Pathways for closing the income gap for cocoa farming households in Côte d'Ivoire, a segmented approach

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Colophon

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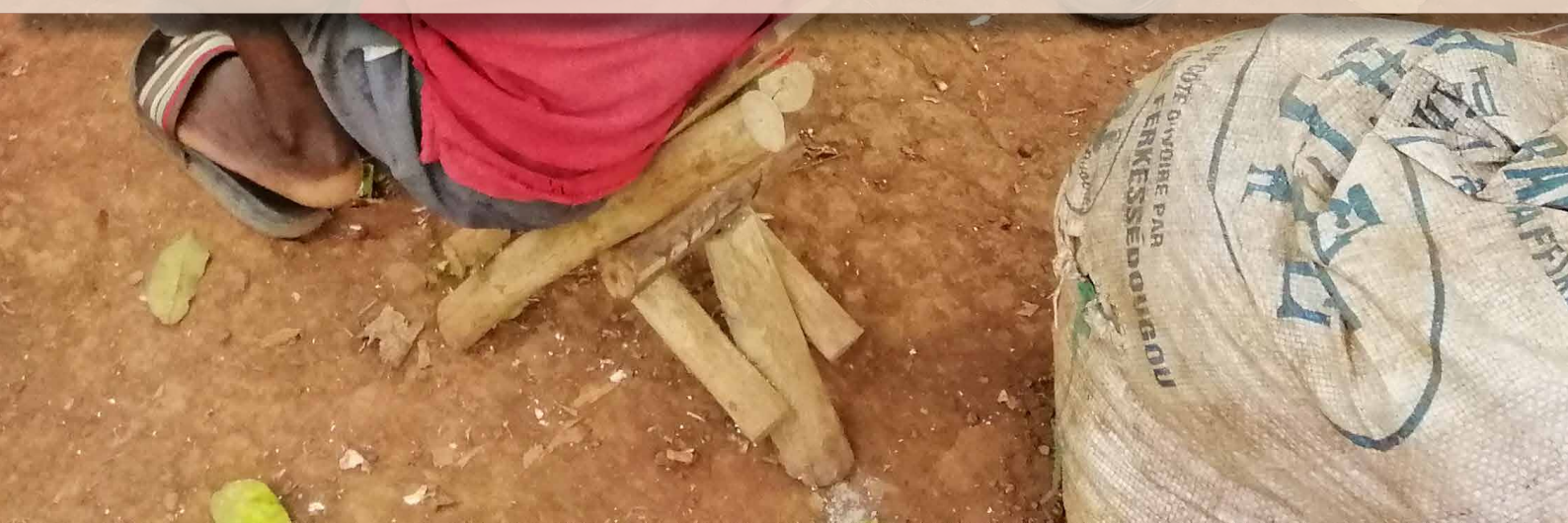
Acronyms

ALP	Agricole Local Partner
ANADER	Agence National d'Appui au Développement Rural
CDI	Côte d'Ivoire
CLMRS	Child Labor Monitoring and Remediation System
CNRA	National Agricultural Research Centre
CSSVD	Cocoa Swollen Shoot Virus Disease
FBS	Farmer business school
FGD	Focus group discussions
GAP	Good agricultural practices
GALS	Gender Action Learning System
GSP	Good social practices
HH	Household
IDH	Sustainable Trade Initiative
ICI	International Cocoa Initiative
KIT	The Royal Tropical Institute
LI	Living income
MEL	Monitoring, Evaluation and Learning
NCP	Nestlé Cocoa Plan
NGO	Non-governmental organization
PCA	Principal Component Analysis
PPI	Poverty Probability Index
SRHS	Sexual and Reproductive Health Services
VSLA	Village Savings and Loans Association
WCF	World Cocoa Foundation

1 Pathways for closing the income gap, a segmented approach



Introduction

In 2015, Nestlé launched a program focusing on the 'better-off farmers', called the Elite Farmer program. The 'elite farmers' were hand-picked from ordinary farmers in villages, based on a number of selection criteria, and intensively trained and coached. The aim was to empower elite farmers to unleash their potential, both in cocoa production and in alternative income generating activities, ultimately achieving a living income (LI) and becoming a lighthouse for others.

In 2019, Nestlé asked KIT to conduct a study to learn more about the outcomes of the Elite program so far, with the assumption that Elite farmers would perform better than other members of the Nestlé Cocoa Plan (NCP). It was thought that we could learn from them and identify:

- Characteristics of elite farmers that explain performance.
- Potential combinations of interventions, which are successful in closing the living income gap.
- Other 'high-potential' farmer segments within the NCP member base that would benefit from a customized approach, including tailored intervention packages that meet their specific needs and aspirations.

The end goal was to develop pathways that demonstrate how a significantly larger proportion of NCP farmers can potentially achieve an LI and to provide actionable recommendations for Nestlé.

Our report shares the learnings from the Elite program, both in terms of farmer's characteristics and performance, as well as the contribution of the program to LI. It also dives deeper into the drivers of productivity and LI, and helps determine effective intervention strategies for the wider base of Nestlé farmers. We share a data-driven segmentation approach and define five reoccurring groups using four different data sets. We explain how we select high potential segments from the defined groups and share segment specific aspirations, challenges and opportunities. This helps us put ourselves in the position of different types of farmers/households and draft customized pathways to contribute to an LI.

This study focuses on elite farmers and other high-potential cocoa farming households (HH). We deliberately choose to take elite farmers as a starting point – primarily because we assume there is more to learn about effective LI strategies from elite farmers who are already relatively successful, benefitting other NCP members. We anticipate it will be easier to begin supporting NCP members who, to some extent, share distinguishing features of elite farmers, rather than start with members who can be considered more marginal. In addition, more vulnerable groups, such as unorganized farmers, female farmers, laborers (including sharecroppers), and farmers who live more remotely are

currently underrepresented in NCP, and therefore naturally fall out of the scope of this study. However, we would like to emphasize that there is an urgent need for the sector to look at such vulnerable groups in more detail in future research and sustainability programs, as poverty and human rights challenges are concentrated among these HH[1,2].

Relevant concepts and definitions

We use a number of concepts and definitions in this study, which are explained below.

Clustering

Clustering is a technique aimed at grouping farming HH in such a way that HH in the same group bear more similarities to each other than to HH categorized in other groups.

Living income

LI reflects the needs of an HH to achieve a decent standard of living for all its members. These include food, water, housing, education, healthcare, transport, clothing, and other essential needs, including provision for unexpected events. The moment in time, geographical region, and family composition are all key in defining the benchmark. Geographical region and moment in time determine prices and overall costs, while family composition has implications for housing space, education costs, and food intake requirements. The actual HH income is typically composed of net farm income (i.e., production and sales of crops and livestock products minus production costs), off-farm income (e.g., own businesses, laboring), and other income (e.g. remittances)[3].

Living income benchmark

The LI benchmark is the net income required for a basic, but decent, standard of living. It is based on the costs of living, in line with the Living Wage methodology of Martha and Richard Anker[4].

Living income gap

To ascertain the LI gap, we calculate the net income from cocoa sales: **(cocoa production * price) – (production costs)**. Based on an (estimate of) the proportion of the net income from cocoa of the total income, we calculate the total HH income.

[1] Waarts, Y. & Kiewisch, M (2021) Balancing the Living Income Challenge. Towards a multi-actor approach to achieving a living income for cocoa farmer. Wageningen University and Mondelēz International, Cocoa Life. Available at: 557364 (wur.nl)

[2] Van Heck, P. & Laven, A. (2021) The Resilience Journey Empathy Generation (Phase 1) – Executive Summary. Mars Wrigley. Available at: https://www.kit.nl/publication/the-resilience-journey-empathy-generation-phase-1-executive-summary/

[3] More details about living income, and how to measure living income benchmarks and actual incomes can be found at www.living-income.com

[4] More details about living wage and the methodology developed by Richard and Martha Anker can be found at Home | Global Living Wage Coalition.

Nestlé Cocoa Plan

The NCP was initiated at the end of 2009 in Côte d'Ivoire. The program is aimed at increasing cocoa productivity and quality through farmer training and the distribution of cocoa seedlings. New elements have since been added over the course of several years, and the program was expanded to other countries, such as Ghana and Ecuador. The current NCP mission is focused on three main pillars: 1.) Better farming: enabling farmers to run profitable farms; 2.) Better lives: improving social conditions; and 3.) Better cocoa: sustainable, good quality cocoa.

To realize this mission, Nestlé collaborates with various organizations, such as industry associations, governments, non-governmental organizations (NGOs), certification schemes, suppliers, and local cooperatives. The following selection of activities are key to the NCP: Implementation of the child labor monitoring and remediation system (CLMRS); setting up village savings and loans associations (VSLAs); initiating pruning gangs and pilot projects on alternative income generating activities and conditional cash transfers to HH (e.g. the newly initiated and currently piloting Household Income Accelerator program).

Segment

A way of referring to a person's economic role and function in society, such as a producer, worker, entrepreneur, or consumer, and their unique intersecting characteristics.

2 Research scope, approach and methodology

Introduction

In this study, we aim to learn from the Elite program and identify other high-potential cocoa farming NCP households who could benefit from more tailored services that meet their specific needs and interests, as well as barriers and opportunities. The end goal is to develop pathways that show how a significantly larger proportion of NCP farmers can achieve an LI, and provide actionable recommendations for Nestlé. Our customized approach involves a number of steps, outlined in subsequent chapters (Table 1).

To develop pathways for high-potential cocoa farming households to achieve an LI, we included four research steps:

1 Take learnings from the NCP Elite Farmer program (Chapter 3).
2 Identify more general interventions that are successful in closing the LI gap (Chapter 4).
3 Data-driven segmentation for LI (Chapter 5).
4 Deep-dive into high potential household segments (Chapter 6).

Table 1 provides details of these steps, including the approaches taken, key questions to be answered, and a summary of the methodology.

Table 1 Scope of this study: approach, key questions, and methodology

Corresponding chapters	Approach	Key questions	Methodology
3. Learning from the Elite Farmer Program	**Conceptually driven approach:** analysis of the 'hand-picked' elite farmers: comparing their demographics, performance, and income levels with non-elite NCP farmers	• Who are the elite farmers? • How do elite farmers perform? • Do elite farmers earn an LI? • What is the likely attribution of the Elite program on HH income? • What can we learn from the Elite program for the wider population of cocoa farming HH?	**Fieldwork data** • Key informant interviews with suppliers, cooperative leaders, and coaches • Survey among elite farm and non-elite farming HH • Focus group discussions (FGDs) with small groups of elite and non-elite farmers • Open-ended interviews with elite farmers and their spouses
4. Drivers of productivity and HH income	**Exploring potential effects of interventions on HH income**	• What are the general drivers of productivity and HH income? • What are effective interventions that give a boost to HH income? • What are effective combinations of interventions?	**Desk study/data analyses** • Literature review • Regression analyses of available data sets **Fieldwork data** • Qualitative assessment of selection of alternative income generating opportunities
5. Data-driven segmentation	**Cluster analysis:** based on a set of data points and characteristics from the wider population of NCP farmers (non-elite), and three additional data sets, we use cluster analysis to understand similarities in terms of demographics, cocoa performance, and income diversification in relation to HH income.	• Which segments/archetypes can be derived from the cluster analyses? • What are consistencies in segments and what do these say about the robustness of the analyses? • What are the estimated segment sizes?	**Desk-study/data analyses** • Literature review • Cluster analysis on NCP data set, the data set of two Nestlé suppliers, and the KIT Demystifying data set
6. Deep-dive into high-potential household segments	**Selection of high potential archetypes and their corresponding identifiable features**	• Which segments can be considered as high potential? • What are segment specific needs and interests (aspirations and self-identified pathways), as well as barriers and opportunities?	**Fieldwork data** • FGDs with representatives of selected segments. • Individual interviews with representatives of selected segments
7. Pathways	**Developing pathways for high-potential segments of cocoa farming HH**	• What are potential pathways for high-potential HH to reach an LI? • What are potential channels to activate (steps of) these pathways? • What are actionable recommendations for Nestlé and their supply chain partners?	**Desk study/data analyses** • Identify entry-points for interventions that are a potential catalyst for LI that are both within the sphere of influence of Nestlé and match segment specific needs and interests. • Identify ways to activate pathways.

Covid-19 precautions

Fieldwork was conducted in the height of the Covid-19 pandemic, meaning additional precautions had to be taken. Consequently, we aimed at avoiding unnecessary travel. Therefore, the fieldwork was exclusively completed by local Ivorian consultants, with support from KIT staff at a distance. The local teams travelled with facemasks and hand sanitizer to distribute to respondents during the fieldwork. Fieldwork within communities was in open air with enough room for distance between respondents, and local teams were instructed to kindly decline offers to enter respondents' houses.

Although the well-trained and experienced field staff did an excellent job, providing us with good quality data, it is important to acknowledge that for the principal investigators not being able to conduct the fieldwork together with the research team might have affected the interpretation of data and quality of the data analyses.

Methodology

Existing data sets

We aimed to find as many synergies as possible with existing data on farmers/households. As such, we also include two suppliers' datasets into our analyses. In addition, KIT's Demystifying the cocoa sector dataset is added to the analyses to support the cluster findings and regression results. For more details on clustering analyses, see Chapter 5.

Primary data collection

We organized two rounds of primary data collection in December 2020 and May 2021, respectively. The purpose of the first round was to understand the demographic features, attitude, and performance of elite farmers and test assumptions. As showcased earlier in Table 1, we designed a mixed-methods approach that included a HH survey to capture the aforementioned characteristics and HH income levels, and FGDs and open-ended HH interviews to obtain more insights in farmers' aspirations and the elite program in general.

The sampling consisted of the following steps:

1. Cooperatives were first selected, based on their location and customers (i.e. suppliers to Nestlé). The research team was divided in two groups to cover multiple cooperatives, and Map 1 illustrates the fieldwork locations.
2. 'Purposive sampling' of the elite farmers from the selected cooperatives followed, based on their involvement in previous data collection for the purpose of comparison between data points.

3 To maximize the number of surveyed elite farmers, additional elite farmers were invited to 'supplement' the pre-selected elite farmers in the second step, based on their proximity to the latter.

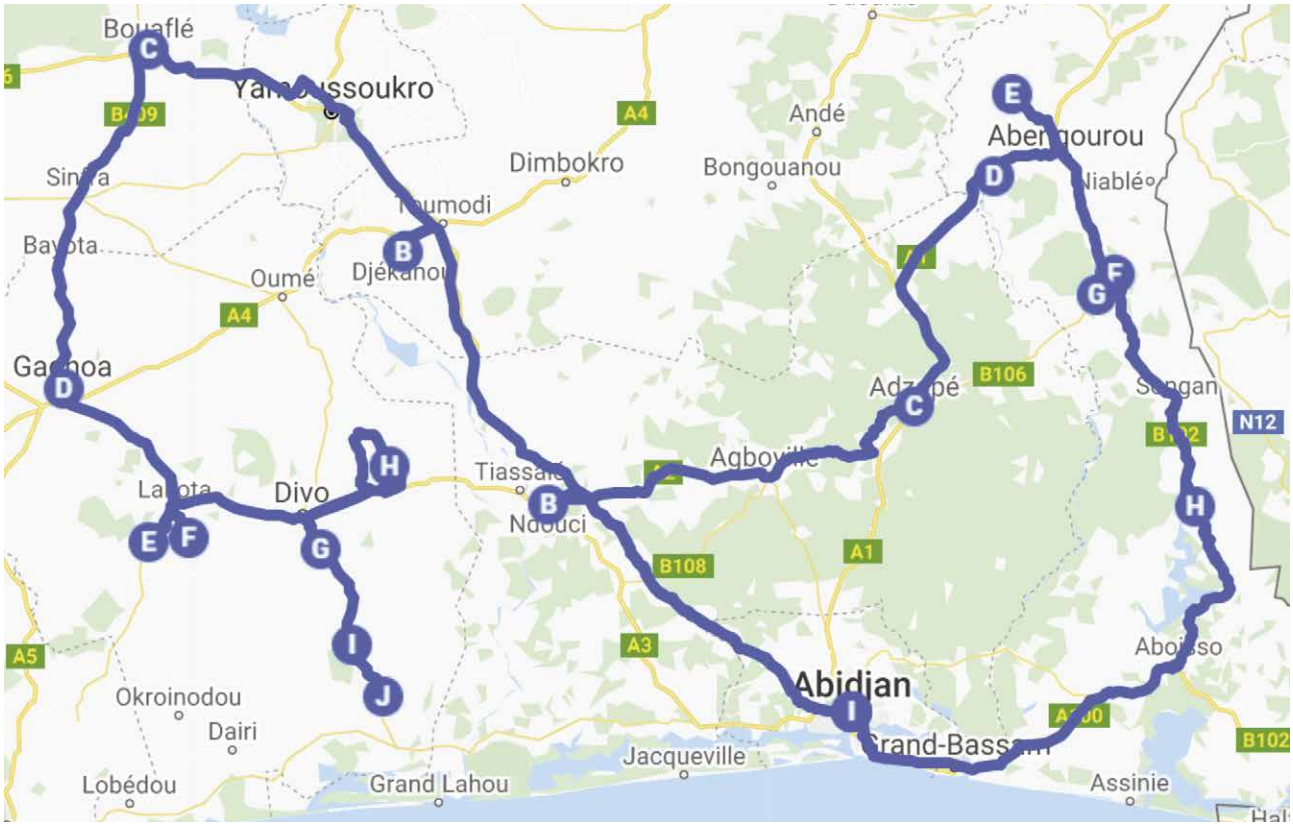
4 Based on their proximity to the selected elite farmers, a random selection of non-elite NCP farmers was made. Cooperatives' membership lists identified all farmers close by to elite farmers, from which they were randomly selected.

In addition, we organized distanced key informant interviews with a number of Nestlé's suppliers (four), cooperative leaders (eight), and Nestlé coaches (three) prior to the first primary data collection phase. The data from these were used to develop the research tools for the follow-up data collection. Table 2 provides an overview of the data collection instruments, and the number of participants, disaggregated by gender.

Table 2 Number of respondents – first round of fieldwork, December 2020

Activity	# of survey interviews/FGD/ open-ended interviews	# of men	# of women	# total participants
Elite survey	46	46	0	46
NCP survey	130	114	16	130
NCP FGD	14	56	20	76
Elite FGD	9	27	0	27
Elite HH interview	41	20	21	41
Total respondents		263	57	320

Map 1 Fieldwork locations in the first round of data collection



The purpose of the second round of data collection in May 2021 was to validate emerging segments of high-potential farmers/households and develop an understanding of their specific aspirations, needs, interests, barriers, and opportunities for improving their HH income. Moreover, we took the opportunity to validate and discuss preliminary findings of our analyses and dive deeper into a number of alternative income generating activities.

