

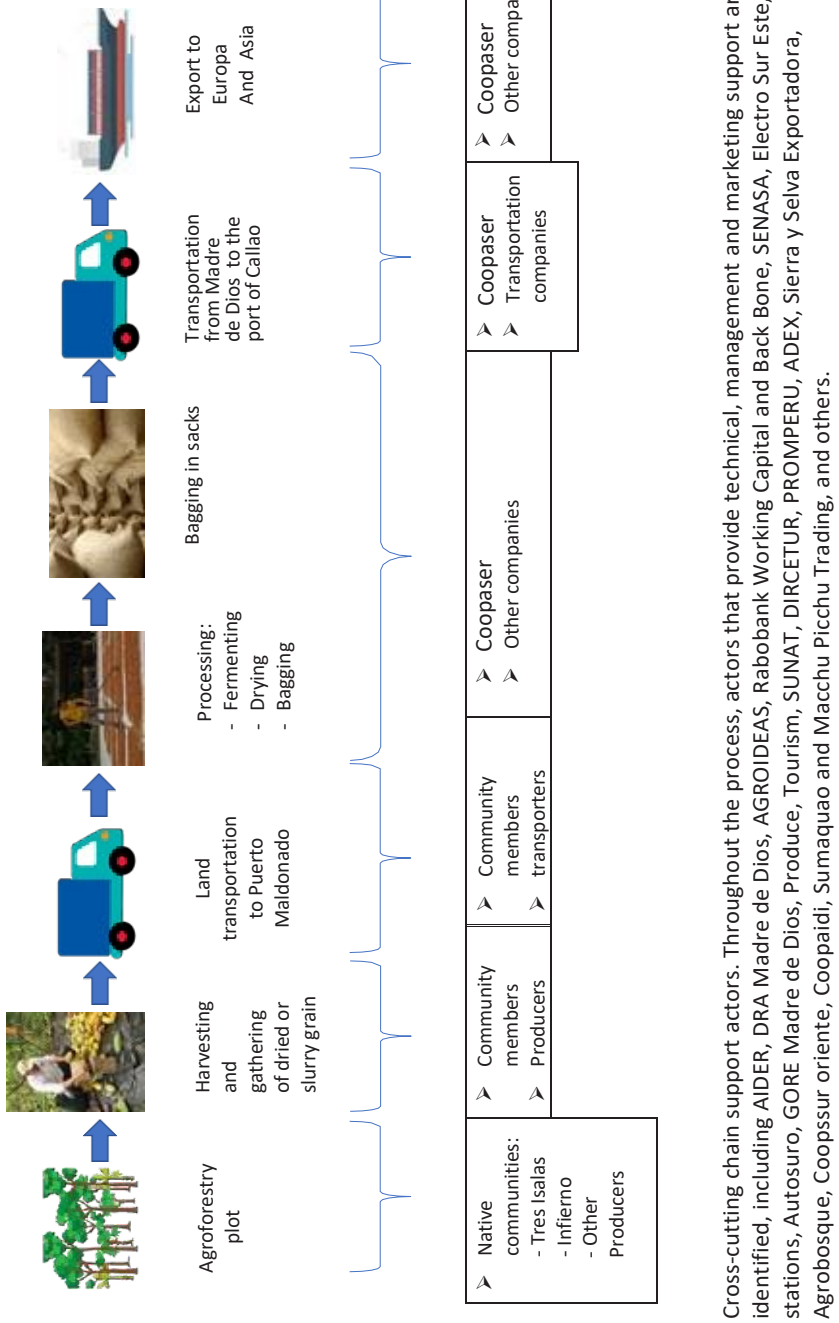


Figure 23. Value chain proposal for the export of dry cocoa beands - Madre de Dios.

Cross-cutting chain support actors. Throughout the process, actors that provide technical, management and marketing support are identified, including AIDER, DRA Madre de Dios, AGROIDEAS, Rabobank Working Capital and Back Bone, SENASA, Electro Sur Este, gas stations, Autosuro, GORE Madre de Dios, Produce, Tourism, SUNAT, DIRCETUR, PROMPERU, ADEX, Sierra y Selva Exportadora, Agrobosque, Coopssur oriente, Coopaidi, Sumaquao and Macchu Picchu Trading, and others.

3.6 Analysis of the business model of the Coopaser cooperative using the Canvas tool.

During the process of designing the Coopaser cooperative's business model, it was identified that the organization has a clear structure for its operations, from cocoa collection to cocoa export. The cooperative has proven that its current business model is viable, it has managed to break even and is looking to increase processing capacity. Since their current clients are interested in obtaining higher volumes of cocoa, they are focused on improving their members' yields and attracting other producers to join the cooperative.

The export experience and commitment of its staff is a strength that contributes to the business model; however, it is recommended to focus efforts on loyalty and technical assistance to partners to increase current production volumes. In addition, it is important to consider the changes in European regulations for cocoa imports and to be within the norm to continue with this market.

On the cocoa demand side, customers make purchase contracts with the cooperative for specific volumes, which guarantees that the marketing of their production is assured.

Coopaser is interested in the international cocoa market and is focusing its efforts on increasing production volumes and complying with international regulations.

With the participation of Coopaser representatives and AIDER's technical team, a workshop was held and the Canvas tool of this cooperative was developed. Figure 24 shows the business model using this tool.

Group work of the Coopaser representatives in the systematization workshop.

