



# ATSAF - CGIAR++ Junior Scientists Program Final Report

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**Country: Colombia**

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**Start and end date of stay at IARC: Sep 2020 - May 2021**

**Start and end date of remotely supervised project: -**

**Title: Sustainable Business Model (SBM) for the Cacao (Theobroma cacao L.) production and distribution in the Amazon region of Caquetá, Colombia**

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## **ATSAF - CGIAR++ Junior Scientists Program – research report**

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### **1. About the research framework:**

The research work conducted is linked to an ongoing project on “Implementing Sustainable Agricultural and Livestock Systems for Simultaneous Targeting of Forest Conservation for Climate Change Mitigation (REDD+) and Peacebuilding in Colombia (SLUS project). The SLUS project is implemented by the Alliance of Biodiversity International and the Center for Tropical Agriculture (Alliance Biodiversity CIAT), together with the Centre for Research on Sustainable Agriculture (CIPAV), the Leibniz Centre for Agricultural Landscape Research (ZALF), and Thünen-Institut.

The research was focused on supporting one of the activities of the SLUS project: Economic feasibility analysis of SLUS including analysis of production costs, re-turn of investment and net present value. Therefore, the topic selected as the master thesis title was: Enhancing cocoa producers’ profitability through a cost-benefit analysis of sustainable agricultural practices in Cesar, Colombia. Initially, the research collaboration was planned to last 6 months starting in September 2020, but due to research needs it was prolonged until May 2021.

### **2. About the work interaction**

Due to the pandemic, all of the work field was conducted virtually. I was part of the sustainable food system team of CIAT which was composed by my supervisor in Colombia, Augusto Castro-Nunez, and two research associates.

My work with CIAT was based on mutual collaboration. On the one hand they were guiding me and providing me the means to acquire some data for my research, and on the other hand I was analyzing the economic feasibility of cocoa production in the region of Cesar, Colombia and the implementation of sustainable agricultural practices. In addition, the output of my research was going to be used as an input to continue their other project activities.

The interaction I had with the sustainable food system team was:

- Update meetings every two weeks with the two research associates
- Update meetings with my supervisor in Colombia: Augusto Castro every month
- Two virtual meetings with cocoa experts of the region of Cesar, Colombia in which I had the opportunity to verify the secondary data collected for my research and to gain more inputs for the construction of the cost-benefit model (primary data).

- Other members of the SLUS project also gave me primary data related to cocoa production costs for Cesar that I was able to implement in my own research.
- I agreed with the food system team that I was going to share the cost-benefit model and to make another report focused on why agroforestry system in cocoa production are profitable production schemes.

### **3. About my work**

The research question of this study was: Can profitability in cocoa farmers be enhanced through the implementation of sustainable agricultural practices in Cesar, Colombia?

There main reasons why Cesar was selected as the study case area were: The first one related to the economic impact and the opportunity to enhance cocoa farmers' profit since Cesar has low economic mobility in the agricultural sector. The second reason is to support cocoa farmers in better overcoming the challenging conditions for agricultural production in the region (Cesar has highest rates of drought and soil degradation).

#### **The cost-benefit model**

The idea of the research is to identify if after implementing sustainable agricultural practices in cocoa production farmers can enhance their profit. The cocoa production scheme analyzed was: a cocoa production scheme including bananas as an intercrop in an agroforestry system. This scheme is the one that the SLUS project is using the region too. The CB model is made for a time period of 25 years.

In addition, the agricultural practices selected as best ones for cocoa production in Cesar were: organic fertilization, irrigation systems, and agroforestry systems.

Thus, the subject of study of the cost-benefit model is a cocoa production scheme including bananas as an intercrop in an agroforestry system with assisted irrigation and organic production. For practical reasons this scheme is called: Designed cocoa scheme. The cost-benefit model also includes a comparison to a baseline that is a monoculture cocoa scheme with conventional production without assisted irrigation.

### **Results**

#### **Cost-structure**

The total cost of the installation and maintenance of the designed scheme is 55,245.57 USD for a time period of 25 years. The distribution of costs is presented in figure 1. The highest cost is related to the workforce, it represents 53.95% of the total costs (29,807.47 USD). A Comparison of production costs between the designed cocoa scheme and the baseline for a time frame of 25 years is presented in Table 1.