Similar to the first phase of data collection, a mixed sampling approach (purposive vs. random) was employed:

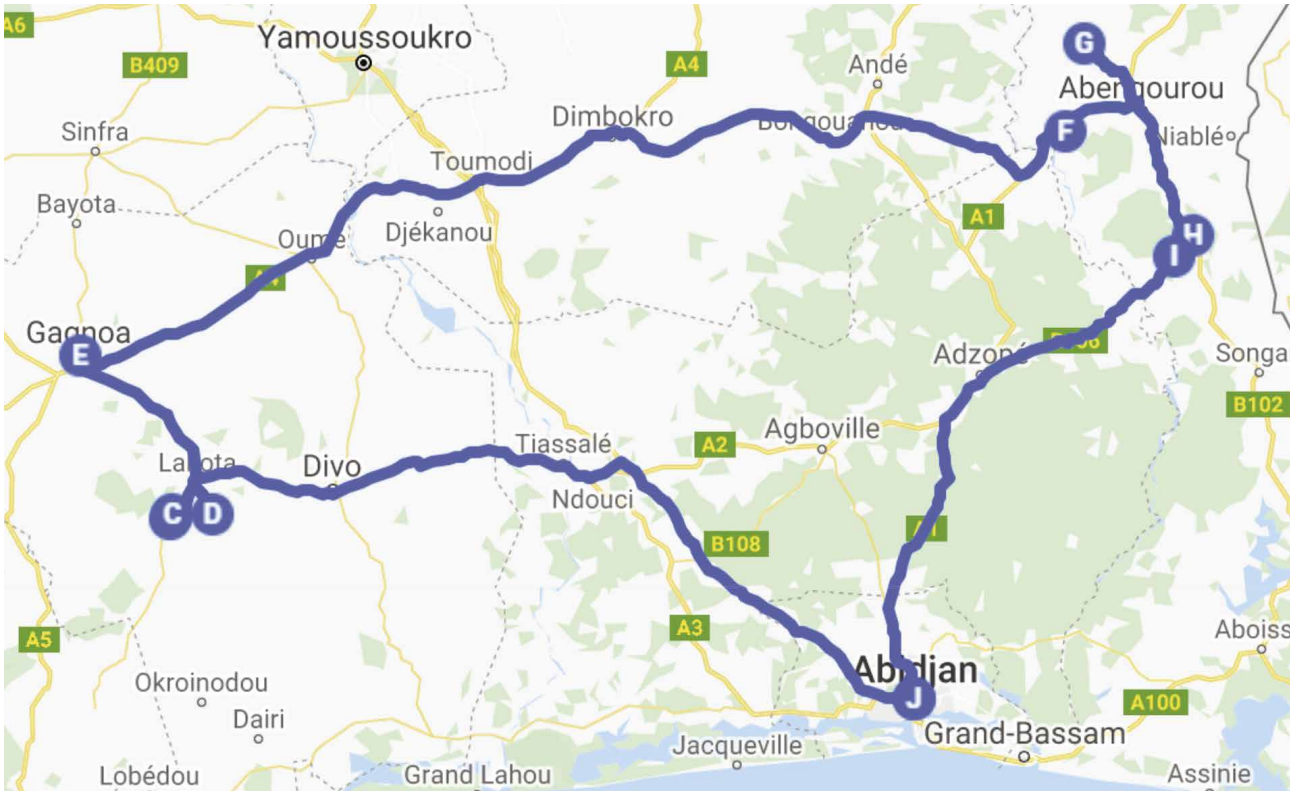
1. Research locations were selected based on the presence of elite farmers who joined the program after 2019 (which we later define as 'Aspirational elite'). In these communities, elite farmers were pre-informed about the research project to ensure their participation.
2. In the same communities, (female) respondents were pre-identified according to whether they belong to a saving group/women's group or were a manager or beneficiary of income-generating activities.
3. Non-elite respondents were purposely selected upon arrival of the research team, based on a number of characteristics that fulfilled the segmentation criteria. Table 3 provides an overview of the farmers groups, how they were selected, and the number of respondents.

In total, 97 respondents participated in the second round of data collection, of which 34 were women. Map 2 illustrates the fieldwork locations and shows that some cooperatives were also included in the first phase of data collection.

Table 3 Selection criteria and sampling approach, number and sex of participants – second phase of data collection, May 2021

Farmer groups	Selection	# of participants	#men/#women
Aspirational elite	Pre-selected by cooperative	8	8/0
Non-elite cocoa farmers	Selected on the spot by research team	45	45/0
Female entrepreneurs/farmers	Pre-selected by Nestlé	44	7/37
Total number		97	60/37

Map 2 Fieldwork locations in the second round of data collection



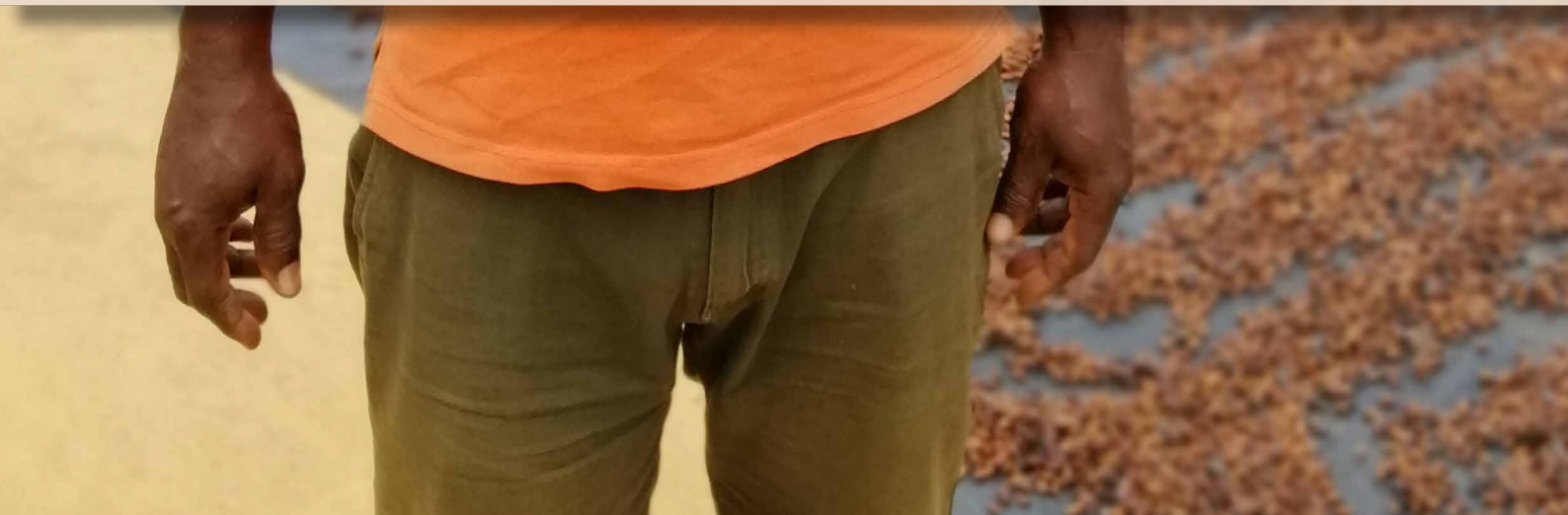
The research team

An experienced Ivorian research team, supported by Nestlé staff, conducted the two phases of fieldwork. The NGO Agricole Local Partner (ALP) coordinated the quantitative data collection, while qualitative data collection was completed by four independent researchers. Table 4 provides the names and affiliations of the research team members.

Table 4 Names, roles, and affiliations of research team members

Name	Role	Affiliation
Robertine Ebah	Team lead/qualitative data collection	Independent
Mariam Ouattara	Qualitative data	Independent
Georges Anicet Atchiri	Qualitative data and translation (French/English)	Independent
Marie Jeanne Angu	Qualitative data	Independent
Roger Tanoh	Coordinator quantitative data	ALP
Kouassi Gnangoran Kouakou	Team lead/quantitative data	ALP
Henriëtte N'Zoré Gnangoran	Quantitative data	ALP
Elisabeth Gnangon	Quantitative data	ALP
Koua Ekou Guillaume	Quantitative data	ALP

3 What can we learn from the Elite Farmer program?



Introduction to the Elite Farmer program

In this chapter, we reveal what we learned from the Elite Farmer program for the wider population of NCP members – which was one of the primary goals of this study. As such, it is not a traditional impact study and we did not capture changes in performance and impact that we can fully attribute to participation in the Elite program. Nevertheless, the data we collected shed light on the extent to which elite farmers benefited from the training, and potential differences between two groups of elite farmers that we distinguished ('Arrived elite' and 'Aspirational elite').

The NCP Elite Farmer program launched in 2015 and is managed directly by Nestlé, with the aim to differentiate the better performing, or 'Elite' farmers, from other NCP farmers. The Elite Farmer program runs in Côte d'Ivoire, and 155 farmers enrolled in different tranches since its inception. To participate in the Elite program, farmers were selected based on recommendations from local cooperative managers in combination with a set of criteria. The original aim of the Elite program was to attract younger farmers (<45 years), farmers who own a large plot of land (>10 ha), farmers who are relatively educated, farmers who have a positive attitude towards farming (e.g., show a willingness to try new techniques and plant seedlings), and farmers who attach a high importance to cocoa. In practice, it turned out to be difficult for cooperatives to identify farmers who ticked all the 'Elite boxes'. As a result, the criteria were often applied in a rather loose way and sometimes other selection criteria were used, such as loyalty to the cooperatives, the age of the plantation, geographical zones, etc.

The Elite program consists of both a three-day intensive training course at a central location and individual coaching. The training consists of various modules: financial and agricultural planning; managing 'cash in, cash out'; (profit) margins, savings, and loans; diversification; HH management; and good agricultural practices (GAPs) (especially pruning). These training sessions are repeated every year as a refresher, while new modules – including nutrition and family planning – have also been added.

Following initial training, elite farmers create an individual action plan. Qualified coaches support the realization of these and monitor the agricultural and financial calendars and adequate adoption.

The objective of the Elite Farmer program

The objective of the Elite Farmer program is to support the development of professional farmers, running their farms as businesses. The Elite program, through intensive training and coaching, aims to empower elite farmers to unleash their potential in both cocoa production and alternative income generating activities, ultimately achieving an LI and becoming leading examples (i.e. 'lighthouse') for others.

As the name suggests, small scale is inherent to the Elite program. Rather than scaling, Nestlé's interest in the program is threefold:

1 To showcase NCP farmers who reach a living income, and to learn about the factors behind their success.
2 To identify other high-potential farmer segments who could be uplifted by tailored intervention packages.
3 To inspire other farmers to adopt good agricultural practices and 'elite behavior'.

> *"The most important element of the Elite program is being a model to other farmers, motivating them to implement trainings and to change their behavior."* (Interview, Supplier Y, November 2020)

> *"It is good to have a local farmer that is known in the community serve as an example and demonstrate what is possible and what is needed to be a good cocoa farmer [...]. This is better than having an agronomist that is expensive and makes sporadic and quick visits to communities."* (Interview, Supplier X, November 2020)

> *"In the community, they [Elite farmers] serve as an example for the other members in the cooperative. He showcases on his demonstration farm. He exchanges with other farmers, the field trainer, and the cooperative. In the cooperative, they have a role in the sense that they are an exemplary model for other farmers."* (Interview, Cooperative A, November 2020)

Who are the elite farmers?

In our survey, we included 46 male elite farmers. In addition, 27 male elite farmers participated in FGDs and 20 male elite farmers participated in an in-depth HH interview. The partners of elite farmers were separately interviewed.

The Elite Farmer program recently started targeting female elite farmers, and around 50 female farmers were brought on. However, due to time constraints, we were unable to include them in our sample and analyses.

In our sample, we included different tranches of elite farmers: Elite farmers who joined before 2019, and Elite farmers who joined the program more recently. It transpired that these groups are very different from each other, and can be considered as two different groups: the older 'Arrived' elite and the younger 'Aspirational' elite:

1 The older 'Arrived elite' joined the Elite program before 2019. They are relatively older men who have at least a primary school education and possess a certain standing in the community or cooperative. They have over two decades of experience in cocoa and cultivate a large piece of (cocoa) land, often under a sharecropper arrangement.

2 The younger 'Aspirational elite' comprise mainly young, ambitious men, with relatively high education levels. Although most of them cultivate a relatively small piece of (cocoa) land, they are confident and determined to become successful in life.

Household characteristics of elite farmers

In this section, we present a number of significant demographic differences between Arrived elite, Aspirational elite and non-elite farmers:

- There is a substantial age difference between the Aspirational elite, the Arrived elite, and non-elite – with the Aspirational elite being relatively young, and the Arrived elite being relatively old. While the largest share of the Arrived elite is between 50 and 60 years old, the Aspirational elite are, on average, 34 years old. The non-elite farmers are between 40 and 50 years old.
- The Aspirational elite have relatively high levels of education. Almost half of the Aspirational elite have completed senior high school, compared to 21% of the Arrived elite and only 13% of the non-elites. Among the non-elite, 30% had no formal education.
- There is a significant difference between the two elite farmer groups in terms of total land size, whereby the Arrived elite cultivate relatively large plots of land, and the Aspirational elite only small plots. On average, the Arrived elite cultivate approx. 18 ha, which is almost 13 ha more than the Aspirational elite and 10 ha more than the non-elite. The Arrived elite use, on average, 8 ha to cultivate cocoa, while the Aspirational elite cultivate 3 ha and the non-elite around 4.5 ha. On average, the Arrived elite have 2.63 ha of vacant land.
- The Arrived elite and non-elite have more experience in cocoa than the Aspirational elite. On average, both the Arrived elite and the non-elite have been growing cocoa for around 20 years, compared to the nine years of the Aspirational elite.
- Elite farmers more often self-identify as leaders and/or innovators than non-elite do.
- The Aspirational elite feel more in control of their lives than the Arrived elite and non-elite.

Table 5 summarizes key features of the different groups.

Table 5 Features of Arrived elite farmers and Aspirational elite farmers, versus regular NCP members (non-elite)

Features (averages)	Arrived elite	Aspirational elite	Non-elites	Sig.
Demographics				
Sex, male	97%	100%	88%	
Age	49 years	34 years	49 years	***
Married/co-habiting	83%	65%	69%	
HH size	7.48 (4 adults, 4 children)	7.12 (3 adults, 4 children)	7.12 (3 adults, 3 children)	
No formal education completed	0%	6%	30%	***
Senior high school education completed	21%	47%	13%	***
Born in Côte d'Ivoire	100%	82%	97%	***
Land				
Total land cultivated	17.88 ha	4.63 ha	7.85 ha	***
Total cocoa land	7.89 ha	2.96 ha	4.41 ha	***
Total productive cocoa land	6.72 ha	2.72 ha	3.84 ha	***
Total vacant land	2.63 ha	0.46 ha	1.11 ha	**
Cocoa				
Years of experience in cocoa	20.55	8.53	19.86	***
Making use of sharecropper	62%	18%	43%	**
Self-image/agency				
Self-identify as local community leader	76%	24%	36%	***
Self-identify as innovator/local lead farmer	69%	59%	21%	***
Self-identify as having influential position in the coop	34%	12%	12%	***
Internal locus of control	0.17	0.32	-0.08	***
N	29	17	130	

Notes: ***, **, * indicate significance levels of 1%, 5% and 10% respectively from one-way ANOVA tests.

How do elite farmers perform?

Based on evidence and experience, it was anticipated that the distinguishing features of elite farmers would influence their performance. For example, it has been well-documented that land size is the main determinant for cocoa production levels, as well as for crop diversification[5,6]. There is also evidence that land size correlates negatively with productivity levels [7].

Cocoa farmers' age is also known to be a factor of importance; previous studies have shown that as farmers get older they are less likely to be open to innovation[8], which decreases uptake of new farming techniques. Another likely consequence of aging is a higher dependence on hired labor, as some tasks can become too physically demanding. This can either result in higher production costs and/or lower

[5] Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

[6] Ingram, V., Waarts, Y., Ge, L., van Vugt, S., Wegner, L., Puister-Jansen, L., Ruf, F., Tanoh, R. (2014). Impact of UTZ Certification of Cocoa in Ivory Coast; Assessment Framework and Baseline. Wageningen, LEI Wageningen UR (University & Research centre), LEI Report 2014-010.

[7] Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf; Vigneri, M., Sera, R. & Cardenas, A.L. (2016). Researching the Impact of Increased Cocoa Yields on the Labour Market and Child Labour Risk in Ghana and Côte d'Ivoire. International Cocoa Initiative. Available at: https://cocoainitiative.org/wp-content/uploads/2016/12/market_research_full_web.pdf

[8] Barrientos, S.W & Asenso Akyere, K. (2012). Mapping Sustainable Production in Ghanaian Cocoa, Report to Cadbury. Institute of Development Studies & University of Ghana. Available at: https://www.cocoalife.org/progress/ mapping-sustainable-production-in-ghanaian-cocoa; Oomes, N., Tieben, B., Laven, A., Ammerlaan, T., Appelman, R., Biesenbeek, C. & Buunk, E. (2016). Market Concentration and Price Formation in the Global Cocoa Value Chain. SEO Amsterdam Economics. Available at : https://www.tonysopenchain.com/resources/uploads/2019/03/2016-79_Market_Concentration_and_Price_Formation_in_the_Global_Cocoa_Value_Chain.pdf

yields, such as when farmers lack financial means to hire labor[9]. Younger farmers, particularly if they are single, are more likely to be interested in making 'fast money'[10] and see cocoa as a stepping stone rather than a life-long profession. For older farmers with many years' of cocoa experience, the crop is more often considered their destiny and an important legacy[11].

> *"There is a mentality with certain farmers that have been in cocoa for a long time. They will say: 'I have been in cocoa for 30 years; I know what I am doing.' These farmers do not want to adopt new practices."* (Interview Supplier Z, November 2021)

Education is another feature influencing behavior – and higher education levels, for example, are associated with enhanced uptake of innovative farmer techniques and greater ambition[12].

The Elite program training, coaching, and selection process were designed to uplift elite farmers and further unleash their potential. In addition to the regular training and services that elite farmers receive as NCP members, they obtain access to innovative and new farming techniques, receive practical and in-depth training with a strong focus on (financial) planning, and are assigned a coach who follows up on the implementation of their planned activities and challenges them to make well-informed decision. Moreover, elite farmers are trained on household relations and, if married, made aware of the importance of involving their spouses in decision-making processes. Several studies show that when women influence HH budgets, HH expenditures shift and a higher proportion of funds are allocated towards essential items, such as food and education[13].

Cocoa production

The following points summarize the main (significant) findings that arose from our data analysis, illustrating the differences between elite farmers and non-elite farmers in terms of activities and investments in cocoa production:

- A higher proportion of elite farms planted new cocoa last cocoa season (2019-2020): 48% of the Arrived elite, compared to 41% of the Aspirational elite and 28% of non-elite.