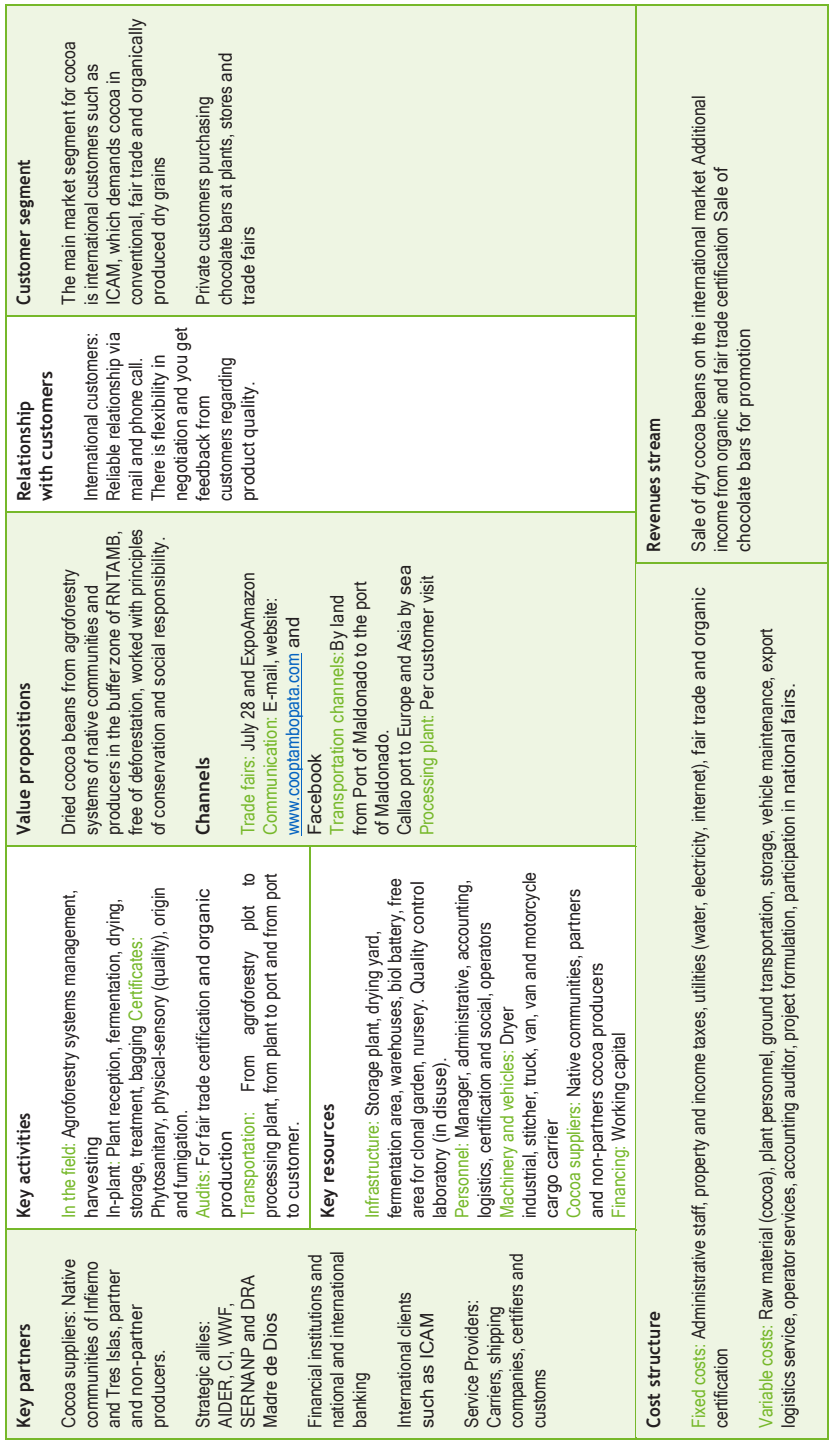


Figure 24. Canvas business model of the Coopaser cooperative.

a) Customer segment

The customer segment to which Coopaser's main product is directed is well defined; they are international customers, mainly Europeans who demand dry cocoa beans and have a preference for those suppliers with organic and fair trade certification.

So far, Coopaser representatives are interested in exploring the U.S. cocoa market, though they are currently doing business with customers in Europe.

The customer segment for chocolate bars, which is the cooperative's promotional product, is people who participate in fairs or visit the production plant, so it would be interesting to explore this market segment further.

b) Value proposal

Coopaser offers dry cocoa beans with organic and fair trade certification, managed under principles of conservation and social responsibility, from agroforestry systems of native communities and producers located in the buffer zone of the Tambopata National Reserve in Madre de Dios, which contribute to reduce deforestation.

It is important to consider that the main product of the cooperative is cocoa for export, so it is oriented towards the inclusion of cocoa producers to commercialize it in the international market. Regarding forest species and temporary shade crops, it is the producers themselves who decide how and with whom to market them.

c) Communication and commercialization channels

The main means of communication for sales and logistical coordination with customers are digital media, mainly e-mail and telephone calls, facilitating direct communication with customers during the purchase and transportation process.

The cooperative has a website (www.cooptambopata.com), where it presents the products and services it offers and uses Facebook as a social network.

The product is transported by land from Puerto Maldonado to the port of Callao, from where it is shipped to its final destination by sea. The purchase price agreement is FOB, which means that the cooperative is in charge of coordinating the land transportation and the buyer coordinates the maritime transportation.

d) Customer relations

Coopaser has built a good relationship with customers over time; there is flexibility in negotiations and constant communication. Customers also provide feedback to the cooperative regarding the quality of the cocoa. During the process of shipping orders, constant communication is maintained to coordinate shipping by sea.

e) Revenue flow

The cooperative's main source of income is from exports of dried cocoa beans. Of the total volume exported, up to this year, approximately 30% is organic cocoa and the remaining 70% is cocoa.

is conventional. Organic cocoa has a differential price of US$300 per ton in relation to conventional cocoa, and all of the cooperative's production is marketed under the fair trade seal, which provides a differential of US$240 per ton of cocoa.