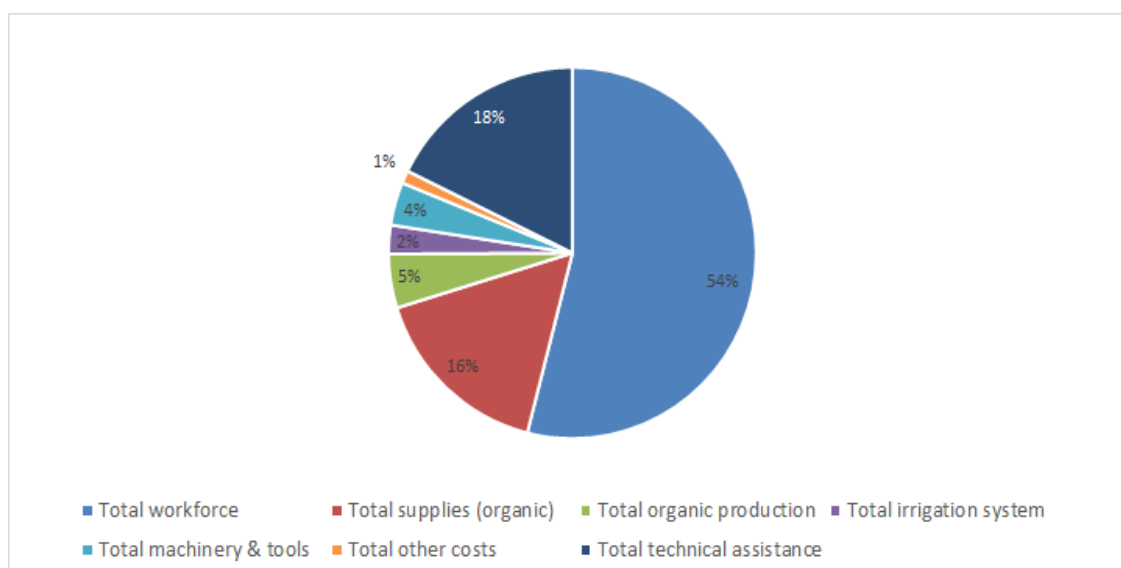


Figure 1. Distribution of costs of the designed cocoa scheme: Cocoa production with bananas as an intercrop in an agroforestry system with the technologies of organic production and an irrigation system. source: Own elaboration

Table 1. Comparison of production costs between the designed cocoa scheme and the baseline for a time frame of 25 years. Source: Own elaboration

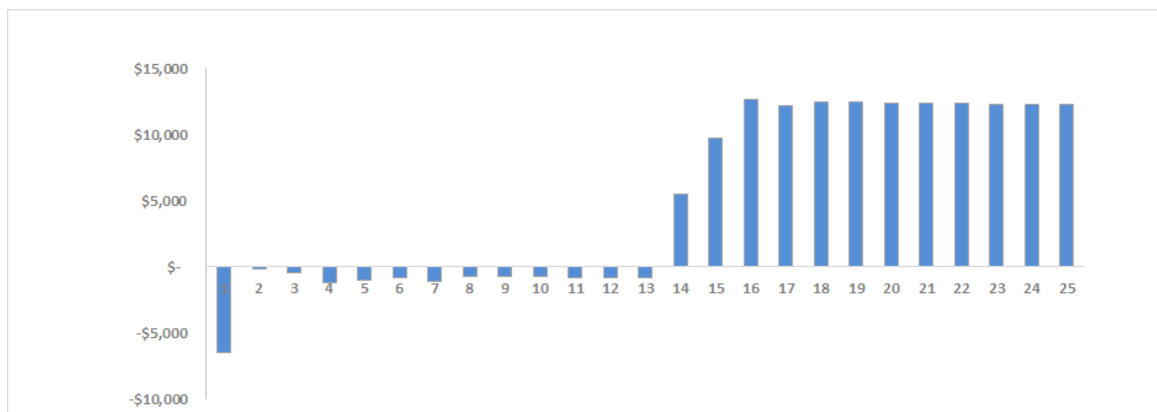
Costs	Designed cocoa scheme	Baseline	Delta USD	Delta %
Total workforce	\$ 29,807.47	\$ 27,466.50	\$ 2,340.97	8.52%
Total supplies	\$ 8,981.53	\$ 9,689.65	\$ -708.12	-7.31%
Total organic production	\$ 2,594.73	Not included	not comparable	not comparable
Total irrigation system	\$ 1,387.39	Not included	not comparable	not comparable
Total machinery & tools	\$ 2,069.15	\$ 2,069.15	\$ -	0.00%
Total other costs	\$ 616.60	\$ 351.02	\$ 265.58	75.66%
Total technical assistance	\$ 9,788.70	\$ 9,788.70	\$ -	0.00%
<b>Total</b>	<b>\$ 55,245.57</b>	<b>\$ 48,656.91</b>	<b>\$ 6,588.67</b>	<b>13.54%</b>