[9] Aneani, F., Anchirinah, V. M., Owusu-Ansah, F. & Asamoah, M. (2011). An Analysis of the Extent and Determinants of Crop Diversification by Cocoa (Theobroma cacao) farmers in Ghana. African Journal of Agricultural Research, 6(18), 4277-4287; Laven, A., Bitzer, V., Steijn, C. & Tyszler, M. (2020). Lindt & Sprüngli Farming Program: Impact Evaluation Ghana. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/publication/lindt-sprungli-farming-program-impact-evaluation-ghana

[10] Van Heck, P. & Laven, A. (2015). Ideation of Small Medium Enterprise (SME) Services in Cocoa Growing Communities in Ghana. The Royal Tropical Institute (KIT). Available at: http://www.cocoaconnect.org/publication/ideation-small-medium-enterprise-sme-services-cocoa-growing-communities-ghana

[11] Baah, F., Anchirinah, V., Badger, E. & Badu-Yeboah, A. (2012). Examining the Cocoa Farmer-purchasing Clerk Relationship in Ghana. Global Journal of Science Frontier Research, 12(11-D)

[12] Baah, F., Anchirinah, V., Badger, E. & Badu-Yeboah, A. (2012).

[13] WCF (2019) Gender Integration Guidance Note. Available at https://www.worldcocoafoundation.org/wp-content/uploads/2019/04/WCF-Gender-Integration-Guidance-Note-Final_pub.pdf

- Elite farmers tend to adopt slightly more GAPs than non-elite farmers, such as weeding and pruning.
- The share of elite farmers that applies granular fertilizer is significantly higher than the non-elite. The qualitative data suggests the main reasons non-elite farmers do not use fertilizers are the involved costs (inputs and labor) that compete with other (more basic) expenses, such as paying for school and food.
- Non-elite use marginally (but significantly) less fungicides than elite farmers.
- Almost two-thirds of the Arrived elite have sharecroppers on their farm who do (at least part of) the labor, compared to 43% of the non-elite and 18% of the Aspirational elite. Sharecroppers are usually involved in all activities, except for land clearing, planting, and spraying, and are considered to be relatively 'cheap labor'. They are not usually exposed to any direct GAP training, which might contribute to relatively lower yields. For the application of pesticides and fungicides, it is most common to use temporary workers.
- Aspirational elite mainly make use of their own HH labor.
- Around half of elite farmers make use of pruning gangs; for non-elite this is only one quarter.

The findings confirm that both the Arrived elite and the Aspirational elite perform better than the non-elite do, albeit in different ways. Arrived elite produce high volumes of cocoa, mainly due to their larger land size, while the Aspirational elite produce higher yields (kg/ha):

- For the Arrived elite, total average production for last cocoa season was almost 4000 kg, around double the volume produced by the Aspirational elite and non-elite *(highly significant)*.
- If we compare average yields (based on all cocoa land), those of the Aspirational elite are 760 kg/ha, while the Arrived elite produce 491 kg/ha and non-elite produce 507 kg/ha. Looking at yields based on productive land (land with trees > 5 years), we find similar differences, where the Aspirational elites produce 844 kg/ha, the Arrived elite 624 kg/ha, and the non-elite 572 kg/ha.

Income diversification

Besides cocoa production performance-related data, in our survey we also collected data on other income generating activities, particularly in relation to other crops. Our respondents reported that, on average, their households produce around 12 other crops – such as plantain, eggplant, cassava, maize, okra, yam, chili, and tomatoes. Most crops are for both personal consumption and sale.

Below is a summary of the main (significant) findings that illustrate differences between elite farmers and non-elite farmers in terms of income diversification:

- The Aspirational elite more often favor other crops (additional to cocoa) than the Arrived elite and non-elite. The Arrived elite reported the most important crops as being rubber, cassava, and oil palm, while for the Aspirational elite, rice and eggplant were favorites, followed by cassava, plantain, oil palm, and coffee. The Aspirational elite produce significantly less chili, cocoyam, tomatoes, and okra. Non-elite lay most importance on rubber, cassava, and plantain.
- For some of the Arrived elite, selling livestock products is an alternative income-generating activity: 21% sell livestock or livestock products, versus 12% of the Aspirational elite and six percent of non-elites.
- The Aspirational elite is more active in selling bush meat (an informal and sometimes illegal activity): 53% are involved in doing so, versus seven percent of the Arrived elite and 10% of non-elites.
- Remittances were another frequently mentioned income source, particularly for the Aspirational elite: 35% have access to remittances, versus 21% of the Arrived elite and 18% of non-elites, but this difference is not statistically significant.
- Around half the elite and non-elite indicate their HH are involved in a small business. Small scale trading, usually in the form of small shops, is often mentioned as a source of income for women.
- Some of the Arrived elite earn additional income through formal employment in a company: 10% of the Arrived elite reported this.

Table 6 illustrates the non-cocoa income sources for the Arrived elite, Aspirational elite and non-elite.

Table 6 Income other than cocoa

Last cycle, besides cocoa, did anyone in your HH receive any income from the following sources?	Arrived elite	Aspirational elite	Non-elite	p-value	Sig.
Sale of crops (non-cocoa)	100%	100%	98%	0.58	
Sale of livestock or livestock products	21%	12%	6%	0.04	**
Sale of fish	7%	0%	8%	0.50	
Sale of bush products	7%	53%	10%	0.00	***
Sale of land	0%	0%	1%	0.84	
Small business	52%	53%	45%	0.73	
Laboring on other people's cocoa farms	0%	0%	3%	0.49	
Laboring on other people's farms for other crops	0%	6%	5%	0.48	
Laboring for other people in other ways (non-farm)	0%	0%	3%	0.49	
Employment with a company	10%	0%	2%	0.07	*
Employment in a government or public job	0%	0%	0%		
Remittances (from family living elsewhere)	21%	35%	18%	0.23	
Other	0%	0%	4%	0.41	
N	29	17	130		

Notes: ***, **, * indicate significance levels of 1%, 5% and 10% respectively from one-way ANOVA tests.

Financial behavior

We also looked more closely at respondents' financial behavior, in terms of decision-making, savings, and loans. Our main observations are as follows:

- A higher proportion of the Arrived elite make decisions on sales, income, and credit together with their spouse (42% of Arrived elite, versus 36% of the Aspirational elite and 19% of the non-elite who are either married or cohabitate).
- The data suggest that the Arrived elite more often put aside money for savings. Almost 80% reported saving money, compared to 47% of the Aspirational elite and 48% of the non-elite.
- Mobile banking is the most common way to save money. All the Aspirational elite saved money in this way, versus 74% of the Arrived elite and 69% of the non-elite; 16% of the non-elite do not have mobile money accounts.
- The percentage of membership to a Village Savings and Loans Association (VSLA) among any of the respondents' HH members is low.
- Borrowing money seem to be less popular than saving money. Around one-third of non-elite farmers borrowed some money from anyone in the last season; while the proportion of elite farmers was slightly, but not significantly, lower. The farmer cooperative was the primary provider of the loans. The main reasons for not taking a loan were either not needing it or not wanting to be in debt.
- There was no significant difference in the proportion of farmers that took a loan, but the amount of the loan differed significantly. The average loan amount was US$830 for the Arrived elite, compared to US$196 for the Aspirational elite and US$321for non-elites.
- Arrived elite typically take out loans to pay for education and make on-farm investments. Aspirational elite take mainly loans for healthcare and on-farm investments, non-elite take loans for education and healthcare[14].

Table 7 summarizes some of the measured differences in activities and investments of the Arrived elite, Aspirational elite, and non-elite.

[14] We know from previous studies that secondary education costs are particularly high, as these involve boarding costs. Source: van Heck, P. & Laven, A. (2021) The Resilience Journey Empathy Generation (Phase 1) – Executive Summary. Mars Wrigley. Available at: https://www.kit.nl/publication/the-resilience-journey-empathy-generation-phase-1-executive-summary/

Table 7 Performance of the Arrived elite and Aspirational elite, versus non-elite

Performance indicators (averages)	Arrived elite	Aspirational elite	Non-elites	Sig.
GAP				
Training attendance last three years	84%	79%	65%	
Self-reported adoption of pruning	97%	94%	81%	*
Self-reported adoption of weeding (last cycle)	93%	100%	91%	
Self-reported times of weeding (last cycle)	2,85	2,65	2,39	***
Application of granular fertilizer	69%	71%	46%	**
Self-reported adoption of shade trees training	45%	35%	29%	
Self-reported adoption of farmer business training	59%	18%	29%	***
Finance				
Loans last cycle	31%	24%	34%	
Amount of loan last cycle	US$830	US$196	US$321	**
Main use of loan	1. Education, 2. Inputs	1. Healthcare, 2. Inputs	1. Education, 2. Healthcare	
Savings last cycle	79%	47%	48%	***
Mobile money as means of saving	74%	100%	69%	
HH decision-making				
Spouse involved in HH decision making on sales, income, and credit	38%	24%	15%	**
Performance				
Yield (kg/ha) (all cocoa land)	490,80	759,66	506,71	***
Yield (kg/ha) (productive cocoa land)	623.76	843.97	572.45	**
Total production	3933 kg	2135 kg	2043 kg	***

Notes: ***, **, * indicate significance levels of 1%, 5% and 10% respectively from one-way ANOVA tests.

Cocoa income

There are some notable differences between the different groups in terms of cocoa income. In large part, these can be explained by differences in land size and total volumes of production. We previously highlighted the substantial differences between farmers in terms of land size (productive cocoa land used and total cocoa land used), and showed that elite farmers invest more in labor and inputs than non-elite do. If we delve further into cocoa income and costs of production, we see the following relevant differences between the Arrived elite, Aspirational elite, and non-elite:

- The average net income from cocoa (cocoa production * price) – (production costs) for the Arrived elite is around double that of the Aspirational elite. The non-elite farmers earn, on average, the least from cocoa production.
- The Arrived elite reported highest input costs, and Aspirational elite reported lowest input costs. The average total input costs for the Arrived elite is US$525, while for the Aspirational elite this is US$197. The average total input costs for non-elite is US$226.
- The reported costs for granular fertilizer are around 50% of total input costs, pesticides are the second largest cost, followed by fungicides.
- The Arrived elite reported the highest labor costs, and the Aspirational elite reported the lowest. The average total labor costs is highest for the Arrived elite (US$800), who often make use of a sharecropper. The average total labor costs for the Aspirational elite is significantly lower (US$93). This is not only because they have smaller land sizes, but also because they mainly make use of their own labor. For the non-elite, the average total labor costs are US$266.
- If you consider total investment costs per ha, the differences between elite and non-elite are relatively small: US$147/ha for the Arrived elite, US$110/ha for the Aspirational elite and US$107/ha for non-elite. These differences are not significant.

Table 8 shows the profit model for cocoa, comparing the elite with the non-elite. There is a difference between the mean and median cocoa income but due to the small sample size, the median value is likely to be more accurate.

Table 8 Profit model for cocoa – comparison between Arrived elite, Aspirational elite, and non-elite

Characteristic	Arrived elite	Aspirational elite	Non-elite	Sig.
Cultivated cocoa land (ha/HH)	7.89 ha	2.96 ha	4.41 ha	***
Productive cocoa land (ha/HH)	6.72 ha	2.72 ha	3.84 ha	***
Price for cocoa (CFA/kg)	825 CFA/kg (= US$1.50 /kg)[15]	825 CFA/kg	825 CFA/kg	-
Premium for cocoa (CFA/per certified kg)	30 CFA/certified kg (US$0.05/kg)	30 CFA/certified kg	30 CFA/certified kg	-
Total production	3933 kg	2135 kg	2043 kg	***
Value of production (US$/HH)	5967	3209	3077	-
Total costs production (US$/HH)	1325	289	513	-
Net cocoa income (US$/HH) (mean)	5108	2923	2574	***
Net cocoa income (US$/HH) median	4027	2412	1933	***

Non-cocoa income

Previous studies showed it is common for cocoa HH to produce other crops and engage in other economic activities to complement their cocoa income[16]. In this study, farmers' estimates suggest that cocoa income generates between 68-72% of their total income. Other HH income comes from selling other crops (20-23%) and small businesses (between seven and 10%).

Living income

Based on an (estimate of) the proportion of the net income from cocoa of the total income, we calculate the total HH income. If we take the mean values of net cocoa income, the estimated total household income for the Arrived elite is US$8183, for the Aspirational elite US$4107, and for non-elite US$4083. The median values are considerably lower, at US$5293, US$3350, and US$3099, respectively.

Living income gap

The LI benchmark is unique for each cocoa farming HH and dependent on HH size. The original benchmark is CFA265,384 per month (US$461)[17], That amount, multiplied by 12, results in a fixed annual benchmark of CFA3,184,608 (US$5528). However, the benchmark is set for an average family of 2 adults and 3.5 children. The average LI benchmark adjusted for HH size (context-specific to the sample of farming HH) is CFA 4,167,988 (US$7235)[18].

[15] Exchange rate XOF fr on 23-6-21.

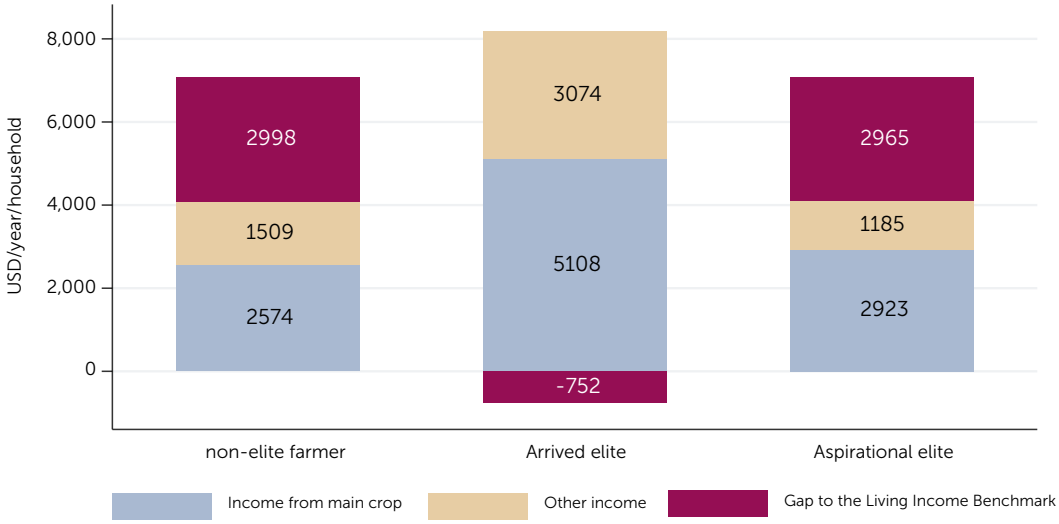
[16] Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

[17] 13 August 16:23 CEST

[18] Adjusted using the OECD Equivalence scale: http://www.oecd.org/economy/growth/OECD-Note-EquivalenceScales.pdf

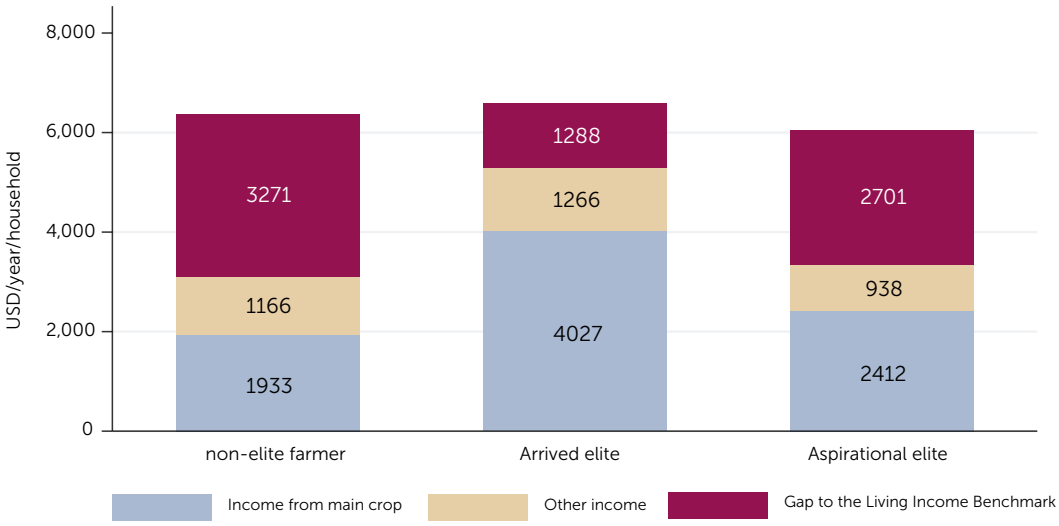
Figure 1 shows that the average income of the Arrived elite is above the LI benchmark (with US$ 752), while for the Aspirational elite the average LI gap is US$ 2965. The average gap to the LI benchmark for non-elite is US$ 2998. If we apply median values (Figure 2), the Arrived elite have an LI gap of US$ 1288, the average LI gap of the Aspirational elite is US$ 2701. The LI gap for non-elite is largest with US$ 3271. Figure 3 shows the distribution of total HH income and percentage of respondents below the LI gap, illustrating that the majority of elite farmers do not (yet) reach an LI.

Figure 1 LI gap (mean)



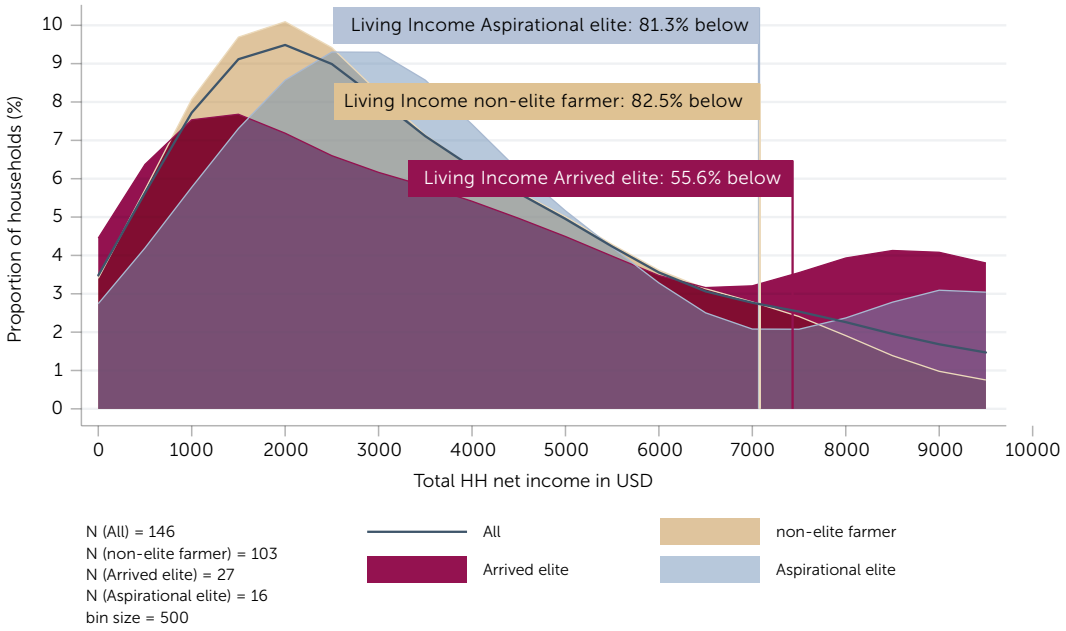
Based on:
non-elite farmer: 103 observations
Arrived elite: 27 observations
Aspirational elite: 16 observations

Figure 2 LI gap (median)



Based on:
non-elite farmer: 103 observations
Arrived elite: 27 observations
Aspirational elite: 16 observations

Figure 3 Distribution of total HH income and % of respondents below the LI gap



To triangulate our findings, we also calculated the chance for elite farmers to fall below national poverty lines and looked at the poverty probability index (PPI). Our calculations suggest that the Aspirational elite are significantly more likely to fall below national poverty line than the Arrived elite are, which confirms the differences between the two in terms of LI gap[19]. The PPI based on US$1.90 per day (for poverty line 2011) does not suggest that the Aspirational elite are more likely to fall below the extreme poverty line than the Arrived elite are.