Chocolate bars are produced for promotional purposes and do not represent more than 1% of Coopaser's revenues; however, given its profit margin, it would be interesting to explore this product further.

f) Key resources

The cooperative's main key resource is its members and the cooperative's staff. There are currently 205 active members, of which 80% are founding members and the remaining 20% have been incorporated, such as the Tres Islas Native Community; the Infierno Native Community has also established commercial agreements with the cooperative to supply cocoa.

The members have approximately 650 hectares of cocoa production. The permanent staff of the Coopaser is of 15 people, who perform administrative, accounting, logistical and processing tasks, as well as social support and certification staff for members.

On the other hand, the six-hectare processing plant is the company's main asset, with a storage area, a drying yard with a capacity of 8 tons, a fermentation area, two warehouses, a battery for the production of biols, and an area for a clonal cocoa garden, a nursery and a quality control laboratory is being adapted. Besides the company also has several vehicles for transporting cocoa and personnel (a truck, a pickup truck, and a motorized truck).

Access to financing for working capital is important for the purchase of cocoa, since without sufficient capital, cocoa production is directed to other enterprises.

g) Key activities

The accompaniment and technical assistance to producers for the management of their agroforestry plots is important for optimal production; however, it is recognized that it is something that has not been carried out as expected.

The activities carried out at the processing plant are as follows:

- 80% of the cocoa beans are harvested in the field and the remaining 20% in the plant.
- The fermentation process is the most important, since the organoleptic qualities of cocoa are obtained in this process.
- Drying is done with an industrial dryer.
- Pre-storage treatment and storage conditions help to avoid fungi that deteriorate the grain quality.

In order to export cocoa beans, the cooperative requires two certificates, for which a phytosanitary analysis and a physical-sensory analysis must be performed. In some cases, depending on the client's requirements, a certificate of origin and a fumigation certificate are added.

In addition, annual audits are carried out to maintain organic and fair trade certification. In terms of logistics, land and sea transportation must meet the requirements for the product to reach its destination while maintaining its organoleptic characteristics.

h) Key partners

Coopaser has key partners and other actors that are important to its business model. From the production side in the field, native communities, agroforestry producers, members and non-members are the suppliers of cocoa to the cooperative. On the other hand, AIDER and the Regional Government of Madre de Dios, through the Regional Directorate of Agriculture, have contributed with technical assistance on cocoa cultivation to producers in the region; likewise, International Conservation (CI) and the World Wildlife Fund (WWF) have contributed projects.

National financial institutions such as Agrobanco and Caja Cusco, and international ones such as Rabobank, have provided them with loans at preferential interest rates for working capital. One of the main partners is a European client, who wants to acquire the product through purchase contracts.

Service providers such as carriers, shipping companies, certifiers and with customs are actors that are involved in the business model, but do not consider them as partners or allies.

i) Cost structure

Coopaser's cost structure can be differentiated between fixed and variable costs.

Fixed costs represent approximately 40% of total costs and consist of: administrative and operating personnel; utilities such as water, electricity and internet; property and income taxes; and costs of audits and fair trade and organic production certifications.

Variable costs represent the remaining 60% and correspond t o : i) purchase of raw material - cocoa; ii) operator, auditor, project formulation and export logistics services; iii) participation in local and national fairs; and iv) the purchase of cocoa; (iv) maintenance of the cooperative's vehicles.

3.7 Coopaser's SWOT Matrix

In the process of constructing Coopaser's SWOT matrix, shown in Figure 25, the participants of this cooperative consider that, like any organization, there are always issues that require attention to improve the operation of the cooperative and consider that having identified these factors allows them to continue to grow and propose strategies to take advantage of opportunities.

One of the main strengths of the cooperative are its 205 members active

The company has potential areas for expanding agroforestry systems, of which approximately 30% are certified organic and Coopaser has fair trade certification, which has allowed it to access differentiated markets. Coopaser also has access to international markets through its commercial partners and has experience in exporting cocoa to the European market. In addition, its six-hectare primary processing plant has a processing capacity of 150 tons.

tons per month, and has the necessary equipment for its processes. Its administrative and technical team facilitates the collection, processing, and commercialization of cocoa. Furthermore, It has strategic alliances with different organizations such as AIDER, which supports the strengthening of the cooperative.

Regarding the opportunities; it is defined the growing demand for specialized niches at the international level, such as organic and by-product trade. On the other hand, there is the possibility of leveraging funds through international credits with attractive interest rates oriented towards social enterprises and access to cooperation funds and government programs to improve the technification of production and transformation processes. On the other hand, several organizations are interested in entering into agreements with the cooperative and there are producer support organizations such as WWF, AIDER, DRA de Madre de Dios and Sierra y Selva Exportadora, with whom efforts could be coordinated. In addition, with the growing demand for carbon, the cooperative has the potential to place carbon credits through a carbon sequestration project with the members' agroforestry systems.

Among the weaknesses, participants noted that Coopaser does not have its own office in the city of Puerto Maldonado and that the plant's infrastructure could be improved. The emphasis of the weaknesses are found in field production, highlighting that the members have not been able to obtain an optimal level of production, which may be due to different factors: the agroforestry systems were installed in recovering soils, so they demand a greater application of fertilizers, the management of the system by the producers is deficient and they have suffered losses due to inappropriate pest management. Cocoa production could be optimized with technical support and assistance to the cooperative's member producers, which could strengthen the members' commitment to comply with the activities.

In analyzing the threats, the presence of buyers from other departments and cocoa collection companies that destabilize the market stand out; in addition, the participants consider that there is an unfair competition from these new actors. The price of cocoa is subject to fluctuations on the New York stock exchange, which generates a certain level of uncertainty.

From a production perspective, climate change has affected the seasonality of rainfall and has increased the periods of drought, which has had a negative impact on the loss of agroforestry systems caused by fires in the area, as well as a greater proliferation of pests and diseases in the cocoa crop.