## Cash flow

The cash flow shows that the timber is the main key for farmers to enhance their profit. The designed cocoa scheme is a long run investment project because cocoa farmers will only see an income after the 14<sup>th</sup> or 15<sup>th</sup> year after started the project. Therefore, it is important for

cocoa farmers to have alternative sources of income in the short term. Banana production is included in the designed cocoa scheme as a short-term source of income but it is not enough to compensate the high amount of investments. In addition, since cocoa cultivation is a family business, there might be cases in which a cocoa cultivation field counts already with timber in their productive stage and therefore, their cash flow could be presenting income in shorter term. Details can be seen in figure 2.

Figure 2. Cash flow of the designed cocoa scheme (values in USD). Source: Own elaboration.



### Investment Criteria

For the cost-benefit model, the following investment criteria were analyzed: Net Present Value (NPV), Internal Rate of Return (IRR), the cost-benefit ratio (B/C). All of the three indicators in table 3 suggest that the baseline is not a profitable project. Nonetheless, all of the three indicators suggest the designed cocoa scheme in an agroforestry system is a good investment project. The B/C for the designed cocoa scheme is 3.9 meaning that cocoa farmers in Cesar could receive 3.9 USD per each dollar invested in the project. It is highly recommended that cocoa farmers in Cesar include in their production schemes agroforestry strategies to overcome the high investment rates and costs for producing cocoa during its lifespan.

Table 3. Investment decision criteria of the designed cocoa scheme and the baseline. Source: Own elaboration

	Designed cocoa scheme	Baseline
NPV	\$ 18,271.65	-\$ 3,935.35
IRR	18.8%	-
B/C	3.90	0.48

## Conclusion

It is important to state that the enhancement of profit for cocoa farmers is directly related to the implementation and a good management of agroforestry systems. This practice is the one that leverages the most the cost of investment and maintenance of cocoa production schemes because it is related to the income the farmer can perceive from the AFS. Furthermore, the organic production practice supports a potential increase in the cocoa selling price while the implementation of an irrigation system supports a better yield for cocoa farmers.

In addition, it is recommended that cocoa farmers do not overuse the land for timber production, or switch from production cocoa to fully produce timber since it can lead to an over exploitation of timber production and even to promote deforestation. The recommended ratio for producing cocoa in an agroforestry system is 1,050 plants per hectare (considering a density of 3x3 meters), for banana a cultivation ratio of 800 plants/hectare, and for timber trees a ratio of 90 plants per hectare.

A commercial opportunity for cocoa farmers in Cesar is not only producing organic cocoa but organic fine and flavor cocoa. It is more demanded internationally and the selling price can be increased in comparison to the selling price from organic bulk cocoa (2.18 USD) and the conventional bulk cocoa (1.91 USD). Currently, some cocoa beans produced as fine and flavor end up in the bulk domestic market since there is not enough support from local governments to promote and enhance fine and flavor production ready to be allocated outside Colombia. Therefore, it is important to promote collaboration among cocoa farmers in Cesar to strengthen their business model plan and value proposition so therefore, they can enter and capitalize international market opportunities.

Finally, it is recommended to continue the support of cocoa production, it is not only a national focus but also a regional need. The cost-benefit model elaborated in this research is a customized proposal for cocoa farmers in Cesar. The cost-benefit model takes into account Cesar's market, climate, and environmental reality. In addition, the cocoa production scheme proposed in this study can enhance farmers' profitability, be produced with adequate environmental practices, and support national peacebuilding strategies to defeat illicit crop cultivation in the country.