Table 9 LI calculations

	Arrived elite	Aspirational elite	Non-elite	Sig.
Net cocoa income (US$/HH) (mean)	5108	2923	2574	***
Net cocoa income (US$/HH) median	4027	2412	1933	***
Income from cocoa (%)	69%	72%	68%	
Total net income (US$/HH/year) (mean)	8183	4107	4083	-
Total net income (US$/HH/year) (median)	5293	3350	3099	-
Average HH size	7.48	7.12	7.12	
LI benchmark in US$ (adjusted for HH size)	7235	7235	7235	-
Above the benchmark (mean)	43%	19%	17%	**
Poverty Probability Index (PPI)[20] (national poverty line 2015)	31%	41%	36%	
PPI (2011)	15%	22%	19%	

Notes: ***, **, * indicate significance levels of 1%, 5% and 10% respectively from one-way ANOVA tests.

[19] Independent t-test: difference = -10.621, p-value=0.072, N=46.

[20] PPI refers to the likeliness to be below the poverty line.

Contribution of the Elite Farmer program

Using other quantitative available data allows for a comparison between before and after participation in the Elite program. Although there is no control group, and differences over time cannot be fully attributed to the Elite program, they do provide insight into how GAPs, production, and access to finance, amongst other indicators, have changed. Our key observations are:

- Fertilizer use has increased, as reflected in recommended fertilizer use and area under fertilizer.
- The vast majority of farming HH have drafted a planning document.
- Cocoa yield levels increased significantly.
- Access to finance did change only slightly (but significantly)

Table 10 presents a before (2016) and after (2017) comparison of 52 elite farmers, based on a select number of key performance indicators.

Table 10 Comparison between before and after participation in Elite Farmer program

Performance indicators (averages)	Before	After	Sig.
Planting	54%	63%	
Fertilizer use	58%	83%	***
Recommended fertilizer use	48%	75%	***
Area under fertilizer (ha)	1.7	2.2	**
Planning document	12%	85%	***
Cocoa production (N=44) in ton	3.1	4.1	***
Cocoa yield (kg/ha)	459.3	612.8	***
Opened bank account	44%	56%	
Received bank loan	6%	10%	*
Income diversification	98%	88%	**
% food production consumed by family	0.7	0.6	*
Participates in demo plots	12%	33%	***

Notes: N = 52. Significance from a two way paired test (for continuous variables a t-test is used. For binary variables, a McNemar test is used). ***, **, * indicate significance levels of 1%, 5% and 10% respectively

Table 11 illustrates the self-reported changes that the Arrived elite and Aspirational elite perceived as a result of different training modules. The results reveal no statistical differences in the proportion of the Arrived and Aspirational elite who report that a training led to changes in practices.

Table 11 Self-reported change in practices as a result of Elite trainings

Which of the Elite trainings led to changes in your practices?	Arrived elite	Aspirational elite	Sig.
GAPs	100%	94%	
Diversification	79%	76%	
Financial management	76%	59%	
Household management/relations	72%	59%	
Planning of activities	72%	53%	
Other	3%	0%	
N	29	17	

Notes: ***, **, * indicate significance levels of 1%, 5% and 10% respectively from one-way ANOVA tests.

In FGDs, the elite farmers self-identified a number of changes in their practices because of Elite trainings. Most frequently mentioned were 1) an increase in yields ('doubled and tripled') and income; 2) change in behavior and improved HH relations; and 3) more discipline with finances. Our qualitative data suggests the Elite program has been a life-changing experience.

> *"The [Elite] program has helped us to greatly increase our income in the sense that with the same area of field yesterday we produced two/three bags, but today we produce double or triple the production of before. We can only be happy. Really our life changed thanks to Nestlé."* (Interview, Elite farmer, November 2020)

> *"It is the entire program that interests us, because it is a sequel. Everything is complementary. How to manage the field, how to manage money and even our homes. It is complementary and all of it is useful for us. This program has opened our eyes."* (FGD, Elite farmers, December 2020)

> *"Today our productivity has more than doubled. [...] In addition, in our behavior there is change. [...] "We manage our families better. We no longer know shame. [Laughs] We earn more than 3X what we used to before the training."* (FGD, Elite farmers, December 2020)

> *"Due to the Elite Program, I was able to build my house. I have farms. I breed goats, I produce chicken meat. The corn gives me money. It helped a lot. We are respected now by our way of life which has changed."* (FGD, Elite farmers, December 2020)

> *"After the first training in 2016, if I had had this training 3 to 4 years ago I would not be here because looking at the wasting I have done in the past ..... (silence), people called me 'president', because it is I who always party at home. I wasn't saving. When I earn money, I organized parties at home. And then I had nothing left. But it was when I did the Elite training that I saw how often my life was not organized. Since becoming Elite things have changed"* (Interview, Elite farmer, November 2020)

> *"It is the pruning that is the most successful for us because it is what was lacking in our plantations in the past since we did it with the machete but now we have the saw, the pruner, the secateurs, the pruning has become more fun and less difficult to do."* (FGD, Elite farmers, December 2020)

> *"The program leads to a higher uptake of trainings among other farmers, including GAPs, financial management, and diversification"* (Interview, Supplier X, November 2020)

Our qualitative data affirm the quantitative analyses and suggest that the Elite Farmer program has contributed to positive changes in performance[21], at least to some extent.

[21] Some of the differences are likely linked to Aspirational elite only joining the Elite program recently. Note that the N is too low to draw any firm conclusions.

Lighthouse effect

Cooperatives reported that elite farmers distinguish themselves from other farmers with their positive attitude towards farming and a motivation to improve their situation. They state that elite farmers demonstrate high training adoption rates, tend to be more innovative, and are often already working as a coach, trainer, or community facilitator. Elite farmers themselves shared the following description of what characterizes an elite farmer:

> *"An elite farmer has a better yield. He is organized and his family life is organized. It is a model. He's a better farmer. He respects the crop (agricultural) calendar and knows when to do what in the maintenance of the farm. He plans his expenses. What makes that he manages to manage his family. He's not in debt. He is not living beyond his means. Everything is calculated and he manages to have savings. The elite farmer feels so good because we see more clearly what we do and we know why to do it. In the family, we feel respected and we get along well with the wife because we have been shown how to lead our family. So less of a problem. Rather a complicity."[...] "The elite is the one who is curious in all things because what someone shows you in your life and things you have never seen are necessary to try at least once and you will see the result which will be positive or negative. You will understand and you will be able to decide. The elite farmer is also enterprising, he knows financial management (it is planning that encompasses all that is related to income). An elite is one who has a plantation that breathes, that lives, and that produces well."* (FGD, Elite Farmers, December 2020)

As mentioned previously, suppliers, cooperatives, and coaches see elite farmers as potential leaders that will stimulate other farmers to adopt good practices and behavior. Elite farmers (often) own demonstration plots through which they showcase the effects of applying trainings (GAPs), improved planting materials, and the use of inputs on demo plots. The idea is that farmers that are well-known in the community can demonstrate how a cocoa farmer can improve his life and motivate others. Through demonstration plots, farmers can see firsthand how and why certain practices work and, in turn, copy the behaviors. Our data suggests that, among non-elite farmers, 17% reported to have learnt GAPs via demo plots.

> *"The other NCP farmers also get training, and benefit from interventions. But the Elite farmers motivate them to implement, to better manage their farms and their finances, they used not to plan their activities, their finances. We have seen a change in behavior of non-elites, they are copying behavior from elite farmers to become more like them. Outside the Elites, the program also very positively impacts other farmers in terms of implementation of GAPs and diversification practices".* (Interview Supplier Y, November 2020)

> *"Our friends with whom we were and then by negligence they were not selected come to ask us for advice today to develop their plantation like ours, and we agree to give them this advice and sometimes we do a little more. We go to their fields to give practical lessons to help them. We share our experiences with them, now that they have seen our results they are interested. So they benefit through us."* (FGD Elite farmers, December 2020)

> *"We just want friends of ours to learn to let go of their old and bad habits when it comes to growing cocoa and that they appropriate the good farming techniques so it's the same program that we extend to our friends since they want all the time we help them maintain their fields like ours."*(FGD Elite farmers, December 2020)

In FGDs and interviews with Elite farmers, virtually all mentioned they help other farmers in some way – some pro-actively, while others are more passive and only help other farmers 'on-demand'. Farmers mainly come to them for advice on productivity (especially on pruning). Some elite farmers use their role within the community to actively share knowledge with others.

> *"When I come back from the elite trainings, I gather the faithful of my church, I share my knowledge with them. I tell them about these trainings because they are also farmers like me. I do it because I like to share knowledge. I want them to have a good production like me."* (FGD Elite farmers, November 2020)

> *"There is only 1 in the 1000 producers who approached me for advice. And that person, he does pruning like me. He applies fertilizer like me. He at least takes advice from me, and he applies it. His field is next to mine. I expect nothing from him. It's the pride of helping him, of being heard. We want more producers to come to us to learn what we learned during the training. But does everyone understand this? Because I can't go to someone who doesn't want to be like me!"* (FGD Elite farmers, November 2020)

> *"It is especially the pruning. They learn the good agricultural practices. Those who are not proud approach us to ask us how we maintain our fields"* (FGD Elite farmers, December 2020).

Our data suggest that elite farmers aim to be a lighthouse for other, but this is not always easy as some farmers are not motivated, lack the resources to copy behavior and/or copy incorrectly.

Conclusions

The aim of this chapter was to learn from the Elite Farmer program, through a deep dive into its participants – comparing their demographics, performance and income levels with non-elite farmers – in order to benefit the wider population of NCP members. Based on this, a number of takeaways can be identified.

Elite farmers are unique but not the same. There are substantial demographic differences between elite farmers who joined the Elite program before 2019 (the Arrived elite) and those who joined after 2019 (the Aspirational elite):

- The Arrived elite are relatively older, and possess a basic education. They tend to have a certain standing in the community or cooperative, and many years' experience in cocoa. They cultivate a large piece of (cocoa) land, often under a sharecropper arrangement. Their volumes of cocoa production are high but yields are relatively low. They earn relatively high incomes.
- The Aspirational elite consists mainly of young ambitious men, with relatively high education levels. Although most cultivate a relatively small piece of (cocoa)

land, they are confident and determined to achieve success. The Aspirational demonstrate relatively high productivity levels but, due to their small land sizes, have relatively low incomes.

The Elite program has improved the behavior and performance of elite farmers. Quantitative and qualitative data suggests participation in the Elite program contributed to increases in yields and HH incomes. Furthermore, better financial planning and discipline, and improved HH relations, have improved their quality of lives.

Elite farmers outperform non-elite farmers in terms of planting new cocoa, adopting GAP, inputs, making use of pruning gangs and income diversification. If we compare yields based on productive land the Aspirational elites produce 844 kg/ha, the Arrived elite 624 kg/ha, and the non-elite 572 kg/ha. If we compare total HH income, the average total HH income for the Arrived elite is almost double the income of the Aspirational elite and non-elite. This is mainly the result of differences in land size and total volume of cocoa production.

The majority of elite farmers do not (yet) attain an LI. If we look at the distribution of HH income, we see that the majority of HH does not reach a LI. From our sample, 43% of the Arrived elite earned an income above the LI benchmark, for the Aspirational elite this was only 19%. The Aspirational elite are significantly more likely to fall below the national poverty line than the Arrived elite are. When looking at the median LI gap, we find a gap of US$1288 for the Arrived elite farmers which is much small than the LI gap of the Aspirational elite (US$2701) and the non-elite farmers (US$3271).

Elite farmers are not automatically a lighthouse to other farmers. Elite farmers seem to consider themselves as role models and share their knowledge with other farmers, at least to some extent. However, other farmers face a number of barriers that prevent them from copying behavior, such as a lack of motivation and resources.

There is an opportunity to strengthen elite farmers to operate as role models, particularly the Aspirational elite cohort. This might require additional coaching and training in soft-skills such as leadership and communication to channel knowledge effectively to others. The Arrived elite cohort represents a small, already established group with very specific and unique characteristics, such as large land size. As they are very different from the Aspirational elite and regular NCP farmers, they are less likely to be an effective lighthouse for others, mainly because other farming HH cannot fully identify with them.

4 Drivers of productivity and household income

Introduction

This section aims to provide further insights into the drivers of cocoa productivity and HH income, using data on 176 NCP farming HH (including those participating in the Elite Farmer program) collected in 2020. Better insight will help determine which elements bear potential to include in intervention packages to increase productivity, cocoa income and, eventually, total HH income (and reduce the LI gap). Econometric analyses in this section also provide suggestions on how an LI can be reached, given the different circumstances, behaviors, and attitudes of cocoa farming HH.

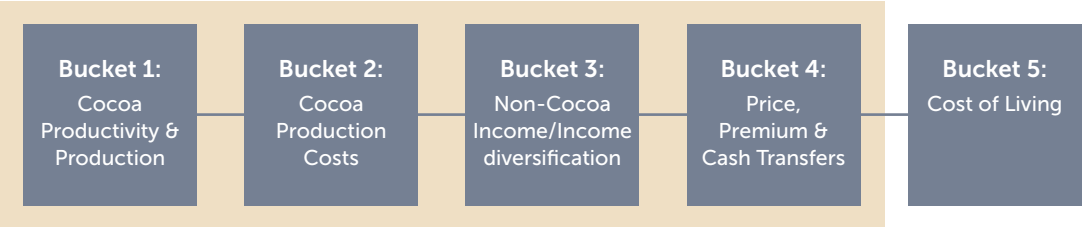
Important to note, however, is that the variables and models of this econometric analysis are, at best, rough approximations of reality and what actually happens 'on the ground'. For example, agricultural practices are based on self-reporting of the respondents and measured as the percentage of land under a certain practice (e.g., percentage of cocoa land pruned). However, this does not reflect the quality of the practice and the intensity to which the practice is implemented. The same holds for eliciting production data, which are entirely based on a recall method. Yet, as the results in the remainder of this chapter show, they strongly correlate: self-reported behavior impacts outcomes like yield, production, and income, and are in-line with the findings of a wide body of literature. All this means that the results of this analysis are rudimentary at best and should be treated as suggestive, with a primary aim of providing indicative input to the segmentation and pathways.

For some of the analyses (e.g., yield, gross cocoa income), we add robustness checks based on datasets from two Nestlé suppliers (data on the cocoa season 2017-18 from Supplier X (N= ~4500) and data on the cocoa seasons 2015-2020 from Supplier Y(N= ~4000)[22]. These databases contain information on yield, production, and agricultural practices. They do not include (extensive) information on income diversification, cocoa net income levels, and total HH income. And, although both supplier datasets are much larger in terms of sample size compared to the NCP KIT dataset, they lack the information needed to further assess the building blocks of LI beyond productivity.

The following sections of this chapter focus on the building blocks of HH income of cocoa farming HH in the Côte d'Ivoire districts of Comoé, Gôh-Djiboua, Lacs, Lagunes, and Marahoué. The building blocks can be divided into five 'intervention buckets' to LI as shown in Figure 4. The analysis included in this chapter touches on all buckets, except the cost of living.

[22] In contrast to the NCP KIT dataset, both supplier datasets are at farmer level, not farm HH level.

Figure 4 Five intervention buckets to LI



Cocoa yield

This first section analyses the drivers of productivity, regressing cocoa yield on a set of HH characteristics, agricultural practices and income diversification indicators[23]. Increasing cocoa productivity on existing land (i.e., sustainable intensification) is one of the main areas in which progress can still be made – especially when available cocoa land is very limited – potentially leading to higher HH income. Current yield levels remain limited, as reflected in the three datasets. In the KIT NCP 2020 dataset, average cocoa yield is around 600 kg/ha, with a median yield level of around 550 kg/ha. Seventy-five percent of farming HH have a yield less than 750 kg/ha. This aligns with the averages found in Supplier X's dataset, where average yield is circa 590 kg/ha, with median yield at around 615 kg/ha. Seventy-five percent of farmers in the Supplier X dataset have a yield that is lower than 725 kg/ha. Average yield in Supplier Y's dataset is lower, at 515 kg/ha, with a median of 455 kg/ha. Seventy-five percent of farmers in Supplier Y's dataset have a yield lower than 700 kg/ha. This demonstrates that large gains can still be made with sustainable intensification.

The linear regression results (NCP KIT data) on cocoa yield in Table 12 show:

- Agricultural practices, such as fertilizer application, pruning, weeding, and shade trees, all have a positive effect on cocoa yield. We find similar statistically significant and positive coefficients for fertilizer and pruning when regressing yield on a set of GAPs in both suppliers' datasets[24].
- Figure 6 reveals the marginal effect of self-reported adoption of shade trees[25]. Farming HH who report adopting shade trees produce, on average, almost 200 kg/ha more than farming HH who report not having any shade trees. This finding,

[23] Due to the limited sample size, not all indicators of interest (e.g., gender of the HH head, access to good variety seedlings, etc.) can be included in the regression analysis. Instead, correlations between outcome variables and practices will be added to some of the analyses

[24] Linear regressions with village-level fixed effects.

[25] Self-reported adoption of shade trees is measured as a binary variable, and does not capture the intensity of shade trees adoption (e.g., number of shade trees per ha) or the % of cocoa land with shade trees. Consequently, the indicator in the NCP KIT dataset only provides a rough estimation of the potential of shade trees on cocoa productivity.

based on a rudimentary proxy for shade trees adoption (yes/no response), is not fully supported by the results from the data analysis on the Supplier datasets[26].