Figure 25. Coopaser's SWOT Matrix

SWOT MATRIX	
Strengths	**Weaknesses**
1. The partners have areas available for the installation of agroforestry systems with cocoa. 2. Primary processing plant with six hectares of land, own vehicles, equipment and tools. 3. Administrative and technical staff committed to the organization 4. Good internal organization 5. Presence throughout the Madre de Dios region with loyal partners 6. Coopaser trains its members and has access to productive resources. 7. It is certified organic, fair trade, conservation and carbon neutral. 8. Has agreements with strategic allies 9. Experience and access to international organic and fair trade cocoa markets 10. Access to credit based on credit history	1. Deficiencies in the processing plant infrastructure 2. The company does not have its own premises in the city of Puerto Maldonado. 3. Low productivity of cocoa clones, due to pests and deficiencies in fertilization and management. 4. Little technical assistance and training for crop management, only for Coopaser members. 5. There is no profitability analysis of agroforestry activities. 6. Lack of a strategy for organic production with partners 7. Lack of fluidity of commercialized product, which delays payment to members 8. Little commitment from some partners to implement Coopaser's suggestions 9. Conservation Allies and Carbon Neutral seals are not used 10. Limited working capital
Opportunities	**Threats**
1. Access to cooperating projects 2. Existence of State competitive fund programs 3. Possibility of a carbon sequestration project 4. Growing market for international loans oriented to social enterprises 5. Opening of market niches in organic and conventional trade and by-products. 6. Other institutions and organizations wish to enter into agreements with the cooperative. 7. Existence of differentiated markets 8. Existence of producer support organizations such as WWF, AIDER, DRA and Sierra y Selva Exportadora.	1. Presence of other cocoa buyers in the region, such as Machu Picchu and others. 2. Entry of cocoa buyers destabilizing the associated market 3. Impact on productivity due to droughts, rains and fires as a result of climate change 4. Proliferation of pests and diseases 5. Change of organic regulations in the European market 6. Market Price volatility 7. Unfair market competition 8. In 2022 there were no differential prices for organic certification.

3.8 Financial economic analysis

3.8.1 Production assumptions

The main assumptions of the economic model are based on the expertise of AIDER's technical team, secondary sources and the results of the workshops held. During the workshops, carried out with the community members and the project's technical team, information on agroforestry plot size, density and spacing of the plantation, estimated mortality, productivity and price per product was extracted, which are described in Table 24.

Table 24. Agroforestry productive assumptions - native communities of Madre de Dios

Assumptions		
Shihuahuaco	Installed planting density (plants/ha)	51
	Estimated annual mortality (%)	2
	Productivity (pt/ha)	11 242
	Price - community dock (soles/pt)	5,80
	Harvest age (years)	30
Cocoa	Planting density (plants/ha)	1 038
	Community dry grain price (soles/kg)	7,93
	Productivity year 3 (kg/ha) Productivity years 4 and 5 (kg/ha/year) Productivity years 6 - 14 and 17 - 30 (kg/ha/year) Productivity year 15 (kg/ha) Productivity year 16 (kg/ha)	500 850 950 500 850
Plantain	Planting density (plants/ha)	1 056
	Price placed in community (soles/bundle)	6
	Productivity year 1 (kg/ha) Productivity year 2 (kg/ha)	1 800 900

3.8.2 Costs structure

The cost structure presented in Table 25 is based on the results of the workshops held in the communities of Infierno and Tres Islas, and the expertise of AIDER's technical team regarding the production of cocoa, plantain and shihuahuaco. Prices were validated with information obtained from previous quotations made in the city of Puerto Maldonado.

Table 25. Cost structure for the installation, maintenance and harvesting of one hectare of AFS - MDD.

Cost structure	Cost (soles)
Construction of nursery and production of seedlings	
Labor	4 733,00
Supplies and materials	1 926,65
Tools	501,80
Installation of the agroforestry system	
Labor	8 435,00
Supplies and materials	4 374,00
Tools	1 565,00
Maintenance of the agroforestry system	
Labor year 1	2 975,00
Labor year 2	3 115,00
Labor from year 3	3 535,00
Inputs and materials years 1, 6, 11, 16, 21 and 26	808,20
Inputs and materials years 2 to 5, 7 to 10, 12 to 15, 17 to 20, 22 to 25, 27 to 30	496,20
Variable tools per year	From 35.00 to 1 565.00
Agroforestry system harvesting	
Annual AFS cocoa harvest	From 800.00 to 1 790.00
Harvesting Year 30 - Shihuahuaco	5 833,54

3.8.3 Budget

The budget required for the establishment and harvesting activities of a one hectare agroforestry plot, without considering the plantain crop harvest, is presented in Table 26. The period of the AFS is 30 years.

Table 26. Agroforestry system budget - MDD

No.	Agroforestry systems budget	Cost (soles)
1	Installation and production of seedlings	6 060
2	Installation of AFS	14 374
3	Variable AFS maintenance per year	From 3,646 to 4,758
4	AFS cocoa harvest variable by year	From 800 to 1,790
5	Wood harvesting and processing	5 834

The installation of the nursery and production of seedlings is done only once at the beginning of the establishment of the AFS. The cost of tools needed to install the nursery and produce seedlings for one hectare amounts to 502 soles, as shown in Table 27.

Table 27. Cost of tools used for the construction of the nursery and seedlings production for one hectare of AFS - MDD.