- Figure 6 suggests that the ambition of reaching a yield of 800 kg or more per hectare will not be fulfilled by only supporting farm households with adopting practices around shade trees, especially given the negative correlation between productive cocoa land and cocoa yield. A similar conclusion can be drawn based on the effect of the number of non-cocoa trees on yield (Supplier Y only).
- The results in Table 12 indicate that fertilizer application is key to obtaining higher cocoa yield[27]. One additional percentage point of cocoa land under fertilizer increases yields by almost four kg/ha, and Figure 7 illustrates how varying levels of fertilizer application at different levels of productive land size have potential to stimulate yield levels[28].
- Given the current fertilizer application levels, fertilizing all cocoa land is not a realistic prediction. However, at the moment, farming HH only use, on average, fertilizer on 23% of their land (the median value is even lower at 12%), and 45% of farming HH do not use fertilizer at all.
- The importance of cocoa as percentage of total HH income correlates positively with yield, and we see similar results in Supplier Y's dataset. A potential explanation could be that those HH focus a larger proportion of HH labor and resources towards cocoa production.
- Married couples obtain more cocoa from a hectare than farmers who are single, divorced, or widowed. This seems to confirm that cocoa farming is a couple's business. They may have more HH labor available to invest in cocoa production, or be able to redirect additional labor towards cocoa production. This finding is also seen in the analysis of Supplier Y's dataset, but not in that of Supplier X.
- Productive land used for cocoa production has a negative relationship with cocoa yield. That negative effect diminishes with each additional hectare of land (see Figure 5). This non-linear relationship suggests farming HH are less productive with each additional hectare. This finding and its non-linearity is confirmed in the regression analyses on the datasets of both suppliers. The finding also aligns with the correlation between land and yield, as presented in the KIT Demystifying the cocoa sector study[29].

[26] Supplier X reports on the number of shade trees, and linear regression analysis indicates no statistically significant relation with yield when controlling for the effect of confounding variables. A pair-wise correlation even suggests a negative correlation, which may suggest that a (too) large number of shade trees (i.e., canopy cover) may actually have the opposite effect. A regression analysis on the data from Supplier Y reveals a different picture, and shows that the number of trees below five meters in height per ha have a statistically significantly positive effect on yield. The difference between no trees and 10 trees per ha is estimated to result in 25 kg/ha more cocoa. Existing studies like lasera, Oppong, Yeboah and Six (2017) and Asare, Markussen, Ashley Asare, Anim-Kwapong, and Ræbild (2018) also provide mixed results on the effect of shade trees on cocoa yield. Also see a study by UTZ (2017) on shade trees: https://utz.org/wp-content/uploads/2018/01/Key-findings-on-shade-trees.pdf

[27] In the NCP KIT dataset, the intensity of adoption/application of agricultural practices is measured as the % of cocoa land on which the practice is applied. The variable does not reveal how much fertilizer (kg) per hectare is applied. In the dataset of Supplier X, we find an average of 27% of farmers who apply fertilizer which comes close to the average of 23% in the NCP KIT dataset.

[28] The size of the effect of fertilizer needs to be put into perspective: when assessing the level of fertilizer use in kg per ha using Supplier Y's dataset, we find that each kg of fertilizer increases yield by 'only' 0.4 kg. We find a similar effect on size when looking at Supplier X's dataset, where each percentage point of land under fertilizer increases yield by 0.3 kg/ha. Moreover, the effect of fertilizer on cocoa yield differs greatly between regions and between farms in the same region , while the adoption of other GAPs (such as pesticide) also increase the effect of fertilizer on yield . Ruf and Bini (2011) suggest that this variability is partially explained by the amount of rainfall and the degree of maintenance. Therefore, although the effect size of fertilizer remains rather context-dependent, it is a statistically significant correlation in all three regressions which serves as a strong indication of fertilizer potential; especially in a context where uptake is low among cocoa farming HH

[29] Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

- The number of GAP and good social practice (GSP) (e.g., child labor mitigation) trainings that HH attended in the past three years correlate negatively with yield levels. This might be the result of self-selection into trainings: farming HH with relatively lower yields are more inclined to participate in training compared to HH who perform relatively well. Moreover, previous studies have shown that child labor mitigation training (as a GSP) has a negative effect on yield levels[30]. We also find that farming HH who attended child labor mitigation training have a statistically significantly lower yield (difference of 113 kg/ha) than HH that did not[31]. In Supplier X's dataset, we do not find a statistically significant relationship between yield and number of trainings. Data on training is not included in the dataset of Supplier Y.
- Gender of the HH head is not included in the linear regression, as only five percent of the sample is a female-headed HH. However, an independent samples t-test reveals that male-headed HH produce, on average, 171 kg per ha more cocoa than female-headed HH; but, due to the low number of female-headed HH, this difference is not statistically significant. Regressing gender of the farmer (not HH head) on yield in the Supplier X's dataset reveals an average yield difference of 26 kg/ha when controlling for the effect of land size and other confounders. Meanwhile, in Supplier Y's dataset, we find no statistical difference.
- Access to finance does not seem to directly affect yield. However, access to finance may determine input use and the use of labor through which yield is affected. In addition, Supplier Y's dataset shows a positive correlation between having access to a bank account and a loan and cocoa yield. No financial inclusion variables are included in Supplier X's dataset.

[30] Bitzer, V., Laven, A., Steijn, C. and Tyszler, M. (2020) Lindt & Sprüngli Farming Program Impact Evaluation Ghana. Executive Summary. KIT Royal Tropical Institute, Amsterdam. Available at https://www.kit.nl/wp-content/uploads/2020/09/202004_Report_Lindt-Spru%CC%88ngli_Executive-Summary_0.pdf

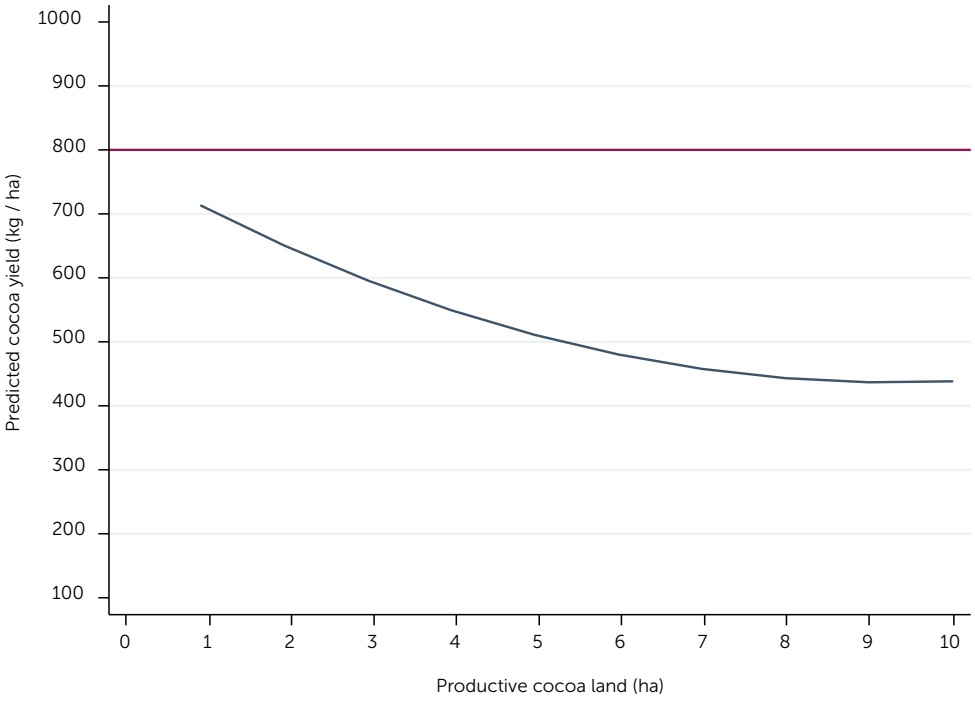
[31] Independent t-test: mean difference =113 kg, p-value = 0.055, N = 152.

Table 12 Overview of determinants of cocoa yield (kg/ha)

Variable category	Variable	Yield (kg/ha)[32]
Household characteristics	Age of farmer/HH head	
	Education level of farmer/HH head	
	Married/cohabiting farmer/HH head	+ + +
	Internal locus of control farmer/HH head	
	External locus of control farmer/HH head	+
	HH size (adults)	
	HH size (children)	
	Farmer/HH head born in region (no/yes)	
	Spouse involvement in HH decision making (no/yes)	
Cocoa production: agricultural practices	Productive cocoa land used (ha)	− −
	Fertilizer use (% of land)	+ + +
	Pesticide (% of land)	
	Fungicide (% of land)	
	Pruning (% of land)	+
	Weeding (% of land)	+ +
	Planting (% of land)	
	% of land with productive trees	
	Shade trees (no/yes)	+ + +
	Sharecroppers (no/yes)	
	Number of GAP and GSP trainings	− − −
Income diversification	Importance of cocoa in % to total (HH) income	+ +
	Number of income sources	+ +
Financial planning and business	Farmer business skills (no/yes)	
	Mobile Money account	+
	Bank account (no/yes)	
	Amount of money borrowed	
	Saved money (no/yes)	
Observations		151

Notes: −/+ p<0.10, − −/+ + p<0.05, − − −/+ + + p<0.01. Yield computation based on productive cocoa land.

Figure 5 Predicted correlation between productive land size and cocoa yield (Dataset: NCP KIT dataset 2020)



[32] Linear regression with district dummies to control for potential variance in soil fertility and rainfall.

Figure 6 Predicted effect of adoption of shade trees and land size on cocoa yield

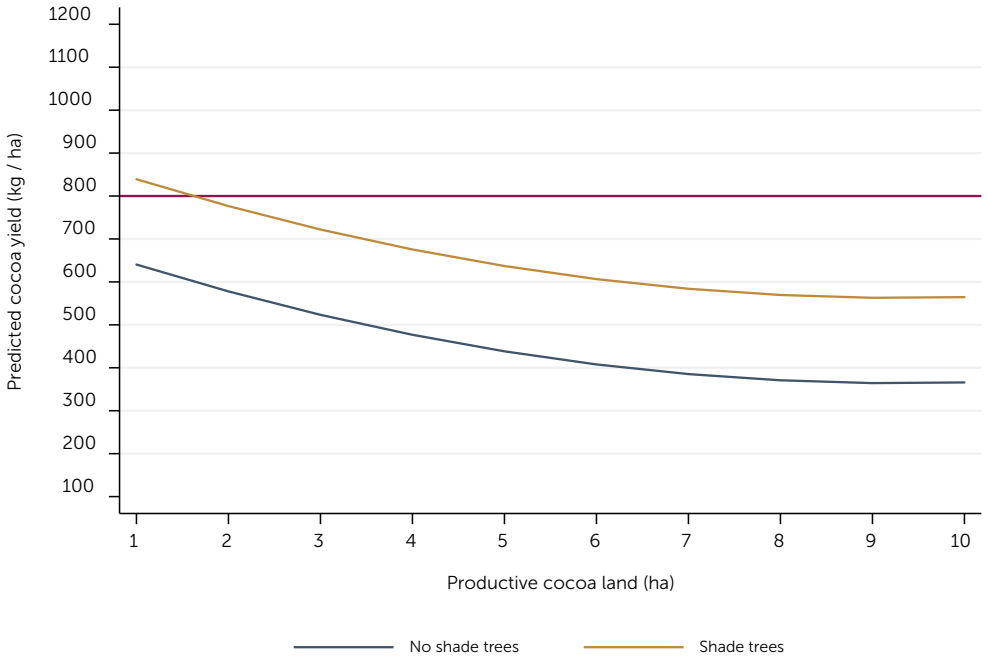
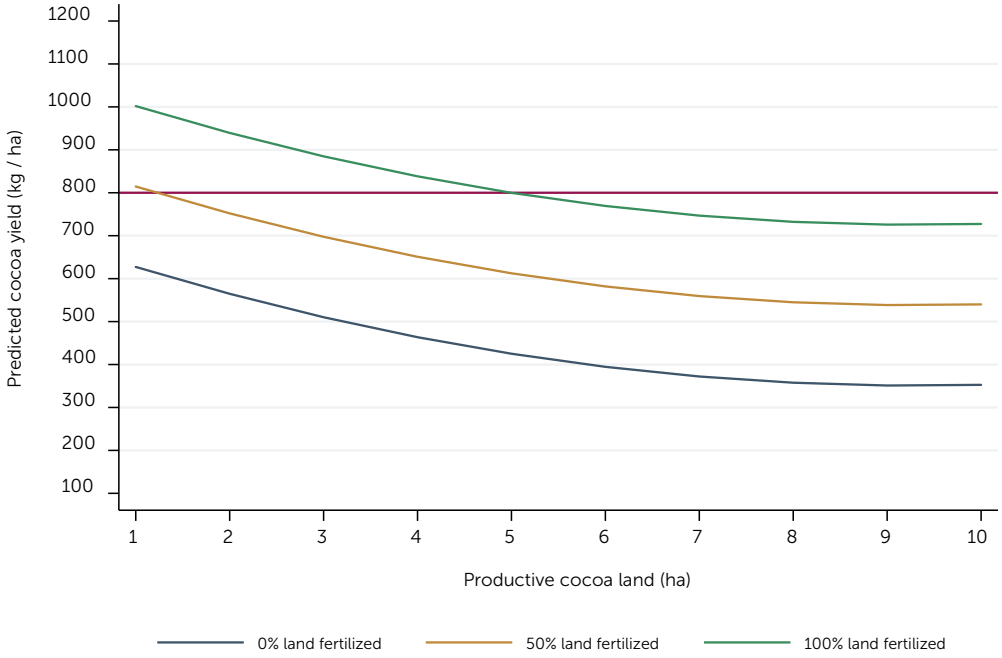


Figure 7 Effect of fertilizer use and land size on cocoa yield



Finance and fertilizer adoption

Almost half of NCP farm households (45%) indicate they do not use fertilizer. Determinants of fertilizer uptake may provide more insights into how its use can be stimulated. The results in Table 13 show the main drivers of fertilizer uptake are:

- An increase in feeling in control of life (internal locus of control) increases the probability of fertilizer uptake (albeit at the 10% significance level), whereas feeling that life happens to you (external locus of control) correlates negatively with fertilizer adoption[33].
- Farming HH with sharecroppers on their cocoa land are more likely to use fertilizer. This may signal a confounding effect of wealth and/or land ownership: farming HH who can afford to have sharecroppers on their land are also more able to access inputs such as fertilizer. This does not indicate, however, that such HH apply fertilizer on more land. In addition, both Suppliers' datasets show a positive correlation between labor (number of workers hired) and adoption of fertilizer, which may signal that labor is hired to fertilize cocoa land.
- Adoption of fertilizer correlates positively with self-reported adoption of shade trees.
- Farming HH with a bank account are 25% more likely to use fertilizer. In the regression results on the data of Supplier Y, loans and bank account access are also positively correlated with uptake of fertilizer, which may further emphasize the importance of access to finance for inputs.
- The number of adults in the HH correlates positively with the application rate of fertilizer. This may suggest that this allows for more necessary household labor to apply fertilizer. The finding is supported by a regression analysis on Supplier X's data, whereby the numbers of family workers, permanent workers, and seasonal/temporary workers positively correlate with the percentage of cocoa land under fertilizer. Marital status correlates negatively with the proportion of cocoa land fertilized, while the number of children correlates negatively with the application of fertilizer, which could suggest that they compete for time and resources.
- The number of income sources correlates negatively with fertilizer adoption. Farming HH who have multiple income sources appear to apply fertilizer on proportionally less land.
- Farming HH with access to a bank account apply fertilizer on a higher percentage of cocoa land than those without access. This re-confirms the importance of access to finance for fertilizer adoption. These findings are further supported by a positive correlation between the amount of money borrowed and fertilizer application: cocoa farmers who borrow more money apply fertilizer on a larger percentage of their land. No correlation is found between savings and fertilizer use/application. The positive effects of access to a bank account and loans underline the importance of access to finance for fertilizer use and application.

[33] Internal locus of control relates to the extent to which an individual expects that an outcome is conditional on their own personal behavior or characteristics. In contrast, external locus of control refers to the degree to which an individual expects that an outcome is the result of external events, chance or fate (Rotter 1966, 1990). Abay, Blalock and Berhande (2017) and Tafesse and Tadesse (2017) find that higher internal and lower external locus of control correlate with the propensity to adopt fertilizer and improved seeds in rural Ethiopia. We measure the two indices using 10 questions based on a Likert format scale. Both indices are computed using an iterative principal factor approach.

Table 13 Overview of determinants of fertilizer use (Dataset: NCP KIT dataset 2020)

Variable category	Variable	Fertilizer adoption[34]	Fertilizer application (% of cocoa land)[35]
Household characteristics	Age of farmer/HH head		
	Education level of farmer/HH head		
	Married/cohabiting farmer/HH head		− −
	Internal locus of control farmer/HH head	+	
	External locus of control farmer/HH head	− −	
	HH size (adults)		+
	HH size (children)		− −
	Farmer/HH head born in region (no/yes)	− − −	−
	Spouse involvement in HH decision-making (no/yes)		
Cocoa production: agricultural practices	Productive cocoa land used (ha)		
	Pesticide (% of land)		
	Fungicide (% of land)		
	Pruning (% of land)		
	Weeding (% of land)		
	Planting (% of land)		
	% of land with productive trees		
	Shade trees (no/yes)	+	
	Sharecroppers (no/yes)	+ +	
	Number of GAP and GSP trainings	+	
Income diversification	Importance of cocoa in % to total (HH) income		
	Number of income sources		−
Financial planning and business	Farmer business skills (no/yes)		−
	Mobile Money account (no/yes)		
	Bank account (no/yes)	+	+ +
	Amount of money borrowed		+ +
	Saved money (no/yes)		
Observations		167	167

Notes: −/+ p<0.10, − −/+ + p<0.05, − − −/+ + + p<0.01.

Cocoa production costs

Investments in inputs and labor are key to cocoa yields; while, at the same time, it remains important for cocoa farming households to keep production costs low. This also signals the importance of having an acceptable return on investment. Therefore, production cost refer to the second intervention bucket.

Table 14 provides insights on what drives input costs (including cost of materials and tools), labor costs, and more generally, total cocoa production costs. For input costs, we find:

- Fertilizer application, fungicide application, pruning, weeding, and planting practices all contribute to input costs. Fertilizer, pruning and planting have a non-linear effect where their effect becomes stronger or less strong with an increase

[34] Probit regression with district dummies to control for potential variance in soil fertility and rainfall. No adoption = 0, adoption = 1.

[35] Truncated regression (tobit) to eliminate the indirect effect of adoption on fertilizer application (i.e. non-adopters would automatically receive a value of 0%).

in % of land under the practice. The regression results also show that fertilizer application is the most 'expensive' in terms of its contribution to input costs.
- Planting has a negative impact, which confirms the notion that input use is very low in Côte d'Ivoire and Ghana when planting cocoa trees[36].

The second column of Table 14 presents the results for labor costs and reveals:

- Married HH spend less on hired labor compared to HH with fewer adults (although the effect is only statistically significant at the 10% level). A plausible explanation is that more adults in the HH provide more labor, which reduces the need to hire additional help.
- Labor costs are largely determined by fertilizer application and pruning. The results suggest that fertilizer application and pruning are the two activities for which farming HH are more likely to hire laborers, most likely because both production steps are labor-intensive (and pruning requires skilled labor and modern equipment).
- Having sharecroppers on cocoa land reduces labor costs (per ha) by almost half on average.
- In addition, cocoa input cost (per ha) and cocoa labor cost (per ha) are correlated, although the strength of the relationship is small[37]. Nonetheless, this still signifies labor is needed to apply inputs.

When we merge both types of costs (or 'investments' in cocoa production, as they correlate positively with yield levels) into one cost variable (Table 14) and conduct a linear regression with the same set of predictors, we observe:

- Fertilizer application, pruning, and also planting remain the most costly production steps.
- The negative effect of sharecroppers is again found on total production costs.
- Furthermore, and not included in the regression model, no differences were found between male-headed and female-headed HH in all three production costs[38].
- Non-migrated households are more likely to invest in labor.
- Access to finance has no direct effect on inputs and labor costs. However, previous sections showed that access to finance determines the uptake of inputs (e.g. fertilizer), which in turn affect production costs.

[36] See the review of Wessel & Quist-Wessel (2015) on cocoa production in West-Africa.

[37] Pearson's correlation coefficient r = 0.248, p-value = 0.001.

[38] Although differences between male-headed and female-headed HH are substantial (US$32 per ha total farm cost difference on average,), the result of an independent t-test is not statistically significant.

Table 14 Overview of determinants of input/material/tools costs and labor costs per ha (Dataset: NCP KIT dataset 2020)

Variable category	Variable	Cocoa production costs per ha (US$): inputs, tools and materials[39]	Cocoa production costs per ha (US$): labor	Cocoa production costs per ha (US$): total [40]
Household characteristics	Age of farmer/HH head	−		
	Education level of farmer/HH head			−
	Married/cohabiting farmer/HH head		−	
	Internal locus of control farmer/HH head			
	External locus of control farmer/HH head			
	HH size (adults)			
	HH size (children)			
	Farmer/HH head born in region (no/yes)		+ + +	+ + +
	Spouse involvement in HH decision-making (no/yes)			
Cocoa production: agricultural practices	Productive cocoa land used (ha)			
	Fertilizer (% of land)	+ + +	+ +	+ + +
	Pesticide (% of land)			
	Fungicide (% of land)	+		
	Pruning (% of land)	+ +	+	+ +
	Weeding (% of land)	+		
	Planting (% of land)	− −		+
	% of land with productive trees			
	Shade trees (no/yes)			
	Sharecroppers (no/yes)		− −	−
	Number of GAP and GSP trainings			
Income diversification	Importance of cocoa in % to total (HH) income			
	Number of income sources			
Financial planning and business	Farmer business skills (no/yes)			
	Mobile Money account (no/yes)			+ +
	Bank account (no/yes)			
	Amount of money borrowed			
	Saved money (no/yes)			
Observations		167	164	163

Notes: −/+ p<0.10, − −/+ + p<0.05, − − −/+ + + p<0.01.

Cocoa production costs/investments correlate positively with yield levels (and thus also with gross crop revenue per ha). However, computing return on investment remains challenging, as gross cocoa revenue is largely – but not only – determined by farm productivity. Therefore, we assess the correlation between farming cost and gross cocoa revenue in absolute numbers and per ha, using linear regression models[41]. Due to the limited sample size, it should be noted this analysis is rudimentary at best and only meant to be indicative in exploring the correlation between production costs and gross cocoa revenue. The regression results reveal that:

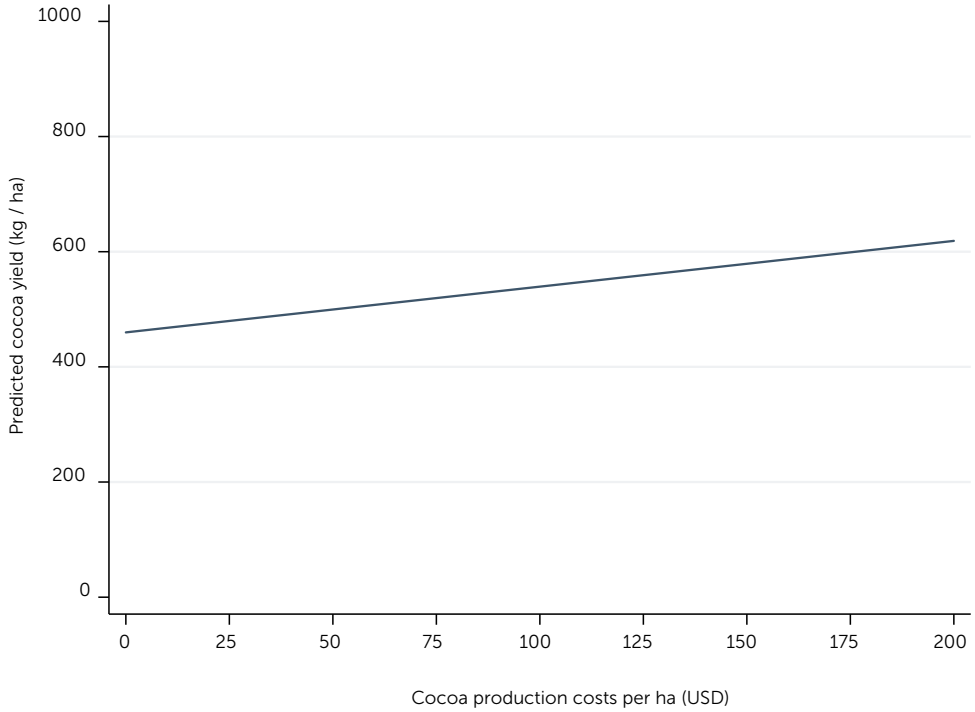
[39] For fertilizer use, pruning and planting, separate regression models conducted with polynomial variables to explore their non-linear effects on input costs per ha.

[40] Linear regression with district dummies to control for potential variance in soil fertility and rainfall for all three cost variables.

[41] Based on all cocoa land used in ha, and not just productive cocoa land used, as investments can also be targeted towards unproductive land to finance regeneration and rejuvenation.

- Each US$ invested in cocoa results in an average increase of approximately 0.8 kg cocoa yield on top of a predicted constant yield level of 460 kg if no investments were made, as illustrated in Figure 8.
- Farming costs per ha and cocoa revenue per ha are positively correlated.
- There is a positive correlation between input costs (inputs, materials, tools) per ha and revenue per ha. The findings suggest that each US$ invested in inputs results in a cocoa revenue per ha of US$3.6[42]. For labor costs per ha, we do not find an effect on gross cocoa revenue per ha.
- Assessing the effect of total cocoa farming costs on total cocoa gross revenue. we find that each additional US$ in cocoa farming costs leads to an increase of US$3.8 in gross cocoa revenue[43],
- Looking at the effect of total input costs and total labor costs separately, the results reveal that each US$ increase in input costs leads to an increase of US$6.0 in gross crop revenue. Labor costs have only a marginal effect when looking at absolute values. Each US$ invested in labor cost result in gross cocoa revenue of US$0.24. However, inputs require labor to become productive, and both costs are correlated[44]. All correlations are plotted in Figure 9.

Figure 8 Predicted effect of production costs per ha on cocoa yield

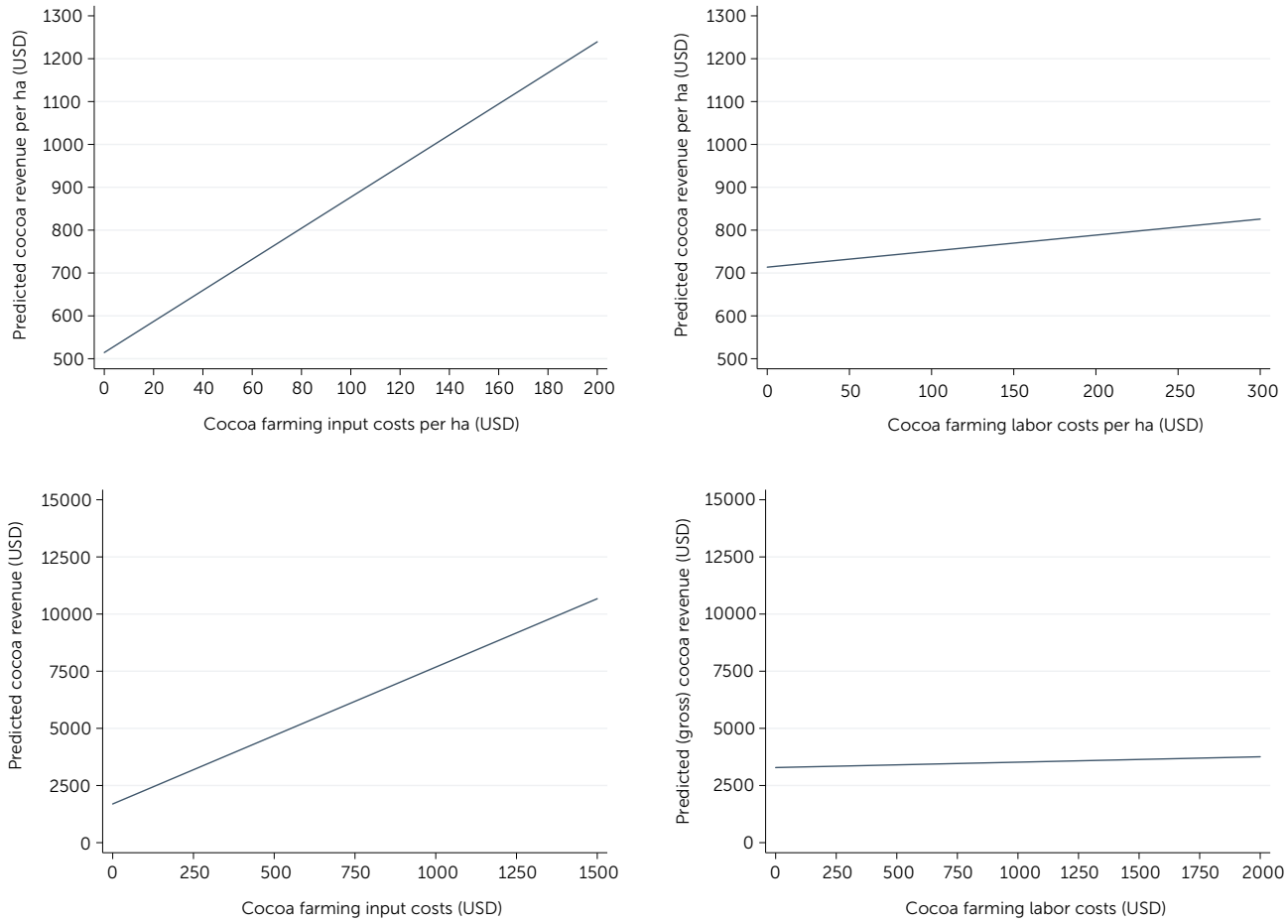


[42] With and without control variables.

[43] This effect is non-linear, and with each additional US$ farm investment, the positive effect on revenue decreases (albeit minimally with US$ 0.001).

[44] For the correlation between total input costs and labor costs, Pearson's R coefficient = 0.218, p-value = 0.004. For the correlation between inputs and labor costs per ha, Pearson's R coefficient = 0.248, p-value = 0.001.

Figure 9 Cocoa gross revenue and farm production costs per ha and in total (US$)



Income diversification

The third intervention bucket to LI refers to income from non-cocoa activities. It is important to note that income diversification already takes place, as 99% of farming HH do not solely rely on cocoa sales as their only source of income (see Figure 10). Moreover, the minimum number of income sources is two (Figure 11), while households have on average five income sources[45].

[45] The number of income sources is computed, based on income from the three most important crops (although HH sell a lot more crops, their sales do not substantially contribute to HH income), sale of livestock, fish, bush products or land, running a business, labor on other people's cocoa farm, labor on other people's farm for other crops, labor for others (non-farm), employment (public and commercial), and remittances from family members living elsewhere.

Figure 10 Income diversification: importance of cocoa sales

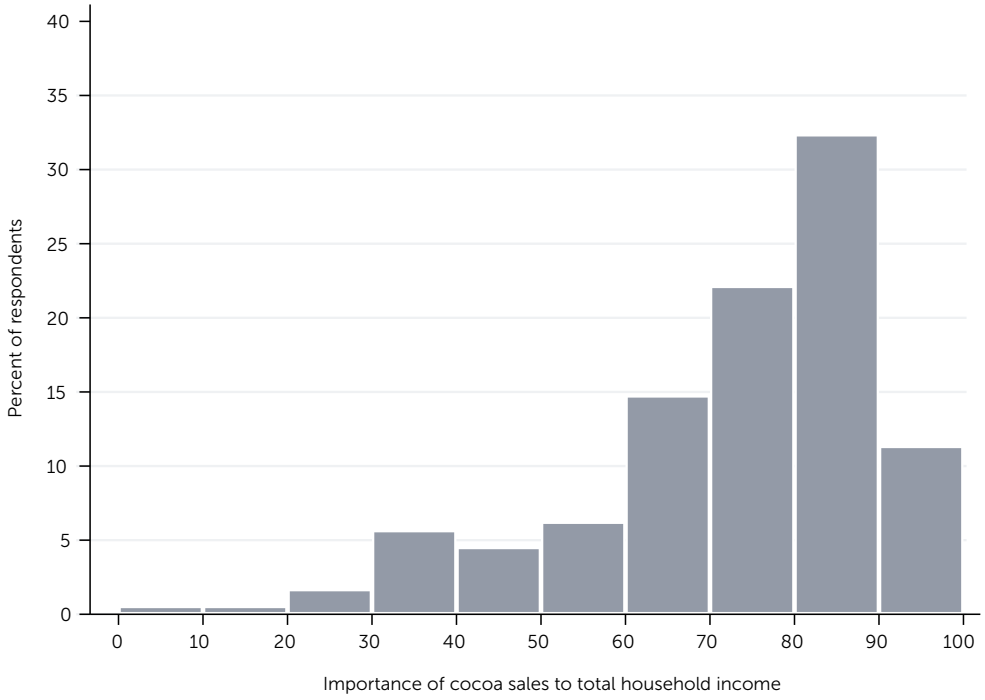


Figure 11 Income diversification: number of income sources

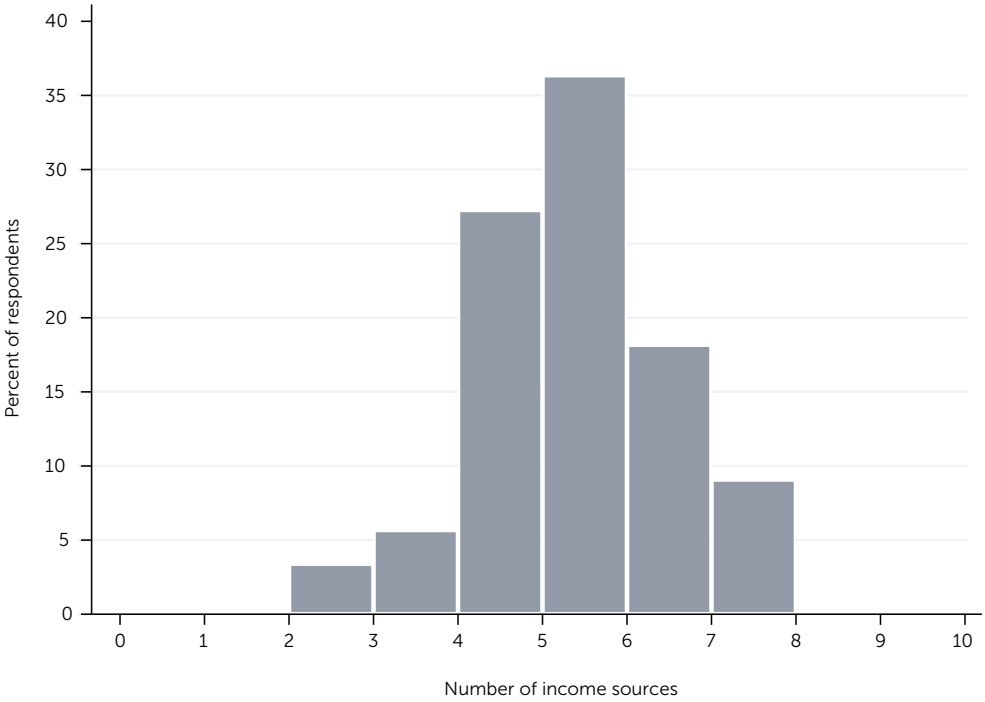


Table 15 presents the correlations between household and farm characteristics on two income diversification indicators: importance of cocoa sales to household income and the number of income sources. The regression results reveal:

- The number of income sources correlates negatively with the importance of cocoa sales to total HH income. The more income sources a farming HH has, the less reliant it is on cocoa sales for income.
- Access to a bank account correlates negatively with reliance on cocoa sales, which suggests that farming HH who rely more on cocoa have reduced access to a bank account.
- Married couples and couples in cohabitation are more likely to have a higher number of income sources than single/widowed/divorced farmers, which is unsurprising as they have more labor to their avail. This is also reflected in the positive effect of the number of adults in the HH.
- (Self-reported) farm business skills correlate negatively with the number of income sources, while the number of trainings correlate positively with the number of income sources.
- Although gender of the HH head is not included in the regression model due to the low number of female-headed HH, the results of an independent t-test reveal that male-headed HH are statistically significant more relying on cocoa sales for their income[46].

Table 15 Overview of determinants of income diversification (Dataset: NCP KIT dataset 2020)

Variable category	Variable	Importance of cocoa sales to total HH income (%)[47]	Number of income sources[48]
Household characteristics	Age of farmer/HH head		
	Education level of farmer/HH head		
	Married/cohabiting farmer/HH head		+
	Internal locus of control farmer/HH head		
	External locus of control farmer/HH head		
	HH size (adults)		+ +
	HH size (children)		−
	Farmer/HH head born in region (no/yes)	−	
	Spouse involvement in HH decision-making (no/yes)		
Cocoa production: agricultural practices	Productive cocoa land used (ha)		
	Fertilizer use (% of land)		−
	Pesticide (% of land)		−
	Fungicide (% of land)		
	Pruning (% of land)		
	Weeding (% of land)		
	Planting (% of land)		
	% of land with productive trees		
	Shade trees (no/yes)		
	Sharecroppers (no/yes)		
	Number of GAP and GSP trainings		+ + +
Income diversification	Importance of cocoa in % to total (HH) income	N.A.	− − −
	Number of income sources	− − −	N.A.
Financial planning and business	Farmer business skills (no/yes)		− −
	Mobile Money account (no/yes)		
	Bank account (no/yes)	− − −	−
	Amount of money borrowed		
	Saved money (no/yes)		+ +
Observations		167	167

Notes: −/+ p<0.10, − −/+ + p<0.05, − − −/+ + + p<0.01.