No.	Nursery tools	Unit	Quantity	Cost (soles)
1	Machete	unit	0,20	4
2	Straight shovel	unit	0,20	10
3	Digger	unit	0,20	22
4	Shovel	unit	0,20	10
5	Peak	unit	0,20	12
6	Hammer	unit	0,20	3
7	Measuring tape	unit	0,20	16
8	Watering can	unit	0,20	10
9	Wheel barrow	unit	0,20	40
10	Cylinder	unit	0,20	44
11	Container	unit	0,20	11
12	Motor pump for irrigation	unit	0,20	200
13	Manual backpack	unit	0,20	60
14	Hose	m	20,00	60
	Total			**502**

On the other hand, investment in tools and equipment is required for the installation and maintenance of one hectare of the agroforestry system. The frequency of this requirement depends on their usefull life. The pruning shears and the curved saw are purchased every three years, the cultivator every five years and the backpack sprayer every six years. The total cost of tools for field activities in the year of installation amounts to 1,565 soles, as shown in Table 28.

Table 28. Cost of tools used for the installation and maintenance of one hectare of AFS - MDD.

No.	Installation and maintenance tools	Unit	Quantity	Cost (soles)
1	Machete	unit	1,00	20
2	File	unit	1,00	15
3	Hand pruning shears	unit	1,00	35
4	Curved pruning saw	unit	1,00	45
5	Backpack (jacto)	unit	1,00	300
6	Cultivator	unit	1,00	500
7	Digger	unit	1,00	110
8	Chainsaw	rent/day	9,00	540
	Total			**1 565**

On the other hand, labor is required for the installation and maintenance of the agroforestry system. For the construction of the nursery and the production of seedlings, labor costs 3,632 soles, and the installation of the one-hectare plot of land for the agroforestry system requires an investment of 8,435 soles. From the third year on, when maintenance and harvesting are carried out, the cost varies annually from 4,235 to 5,145 soles, as shown in Table 29.

Table 29. Labor employed in the agroforestry system - MDD

No.	Activity	Number of days worked	Cost (soles)
Nursery labor			**3 632**
1	Location of nursery area	0,20	14
2	Land preparation	1,50	105
3	Pole planting, wiring and mesh laying	1,50	105
4	Collection of substrate, mixing and filling of bags	6,25	438
5	Bag loading and unloading	1,75	123
6	Seed selection and seed washing	0,50	35
7	Cocoa pre-germination and planting	1,25	88
8	Shihuahuaco pre-germination and planting	0,15	11
9	Micro-grafting (160 soles is the equivalent cost of this day's work including lunch).	15,00	2 400
10	Nursery maintenance	4,50	315
AFS installation labor			**8 435**
1	"Rozo" and chopping	25,00	1 750
2	Lined for plantain	6,50	455
3	Pocking and planting of platain	12,00	840
4	Cocoa lining - square design	3,00	210
5	Cleaning (5 per year)	60,00	840
6	Pocking and planting of cocoa and shihuahuaco	12,00	4 200
7	Formative pruning	2,00	140
Maintenance and harvesting AFS			**From 4 235 to 5 145**
1	Weeding (3 times per year)	36,00	2 520
2	Phytosanitary control	2,00	140
3	Formation pruning year 2	4,00	280
4	Formation pruning year 3	6,00	420
5	Maintenance pruning from year 4	12,00	840
6	Annual cocoa sowing	0,50	35
7	Variable cocoa harvest per year	23,00	From 700 to 1 610

Starting in the fourth year, the production costs of the agroforestry system fluctuate between 3,818 and 4,758 soles, due to the replacement of tools. For the year of timber harvesting and processing, 5,833.54 soles are required to carry out this activity, as shown in the cash flow for Madre de Dios (Annex 3).

3.8.4 Projected revenue

The agroforestry system begins to generate income since the first year with the production of platains with 1,800 bunches, then in the second year with 900 bunches per hectare. Cocoa, on the other hand, begins to produce beans in year 3, after its installation, with a production ranging from 500 kg this year, 850 kg in the fourth year and 950 kg in the fifth year, when it reaches its maximum production. The shihuahuaco wood is projected to be harvested in the year 30, with a potential of 11,242 board feet (21.5 m^3).

3.8.5 Cash flow analysis

The cash flow analysis takes into consideration the company's incomes and expenses.

Plantain, cocoa and shihuahuaco production, which provides the cash flow generated by the productive activity, allows us to determine the main economic indicators that serve as a basis for decision making.

In year zero, an investment of 20,434 soles is made for the installation; from the first year on, income is generated that allows for a profit of 6,982 soles from the sale of plantains. From the second year on, plantain production decreases and generates a profit of 1,754 soles. In year three, there is no more income from plantain production and cocoa production begins, resulting in a loss of 614 soles. Beginning in year four, profits are positive and are significantly higher due to cocoa production, so in year four the profit is 2,020 soles, which generally increases each year, reaching a maximum profit of 164,942 soles in year 30, when the sale of shihuahuaco wood is added.

Table 30. Agroforestry system cash flow - MDD

Unit	0	1	2	3	4	5	6	7	8	9	10
Revenues	0	10 800	5 400	4 333	7 586	8 733	8 995	9 265	9 543	9 830	10 124
Costs	20 434	3 818	3 646	4 946	5 566	6 356	6 468	5 776	5 856	5 856	6 276
Utility	-20 434	6 982	1 754	-614	2 020	2 377	2 527	3 489	3 687	3 973	3 848

Year	11	12	13	14	15	16	17	18	19	20
Revenues	10 428	10 741	11 063	11 395	6 177	10 817	12 452	12 825	13 210	13 606
Costs	6 168	6 156	5 776	5 856	5 446	5 878	5 856	6 156	5 776	6 356
Utility	4 260	4 585	5 287	5 539	731	4 938	6 596	6 669	7 434	7 250

Year	21	22	23	24	25	26	27	28	29	30
Revenues	14 015	14 435	14 868	15 314	15 773	16 247	16 734	17 236	17 753	176 552
Costs	6 168	5 776	5 856	6 156	6 276	6 168	5 856	5 776	5 856	11 610
Utility	7 846	8 659	9 012	9 158	9 497	10 078	10 878	11 460	11 897	164 942

Based on this cash flow and applying a discount rate of 9%, a benefit/cost ratio of 1.58 is obtained, which means that for each sol invested, S/. 1.58 is recovered. Likewise, an IRR of 17.9% is obtained, which represents the profitability of the project's cash flows. The net present value is positive and equal to S/ 34,940, which indicates that the project is profitable according to the opportunity cost.