[46] For male-headed HH, cocoa sales constitute 70% of their income, whereas for female-headed HH cocoa contributes to 57% of their income.

[47] Linear regression with district dummies to control for potential variance in soil fertility and rainfall.

[48] Poisson regression with district dummies to control for potential variance in soil fertility and rainfall.

To stimulate income diversification, several innovative income generating activities have been introduced to NCP farming HH in Côte d'Ivoire in the last couple of years. They include poultry farming, beekeeping, livestock herding and fish ponds amongst others. Appendix 2 presents a brief assessment of these income generating activities. In addition, it presents two boxes on income generating activities are based on the opportunities to exploit the remaining cocoa waste, like cocoa pods, weeds and leaves, to make cocoa juice and biochar. Both developments are still in an early stage[49].

Pricing mechanisms, premiums and cash transfers

The fourth intervention bucket refers to price, premiums, and cash transfers. To explore their effects, we aim to provide some initial insights around the proportion of farming HH that move into the 'above LI' group when farm gate prices increase, when farm households receive an annual cash transfer of US$568 (EUR500), or when current premiums (for certification) double.

In general, cocoa farming HH are vulnerable to changes in cocoa prices, on which they cannot exert much influence being 'price-takers'[50]. However, their livelihoods largely dependent on cocoa sales, and when prices fall below the cost of production they are likely to face more severe poverty. Proposals have been made to increase the cocoa prices that cocoa farmers receive[51], and although price increases are important to absolute income levels of farmers (e.g. each additional US$ adds directly to a farmer's income), an artificial price increase will not automatically lift large portions of smallholder farmers out of extreme poverty[52] and can potentially do harm if a supply/demand imbalance results[53].

To assess the effect of an increase in farm gate prices on the proportion of HH that make an LI, we assume that all other income sources remain at their current levels. Naturally, an increase in price could incentivize farmers to make more land available for cocoa production, and may intensify labor on the cocoa farm and/or may reduce the labor designated to alternative income sources. Moreover, for simplicity, we assume the absence of price elasticity (i.e. no changes in supply and demand when prices change), although, the KIT Demystifying study revealed that price and stocks-to-grindings ratio are strongly correlated in the opposite direction[54]. Moreover, to keep the analysis comprehensive, we use observational data.

[49] The income generating activities listed are primarily included for inspirational purposes and to show that income diversification is desired, initiated and adopted already by NCP farm HH. No economic analysis is offered on their viability nor on their return on investment.

[50] Bymolt, Laven &Tyszler (2018).

[51] See, for example, Fountain, A.C. and Hütz-Adams, F. (2020) The 2020 Cocoa Barometer. Available at https://voicenetwork.cc/wp-content/uploads/2021/03/2020-Cocoa-Barometer-EN.pdf

[52] See the recent studies by Waarts, Janssen, Aryeetey, Onduru, Heriyanto, Aprillya, N'Guessan, Courbois, Bakker and Ingram (2021) and Van Vliet, Slingerland, Waarts and Giller (2021).

[53] See concluding chapter of Bymolt, Laven &Tyszler (2018)

[54] Bymolt, Laven &Tyszler (2018).

The first bar of Figure 12 provides the current proportion of farming HH that earn an LI, while the second bar shows that, with an increase of 25% of the current farm gate price for cocoa (100% = 825 CFA per kg), the proportion of cocoa farming HH who attain an LI increases by four percentage points. With a 50% increase in farm gate price, we find an increase of 10 percentage points in the proportion of cocoa farming HH obtaining an LI, as demonstrated in the third bar of Figure 12. Altogether, this finding confirms the results of recent studies that increases in price alone are not effective in the short-term if volumes of cocoa sold do not increase; and is only effective in combination with sustainable intensification (i.e. a higher production without increasing the ha of land used for cocoa production) and with international supply management policies. Nonetheless, as volumes produced and prices are strongly connected[55], a one-dimensional focus on intensification without addressing price levels or differentiation based on viable alternatives with fair prices is not helping farming HH earning an LI.

Conditional cash payment programs have gained momentum over the last decade, and their adoption has greatly increased as poverty reduction mechanisms. Several examples demonstrate that cash transfers hold potential to invoke behavioral change (e.g. school enrolment, investment in agricultural assets, involvement in non-farm income generating activities) while at the same time adding directly to the incomes of smallholder farmers[56,57]. However, many evaluations demonstrate that the transfers are often too small in size to have a direct impact on the livelihoods of the recipients, lifting large proportions of HH out of poverty.

Conditional cash transfers can play a role in increasing the income of cocoa farming HH through two mechanisms: first, the payment directly adds to their income, having a short-term effect on income levels. Second, conditional cash payments can be effective through a long-term impact on (stimulating the adoption of) GAPs, increasing sustainable intensification of cocoa production and income diversification. Nestlé and partners are currently piloting The Household Accelerator Program[58], which aims to transfer a maximum of EUR 500 to farming HH if they demonstrate adoption of GAPs, diversify their income sources, send their children to school, and engage in agro-forestry.

[55] This phenomenon is also known as the agricultural treadmill, which refers to a process where farmers adopt modern technology and increase their production, but the increase in supply lowers the price of the commodity and ultimately, revenue. This then requires a higher production volume to earn a similar income, hence labeled a treadmill.

[56] Bastagli, F., Hagen-Zanker, J., Harman, L., Barca, V., Sturge, G., Schmidt, T., & Pellerano, L. (2016). Cash transfers: what does the evidence say. A rigorous review of programme impact and the role of design and implementation features. London: ODI, 1(7). Available at: https://cdn.odi.org/media/documents/11316.pdf

[57] Bernstein, J., Johnson, N., & Arslan, A. (2019). Meta-evidence review on the impacts of investments in agricultural and rural development on Sustainable Development Goals 1 and 2. IFAD Research Series, 38. Available at: https://www.evalforward.org/sites/default/files/2019-09/Meta-evidence%20review.pdf

[58] Nestlé and partners are currently piloting whether a conditional cash transfer program has the potential to increase the adoption of good agricultural practices like pruning and agro-forestry, while also stimulating income diversification and school enrolment of children. For each activity, a farm HH receives EUR 100. 'Completing' all four activities leads to an additional encouragement of EUR 100, which means the total conditional cash transfer can amount to EUR 500 per year.

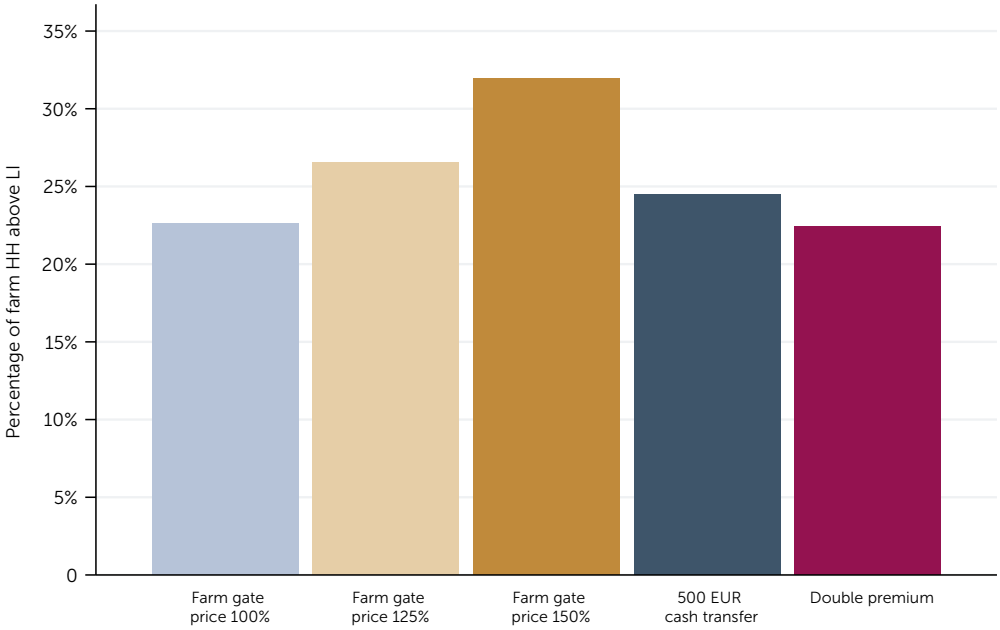
In this analysis, we only focus on the short-term effect of adding directly to the HH income, as we do not yet know the impact on adoption of GAPS, farm productivity, and income levels in the long-term. The fourth bar in Figure 12 shows that a direct contribution of EUR 500 to total HH income pushes an almost negligible group (in size) of farming HH towards an LI (one percentage point increase). This may suggest that the benefit of conditional cash payment programs is primarily the provision of funding for short-term investments in productive means. In the long-term, the availability of resources to invest, in combination with adoption of GAPs and income diversification, is expected to sustainably contribute to higher HH income. Moreover, poorer HH are more likely to benefit from conditional cash transfers, especially in the short-term.

Finally, we focus on premiums as an additional income source, adding to cocoa income received from selling cocoa for the common farm gate price. The last bar in Figure 12 reveals that doubling the current premiums (from CFA 30 to CFA 60[59]) has no direct effect on the proportion of farming HH who obtain an LI. This is partly explained by HH not selling all their cocoa as certified, even though most of their plots are certified. On average, only 44% of all cocoa produced is sold as certified, meaning that only for that proportion of cocoa sold a premium was received.

Ultimately, a doubling of premiums and the one-off EUR 500 cash transfer have very limited short-term impact on lifting HH towards earning an LI. The EUR 500 cash transfer is expected to have a larger impact on poorer farming HH, as it has more relative value and the other pricing mechanisms are highly dependent on production volumes. Increasing the farm gate price by 50% still leaves a large proportion of farming HH below the LI benchmark. Although a moral imperative, the results suggest that increased pricing mechanisms as singular instruments have a limited effect in the short-term, and also indicate that they would be more effective in combination with sustainable intensification of cocoa production and international supply management or if they are envisioned to have a more sustainable impact in the long-term through supporting adoption of GAPs.

[59] Premiums for the 2019 cocoa season.

Figure 12 Observed increase in % of farming HH reaching LI by increasing farm gate prices for cocoa and cash transfers



HH income

In the following section, we explore the determinants of HH income and earning an LI. We start with investigating cocoa income levels and how aspired GAP implementation levels can increase income from cocoa. This is followed by analyses on total income levels, and we end the section with drivers of earning an LI and with a comparison of income composition between HH below and above the LI benchmark.

Cocoa income

Cocoa remains the core income generating activity, and Figure 13 shows that the distribution of cocoa income is skewed to the right (i.e., tail is on the right side), as a small proportion of farming HH earn substantially more than the vast majority of cocoa farming HH[60]. What further stands out is that most farming HH earn less than US$5000 from cocoa, while the median net income from cocoa is approximately US$2200.

[60] These more 'extreme' income levels make regressing a set of predictors on absolute cocoa income levels sensitive to outliers (which are located in the right tail of the distribution). As such, we log transform the cocoa net income variable to create a more normally distributed variable, which is better suited to regression analysis. To interpret the results from a log transformed variable, we use a generalized linear regression model (Gaussian) with district dummies to control for potential variance in soil fertility and rainfall. This model is a flexible generalization of a linear regression. Similar to the findings on the factors driving farm productivity, we also check the robustness of our results on cocoa income using the two farmer datasets provided by Nestlé's Suppliers.

Figure 13 Distribution of HH net cocoa income (in US$)

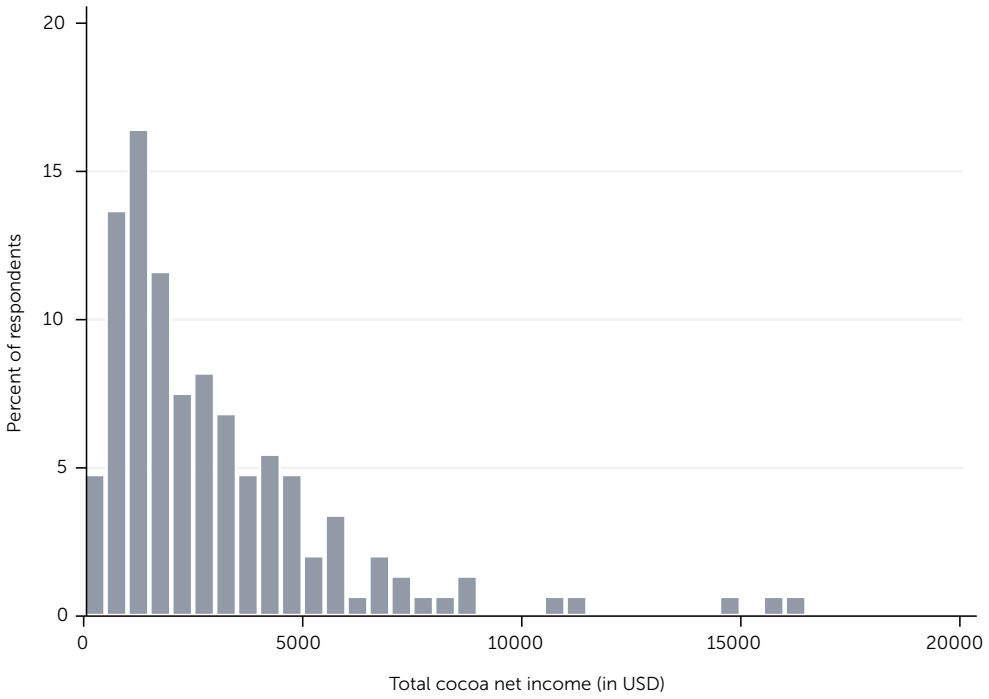


Table 16 presents the regression results of HH net cocoa income. The following observations can be distilled from the overview:

- Similar to the finding for yield, being married has a substantial impact on net cocoa income. The effect of marital status on yield and income suggests that pooling of financial resources, land, and labor offers an advantage to married farmers. In the analyses of the Supplier datasets we find similar results.
- A positive effect is also found for number of adults in the HH, which emphasizes the augmenting effect that pooling of resources and labor can have on total cocoa net income. Naturally, more HH members imply that HH also have a higher LI benchmark[61].
- Internal locus of control, correlates positively with net cocoa income. This emphasizes the importance of soft skills development of farmers, such as leadership, (financial) planning skills, communication skills, and self-esteem training. Nonetheless, the effect of internal locus of control should be interpreted with caution, as its relationship with income is endogenous: higher income levels also contribute to higher internal locus of control levels.
- Productive cocoa land is a strong determinant of cocoa net income, as shown in Figure 14. Although the effect of cocoa land is non-linear, each additional ha of cocoa land increases cocoa net income by approximately US$400 for an increase

[61] The positive effect of household size on cocoa income is confirmed in the analysis on the dataset from Supplier X.

from two to three ha, US$500 from three to four ha, and US$600 from four to five ha. The non-linear effect of cocoa land on cocoa income is also found in the analyses on the two datasets from the Suppliers.

- Several agricultural practices, such as pesticide and fungicide use, weeding, and adoption of shade trees, correlate with net cocoa income. This demonstrates there is a correlation between investing effort and resources in cocoa and cocoa income[62].
- Farming HH for whom cocoa sales form an important part of their total HH income are more likely to have a higher cocoa net income[63].
- The number of income sources correlates positively with cocoa income. As we also observe a positive correlation between the number of income sources and yield levels, this could suggest positive spill-over effects between cocoa and other income sources where profits from one source of income are invested in cocoa production and vice versa.

Table 16 Overview of determinants of HH net cocoa income in US$ (Dataset: NCP KIT dataset 2020)

Variable category	Variable	HH net cocoa income (US$ - log)[64]
Household characteristics	Age of farmer/HH head	
	Education level of farmer/HH head	
	Married/cohabiting farmer/HH head	+ + +
	Internal locus of control farmer/HH head	+ + +
	External locus of control farmer/HH head	
	HH size (adults)	+
	HH size (children)	
	Farmer/HH head born in region (no/yes)	
	Spouse involvement in HH decision-making (no/yes)	
Cocoa production: agricultural practices	Productive cocoa land used (ha)	+ + +
	Fertilizer use (% of land)	
	Pesticide (% of land)	+
	Fungicide (% of land)	− −
	Pruning (% of land)	
	Weeding (% of land)	+ + +
	Planting (% of land)	
	% of land with productive trees	
	Shade trees (no/yes)	+ + +
	Sharecroppers (no/yes)	+ +
	Number of GAP and GSP trainings	−
Income diversification	Importance of cocoa in % to total (HH) income	+ +
	Number of income sources	+
Financial planning and business	Farmer business skills (no/yes)	
	Mobile Money account	
	Bank account (no/yes)	
	Amount of money borrowed	
	Saved money (no/yes)	
Observations		145

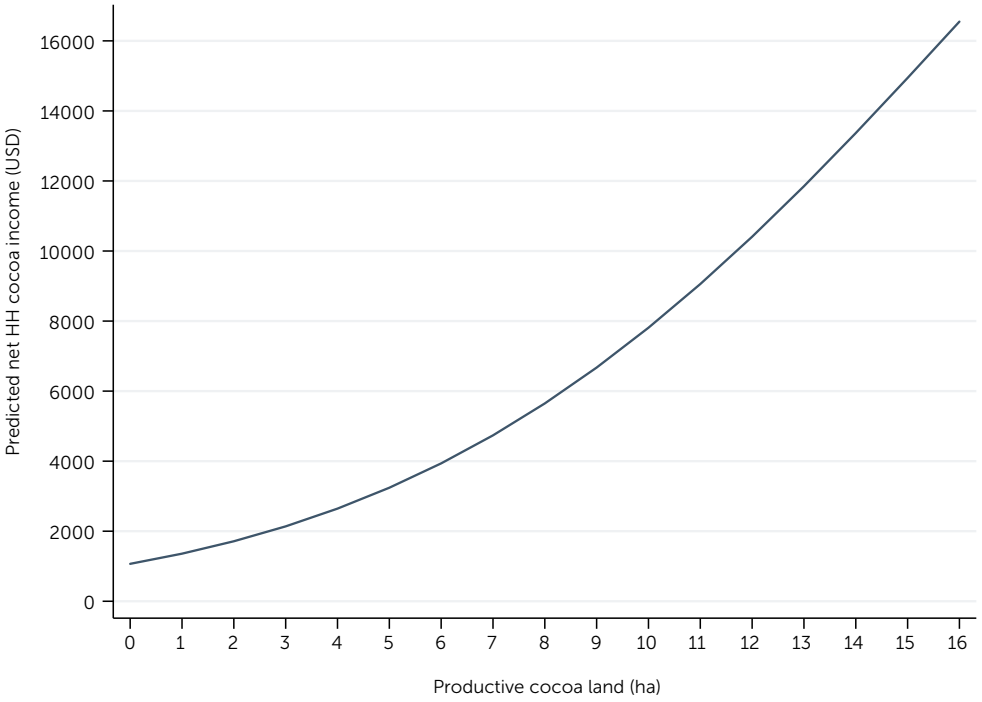
Notes: −/+ p<0.10, − −/+ + p<0.05, − − −/+ + + p<0.01.