Table 31. Economic indicators of the agroforestry system - MDD

Economic indicators	
Discount rate	9%
B/C	1,58
IRR	17,95%
VAN	34 940
PP	8 years

Group work with the members of the agroforestry interest group. C. N. Yamino, Ucayali

Presentation of workshop results - Yamino N. C. Yamino, Ucayali

4 Conclusions

» The conclusions of the study are presented below.

- Based on the workshops and field visits to the agroforestry plots, information was obtained from the community members about their agroforestry experiences, which served as the basis for the systematization and conceptualization of the design of the agroforestry model for Ucayali and Madre de Dios.

- In addition, the systematization included the participation of AIDER's technical team and the experiences of the technical team of the Nii Biri indigenous company in Ucayali and the Coopaser cooperative in Madre de Dios, which made it possible to develop agroforestry business models for each region.

- Agroforestry producers in the communities, both men and women, participate very actively in the nursery work and the installation of agroforestry plots. They shared their experience in the workshops and field vists and they are very enthusiastic with agroforestry work and they have been investing time and resources to develop this productive activity, with the expectation of having a profitable and sustainable production system over time, so they still require technical assistance for the maintenance of the plots and the work of harvesting and post-harvesting of cocoa.

- Two agroforestry models are proposed for native communities, one for Ucayali and the other for Madre de Dios. Both are framed within the Communal Forest Management model promoted by AIDER. They include short-cycle agricultural components (Plantain), permanent crops (cacao) and forestry (shihuahuaco), and may also include other temporary crops at the beginning of the installation of the system, as well as the maintenance of remaining trees.

of value for the community members that may exist in the agroforestry plot. The distribution and spatial density of the species are the same, the difference lies in the economic aspects such as costs and income.

- The model proposes the establishment of agreements between the native communities of Ucayali with Nii Biri and between the native communities of Madre de Dios with Coopaser, as they are companies that are part of the value chain, are working with the communities in the commercialization of their products under principles of mutual trust and transparency, are recognized by public and private institutions and have their own infrastructure, among other strengths.

- NGO and cooperation organizations are key actors to continue strengthening capacity building in technical and business management aspects for community members and agroforestry committees.

- The financing available to the native communities to ensure the implementation of agroforestry models mainly comes from their own resources, through other productive activities and services provided by the communities themselves; however, resources for capacity building and technical assistance are covered by external sources.

- The economic model of the agroforestry system for Ucayali, according to the profitability indicators, indicates that the project is economically attractive for a discount rate of 9.02%, with an internal rate of return of 20.82%, a benefit/cost ratio of 1.51, a payback period of six years after the agroforestry plot is installed and a positive net present value (NPV) of S/ 30,703.

- The economic model of the agroforestry system for Madre de Dios, for the same discount rate (9.02%), is also economically attractive, with an internal rate of return of 17.95%, benefit/cost ratio of 1.58, investment recovery period of eight years and positive net present value (NPV) of S/ 34,940.

5 Recommendations

- The establishment of agroforestry plots under these two models, which have demonstrated economic profitability, is recommended.

- To promote a greater number of agroforestry plantations in native communities on deforested areas with a certain age, as it is an economically viable productive activity with a positive environmental impact that allows carbon sequestration and the recovery of degraded areas, which contributes to improving the quality of life of the native communities of Ucayali and Madre de Dios.

- Continue with the development of capacities and technical assistance of agroforestry community members, especially in maintenance, harvesting and post-harvesting issues, as well as strengthening the business skills of the agroforestry productive committees for the compliance with commitments regarding quality, time, opportunity and price, which in turn guarantee the traceability of the agroforestry products.

- Continue to raise awareness among community members, entrepreneurs, authorities, officials and others about the importance of developing sustainable productive activities such as the agroforestry in the communities, in order to promote public and private investment in nature-based solutions that contribute to climate change mitigation and the transition to a green economy.

- Consolidate the agroforestry value chain by articulating the actors of the different links with whom Nii Biri and Coopaser have been working, that create relationships of trust and allow a exchange of information for the benefit of all actors in the chain.

- It is necessary that the Nii Biri and Coopaser companies enter into commercial agreements with a larger number of suppliers, especially from native communities, to increase the supply of products and achieve an economy of scale in order to consolidate the business models.

- Take into account the characteristics of each community, that may affect the functionality of the agroforestry model, for example, areas availability, accessibility, location, workforce availability, technical assistance, etc., in order to implement the proposed models in an adequate manner.

- For the application of the models, it must also be taken into account that this have been carried out on the basis of one hectare, therefore, smaller or larger surfaces have cost implications.

- The communities in Ucayali, in a similar way to those in Madre de Dios, must access fair trade and organic certifications to target specialized market niches that offer a price differential that gives a higher economic value to the products.

- Promote the production of agroforestry products with higher added value, in order to make business models more attractive.

Workshop participants - N. C. Infierno, Madre de Dios

Workshop participants - Tres Islas N. C., Madre de Dios

Community members sharing agroforestry experiences in Mr. Merino Odicio's AFP - N. C. Mariscal Cáceres, Ucayali

6 | Appendices

Annex 1
List of agroforestry producers by native community participants of the systematization workshops.

List of agroforestry producers by native community participants of the systematization workshops.

No.	Date	Native community	Name and Last names	Sex	Age
1	3/11/2022	Yamino	César López Tanchiva	M	36
2	3/11/2022	Yamino	Levi Julca Cruz	M	40
3	3/11/2022	Yamino	Raquel Huamán Lavado	F	31
4	3/11/2022	Yamino	Adid Torres Flores	F	28
5	3/11/2022	Yamino	Pablo Estrella Gonzales	M	48
6	3/11/2022	Yamino	Wilder Olivera Bonzano	M	44
7	3/11/2022	Yamino	Tomas Odicio Estrella	M	57
8	3/11/2022	Yamino	Wilton Odicio Angulo	M	43
9	3/11/2022	Yamino	Bety Isacama Feliciano	F	41
10	4/11/2022	Mariscal Cáceres	Walter Angulo Estrella	M	54
11	4/11/2022	Mariscal Cáceres	Sergio Pino Angulo	M	51
12	4/11/2022	Mariscal Cáceres	Avelino Pino Angulo	M	58
13	4/11/2022	Mariscal Cáceres	Merino Odicio Huayta	M	48
14	4/11/2022	Mariscal Cáceres	Guillermo Bolívar Odicio	M	65
15	4/11/2022	Mariscal Cáceres	Safira Pino Octavio	F	30
16	4/11/2022	Mariscal Cáceres	Ernestina Pino Octavio	F	42
17	4/11/2022	Mariscal Cáceres	Adela Estrella Barbaran	F	30
18	4/11/2022	Mariscal Cáceres	Patricia Rodríguez Hidalgo	F	27
19	4/11/2022	Mariscal Cáceres	Humberto Huayta Chanchari	M	65
20	4/11/2022	Mariscal Cáceres	Antony Acoticona Pino	M	27
21	11/11/2022	Infierno	Artemio Limachi Navarro	M	62
22	11/11/2022	Infierno	Amelia Escobedo Romero	F	51
23	11/11/2022	Infierno	Yesmi Hualla Zevallos	F	38
24	11/11/2022	Tres Islas	Ercilia Payabe Cachique	F	46
25	11/11/2022	Tres Islas	Norma Cusurichi Payaba	F	33
26	11/11/2022	Tres Islas	Sergio Perea Ponce	M	53
27	11/11/2022	Tres Islas	Milagritos Aguilar Chao	F	20
28	11/11/2022	Tres Islas	Augusto García Rodríguez	M	45
29	11/11/2022	Tres Islas	Carlota Vásquez Vásquez López	F	44
30	11/11/2022	Tres Islas	Mirtha Aguilar Cachique	F	45
31	11/11/2022	Tres Islas	Ulmer Villar Vargas	M	40
32	11/11/2022	Tres Islas	Yoshineiri Aguilar Chao	F	28
33	11/11/2022	Tres Islas	Cristina Cruz Borja	F	38
34	11/11/2022	Tres Islas	Oscar Vargas Rumayna	M	65
35	11/11/2022	Tres Islas	Marvila Racua Chávez	F	45
36	11/11/2022	Tres Islas	César Estanico Sánchez	M	51
37	11/11/2022	Tres Islas	Clara Yomira Cogna Payaba	F	37

Annex 2
Economic cash flow of Ucayali's agroforestry business model

Cash flow AFS - Ucayali

Cash flow AFS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues	0	10 800	5 400	3 714	6 440	7 342	7 489	7 639	7 792	7 947	8 106
Plantain revenues	0	10 800	5 400	0	0	0	0	0	0	0	0
Cocoa revenues	0	0	0	3 714	6 440	7 342	7 489	7 639	7 792	7 947	8 106
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	0	0
Operating costs	17 910	2 837	2 633	3 631	3 981	4 705	4 935	4 125	4 205	4 255	4 625
Agroforestry system	17 910	2 837	2 633	3 631	3 981	4 705	4 935	4 125	4 205	4 255	4 625
Nursery and seedling production	6 059	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	11 851	2 837	2 633	3 051	2 921	3 421	3 731	2 921	2 921	3 051	3 421
Harvest	0	0	0	580	1 060	1 284	1 204	1 204	1 284	1 204	1 204
Cash flow from operations	-17 910	7 963	2 767	83	2 459	2 637	2 554	3 514	3 587	3 692	3 481
Cash flow for the period	-17 910	7 963	2 767	83	2 459	2 637	2 554	3 514	3 587	3 692	3 481
Cash at the beginning of the period	0	-17 910	-9 947	-7 180	-7 096	-4 637	-2 000	554	4 068	7 655	11 347
Cash at end of period	-17 910	-9 947	-7 180	-7 096	-4 637	-2 000	554	4 068	7 655	11 347	14 828

Cash flow AFS	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Revenues	8 268	8 434	8 602	8 775	4 711	9 129	9 312	9 498	9 688	9 882
Plantain revenues	0	0	0	0	0	0	0	0	0	0
Cocoa revenues	8 268	8 434	8 602	8 775	4 711	9 129	9 312	9 498	9 688	9 882
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	0
Operating costs	4 505	4 635	4 125	4 205	4 131	4 281	4 205	4 635	4 125	4 705
Agroforestry System	4 505	4 635	4 125	4 205	4 131	4 281	4 205	4 635	4 125	4 705
Nursery and seedling production	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	3 221	3 431	2 921	2 921	3 551	3 221	2 921	3 431	2 921	3 421
Harvest	1 284	1 204	1 204	1 284	580	1 060	1 284	1 204	1 204	1 284
Cash flow from operations	3 763	3 799	4 477	4 570	580	4 848	5 107	4 863	5 563	5 177
Cash flow for the period	3 763	3 799	4 477	4 570	580	4 848	5 107	4 863	5 563	5 177
Cash at the beginning of the period	14 828	18 592	22 391	26 868	31 438	32 017	36 865	41 972	46 835	52 397
Cash at end of period	18 592	22 391	26 868	31 438	32 017	36 865	41 972	46 835	52 397	57 574

Cash flow AFS	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Revenues	10 079	10 281	10 486	10 696	10 910	11 128	11 351	11 578	11 809	130 153
Plantain revenues	0	0	0	0	0	0	0	0	0	0
Cocoa revenues	10 079	10 281	10 486	10 696	10 910	11 128	11 351	11 578	11 809	12 046
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	118 107
Operating costs	4 555	4 125	4 205	4 635	4 625	4 505	4 255	4 125	4 205	9 959
Agroforestry System	4 555	4 125	4 205	4 635	4 625	4 505	4 255	4 125	4 205	9 959
Nursery and seedling production	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	3 351	2 921	2 921	3 431	3 421	3 221	3 051	2 921	2 921	2 921
Harvest	1 204	1 204	1 284	1 204	1 204	1 284	1 204	1 204	1 284	7 038
Cash flow from operations	5 524	6 156	6 281	6 061	6 285	6 623	7 096	7 453	7 604	120 194
Cash flow for the period	5 524	6 156	6 281	6 061	6 285	6 623	7 096	7 453	7 604	120 194
Cash at the beginning of the period	57 574	63 098	69 254	75 535	81 596	87 881	94 505	101 600	109 053	116 658
Cash at end of period	63 098	69 254	75 535	81 596	87 881	94 505	101 600	109 053	116 658	236 852

Annex 3
Economic cash flow of the Madre de Dios agroforestry business model

Cash flow AFS - MDD

Cash flow SAF	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues	0	10 800	5 400	4 333	7 586	8 733	8 995	9 265	9 543	9 830	10 124
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	0	0
Cocoa revenues	0	0	0	4 333	7 586	8 733	8 995	9 265	9 543	9 830	10 124
Plantain revenues	0	10 800	5 400	0	0	0	0	0	0	0	0
Operating costs	20 434	3 818	3 646	4 946	5 566	6 356	6 468	5 776	5 856	5 856	6 276
Agroforestry system	20 434	3 818	3 646	4 946	5 566	6 356	6 468	5 776	5 856	5 856	6 276
Nursery and seedling production	6 060	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	14 374	3 818	3 646	4 146	4 066	4 566	4 758	4 066	4 066	4 146	4 566
AFS Harvest	0	0	0	800	1 500	1 790	1 710	1 710	1 790	1 710	1 710
Cash flow from operations	-20 434	6 982	1 754	-614	2 020	2 377	2 527	3 489	3 687	3 973	3 848
Cash flow for the period	-20 434	6 982	1 754	-614	2 020	2 377	2 527	3 489	3 687	3 973	3 848
Cash at the beginning of the period	0	-20 434	-13 453	-11 699	-12 312	-10 292	-7 915	-5 388	-1 899	1 788	5 762
Cash at end of period	-20 434	-13 453	-11 699	-12 312	-10 292	-7 915	-5 388	-1 899	1 788	5 762	9 610

Cash flow AFS	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Revenues	10 428	10 741	11 063	11 395	6 177	10 817	12 452	12 825	13 210	13 606
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	0
Cocoa revenues	10 428	10 741	11 063	11 395	6 177	10 817	12 452	12 825	13 210	13 606
Plantain revenues	0	0	0	0	0	0	0	0	0	0
Operating costs	6 168	6 156	5 776	5 856	5 446	5 878	5 856	6 156	5 776	6 356
Agroforestry system	6 168	6 156	5 776	5 856	5 446	5 878	5 856	6 156	5 776	6 356
Nursery and seedling production	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	4 378	4 446	4 066	4 066	4 646	4 378	4 066	4 446	4 066	4 566
AFS Harvest	1 790	1 710	1 710	1 790	800	1 500	1 790	1 710	1 710	1 790
Cash flow from operations	4 260	4 585	5 287	5 539	731	4 938	6 596	6 669	7 434	7 250
Cash flow for the period	4 260	4 585	5 287	5 539	731	4 938	6 596	6 669	7 434	7 250
Cash at the beginning of the period	9 610	13 870	18 455	23 742	29 280	30 012	34 950	41 545	48 215	55 648
Cash at end of period	13 870	18 455	23 742	29 280	30 012	34 950	41 545	48 215	55 648	62 898

Cash flow AFS	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Revenues	14 015	14 435	14 868	15 314	15 773	16 247	16 734	17 236	17 753	176 552
Shihuahuaco revenues	0	0	0	0	0	0	0	0	0	158 266
Cocoa revenues	14 015	14 435	14 868	15 314	15 773	16 247	16 734	17 236	17 753	18 286
Plantain revenues	0	0	0	0	0	0	0	0	0	0
Operating costs	6 168	5 776	5 856	6 156	6 276	6 168	5 856	5 776	5 856	11 610
Agroforestry system	6 168	5 776	5 856	6 156	6 276	6 168	5 856	5 776	5 856	11 610
Nursery and seedling production	0	0	0	0	0	0	0	0	0	0
AFS installation and maintenance	4 458	4 066	4 066	4 446	4 566	4 378	4 146	4 066	4 066	4 066
AFS Harvest	1 710	1 710	1 790	1 710	1 710	1 790	1 710	1 710	1 790	7 544
Cash flow from operations	7 846	8 659	9 012	9 158	9 497	10 078	10 878	11 460	11 897	164 942
Cash flow for the period	7 846	8 659	9 012	9 158	9 497	10 078	10 878	11 460	11 897	164 942
Cash at the beginning of the period	62 898	70 745	79 404	88 415	97 573	107 071	117 149	128 027	139 487	151 384
Cash at end of period	70 745	79 404	88 415	97 573	107 071	117 149	128 027	139 487	151 384	316 326

AGROFORESTY business models promoted by AIDER in native communities of Ucayali and Madre de Dios

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