[62] In the analyses on the two datasets of the Suppliers we also find that GAP implementation correlates positively with net cocoa income.

[63] This finding is also confirmed in the analysis on the dataset of Supplier Y.

[64] Generalized linear regression (Gaussian) with district dummies to control for potential variance in soil fertility and rainfall.

Figure 14 Correlation between productive land size and cocoa net income in US$



The results presented in Table 16 suggest that combining both – adding soft skills training to enhance non-cognitive characteristics to more conventional technical programs aimed at increasing technology adoption – could yield great potential to substantially increase cocoa net income.

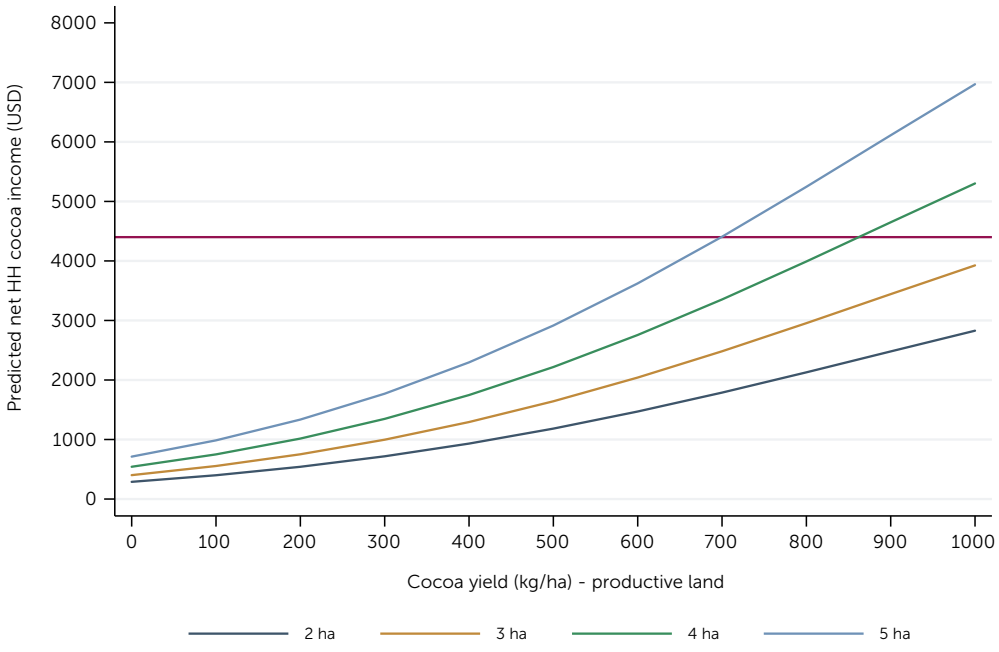
To plot the correlation between yield levels, productive land and cocoa income levels in Figure 15 we replace the agricultural practices variables with cocoa yield as predictor of cocoa income in the regression[65]. We also plot a cocoa income benchmark (red line in Figure 15) based on the contribution of cocoa sales to total HH income (in percentages). The median LI benchmark (adjusted for HH income) for the NCP KIT dataset is US$6369 on average, adjusted for HH size, while the mean value for the importance of cocoa sales to total HH income is 69%. Based on these numbers, we estimate that, to reach an LI, cocoa net income should be approximately US$4400 on average (keeping all else equal)[66]. The regression results show that:

[65] As agricultural practices determine cocoa yield, we only include the latter in the regression model to estimate the effect of farm productivity levels on HH cocoa net income.

[66] The mean LI benchmark (adjusted for HH income) is US$ 7235, but this number may be sensitive to outliers in HH size. Therefore, we have taken a more conservative approach and estimate the cocoa net income needed to reach an LI (conditional on the importance of cocoa sales to total HH income) using the median value of US$ 6369. As the importance of cocoa to HH income is measured on a continuous scale from 0 to 100, its mean is less sensitive to outliers. Naturally, this approach is a rough approximation.

- Yield levels have a statistically significant, positive (but non-linear) effect on cocoa net income[67].
- For HH with five ha of productive cocoa land, a yield of 700+ kg/ha suffices to approximate US$4400 and potentially reach an LI – conditional on cocoa sales representing 69% of total HH income (i.e., keeping non-cocoa income constant). However, an increase in farm productivity may increase the percentage that cocoa sales contribute to the total HH income. It would be unlikely that the absolute income levels of non-cocoa activities increase proportionally. On the contrary, redirecting resources towards increasing cocoa net income may come at the expense of other income generating sources, in turn creating a substitution effect on HH income (i.e., an increase in cocoa income is compensated by a decrease in alternative income sources, as resources need to be redirected to cocoa production). An alternative way of reasoning could suggest that the revenue from increased farm productivity can be invested in alternative income sources, increasing their profitability as well.
- For HH with four ha of productive cocoa land, a yield of 850-900 kg/ha suffices to approximate US$4400 and potentially reach an LI (again, conditional on non-cocoa income remaining constant).
- For HH with three ha of productive cocoa land, obtaining a substantial cocoa net income remains challenging. However, as the results in Table 16 suggest, soft skills development has potential to further accelerate cocoa net income.

Figure 15 Cocoa net income in US$ by cocoa yield (kg/ha) and cocoa productive land



Notes: Red line represents 69% of the total LI benchmark (cocoa sales constitute on average 69% of HH income)

[67] To check the robustness of our finding, we conduct similar regression analyses on the correlation between yield and net HH cocoa income using the two Suppliers' datasets. We find similar positive (and non-linear) yield effects. The effect sizes differ across datasets, which is not surprising given that they represent different cocoa seasons and regions.

Scenario-building: Standard cocoa support package

The previous sections have provided insights into the drivers of cocoa productivity, costs an cocoa income. These insights allow for developing a 'standard cocoa support package' that is anticipated to support all NCP farming HH to increase their income from cocoa sales. Such a package should include services that allow access to finance and labor, support GAP adoption and soft-skills development.

To understand the impact of such a standard support package, we draft a scenario where farming HH have access to financial services to buy inputs (e.g., fertilizer) and affordable labor (such as pruning gangs that are trained and coached to apply GAPs) and have participated in soft-skills development programs. To understand their effect on farm productivity, we assume that the most essential GAPs, such as fertilizer application, pruning, and weeding, are implemented on the majority of cocoa land. Moreover, we assume that internal locus of control levels have increased as a result of soft-skills skills training in combination with receiving valuable information on how to apply effective farming techniques.

Using the NCP KIT data, we predict cocoa yield levels based on the following aspired levels of a HH:

- Weeds 100% of all productive cocoa land (currently 88%, on average).
- Applies fertilizer on at least 75% of productive cocoa land (currently only applied on 22%, on average).
- Prunes 75% of trees on productive cocoa land (currently 66%, on average).
- Has an 'internal locus of control at least at the level of the median value of the total farming HH sample.

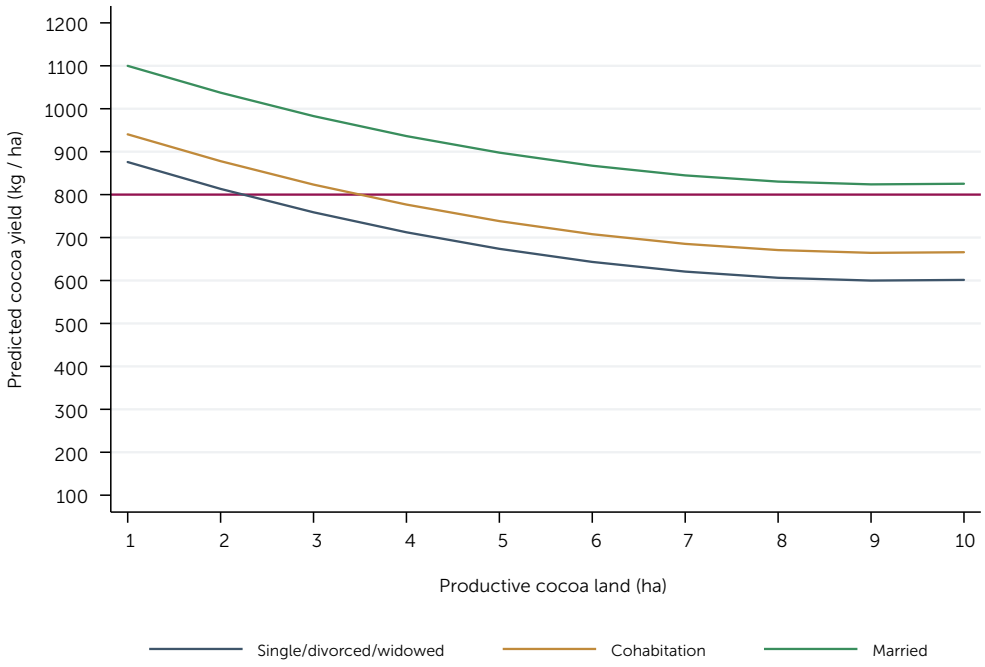
Using linear regression, these aspired levels of GAP implementation, in combination with a median internal locus of control level, result in the predicted yield levels presented in Figure 16[68]. As marital status remains an important determinant of farm productivity, we present the predicted yield levels according to this.

The results reveal that HH with less than four ha of land are predicted to produce 900 kg per ha. For HH with larger land sizes, this becomes more difficult, as each additional ha of land requires an equal amount of resources, effort, and labor to uphold high yield levels. This prediction is an average value on the base of 150 farming HH[69], but still signifies that sustainable intensification has a lot of potential for HH, which can be enhanced when provided with the correct technical training, soft-skills training, access to finance (and high-quality inputs) and affordable labor.

[68] Keeping all other explanatory variables at their mean in a linear regression including the importance of cocoa, which could proxy for how much time and resources farming HH could invest in cocoa farming given potential other sources of income that would compete for time and resources

[69] If we would plot the observed yield of cocoa households with the proposed GAP implementation levels along the regression prediction line they would most likely be scattered as a cloud.

Figure 16 Predicted yield levels when 100% of productive cocoa land is weeded, 75% is fertilized, 75% is pruned, and the median internal locus of control levels are per marital status

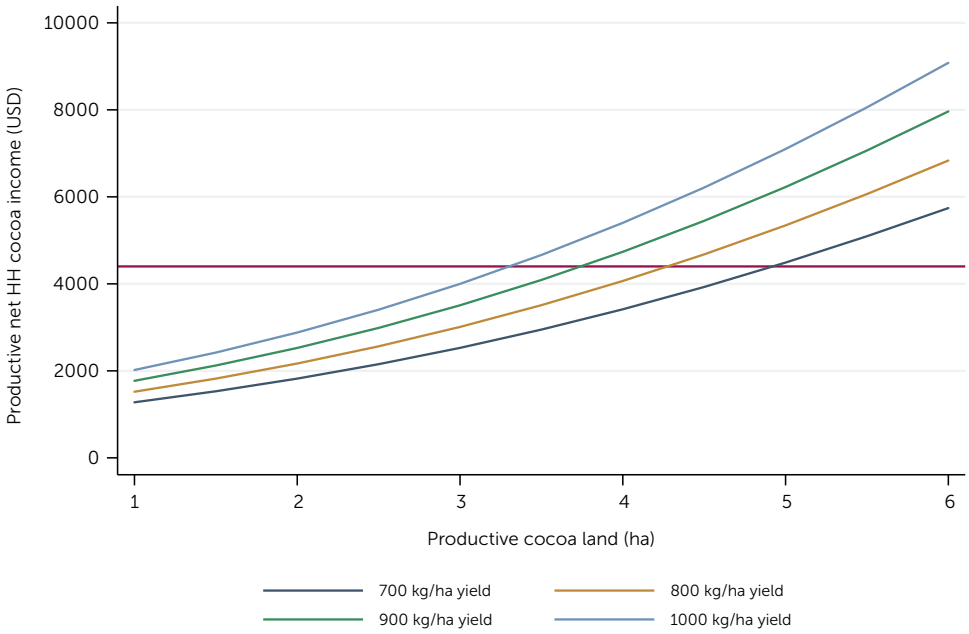


An increase in GAP implementation levels increases farm productivity, but also suggests the cost of input use and labor increases substantially. Given that the current average cocoa farm cost per ha is around US$114, an increased uptake of GAPs as proposed in the scenario above leads to a substantial increase in production costs of more than US$200 per ha.

The graph in Figure 17 shows that, for HH that have three ha or less of productive cocoa land available, it remains challenging to reach the average cocoa benchmark (which is 69% of the average LI benchmark), despite their increased uptake of GAPs[70]. This suggests that, for these HH, sustainable intensification remains highly important (e.g., for a HH with three ha of land, an increase of yield from 500 to 900 kg/ha means a doubling of net cocoa income from US$1600 to US$3400). However, with cocoa production alone, an LI will not be reached under current prices. This also emphasizes the importance of providing support to accelerate income diversification.

[70] As highlighted previously, to predict HH net cocoa income, we input the potential yield levels that are predicted as attainable given the increased uptake of GAPs. As we use cocoa yield as an outcome of the GAP implementation scenario, we do not use GAP levels as explanatory variables in the regression model. We do add the median value for internal locus of control as control variable, as it remains a statistically significant determinant of cocoa net income, also when including yield as predictor

Figure 17 Predicted net cocoa income by different yield levels



Notes: Red line represents 69% of the total LI benchmark (cocoa sales constitute on average 69% of HH income)

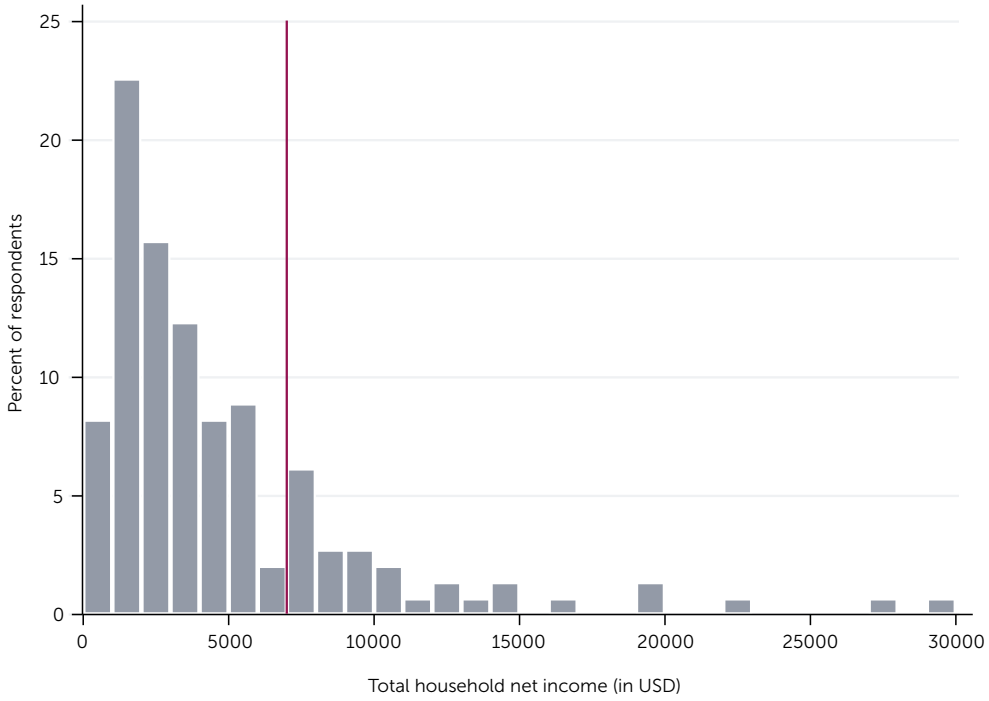
Total income

Based on the income component of cocoa and the non-cocoa income component, we compute the total net HH income of cocoa farming HH. Gross cocoa revenues and cocoa production costs are extrapolated to HH income, based on the importance of cocoa sales as a percentage of total HH income. Consequently, we also compute whether cocoa farming HH are above or below the LI benchmark for cocoa farming HH in Côte d'Ivoire, which is adjusted for HH size.

As the graph in Figure 18 shows, only a limited number of HH find themselves on the right-hand side of the red plotted line. Approximately 23% of cocoa farming HH have a net income above the LI benchmark (the vertical red line represents the benchmark). The plot also reveals that a small proportion of HH have an income that is substantially higher compared to the majority of farming HH[71].

[71] Due to skewed distribution, we log transform the total HH net income variable to make the regression analysis less sensitive to outliers.

Figure 18 Distribution of total household income in US$



The regression results in Table 17 include an analysis on total HH net income and the probability that a HH has/earns an LI. Starting with the first outcome variable, the results show:

- Married couples have higher HH income than single/widowed/divorced farm households. This confirms the positive effect that pooled labor (and land and resources) has on yield, cocoa net income, and income diversification. A similar logic can be applied for the number of adults in the HH. More adults offer more resources and labor to invest in income-generating activities and farming, resulting in higher income levels. We do not find an effect of cohabitation on total HH income.
- Internal locus of control is positively correlated with total HH income. Farmers who feel in control of their lives are more likely to have higher income levels. Naturally, this result might be endogenous, as farm households who earn a higher income might also feel more in control of their lives.
- Productive cocoa land has a positive effect on total HH net income, primarily through its effect on cocoa net income: more cocoa land results in higher production, resulting in higher cocoa income and total HH income.
- The effects of agricultural practices are a mixed bag: fungicide has a negative effect on income, whereas weeding and shade trees positively contribute.
- Farming HH that are less reliant on cocoa for their total income have higher total incomes. This signifies that income diversification is key to increasing

household income[72]. Figure 19 illustrates the non-linear correlation between cocoa dependence and income.

- Having sharecroppers on productive cocoa land is positively correlated with total HH income.
- The amount of money borrowed correlates negatively with total HH income.

Table 17 Overview of determinants of total HH net income in USD (Dataset: NCP KIT dataset 2020)

Variable category	Variable	Total HH net income (US$ - log)[73]	Probability of obtaining an LI[74]
Household characteristics	Age of farmer/HH head		–
	Education level of farmer/HH head		
	Married/cohabiting farmer/HH head	+ + +	+ + +
	Internal locus of control farmer/HH head	+ + +	
	External locus of control farmer/HH head		
	HH size (adults)	+ +	– – –
	HH size (children)		–
	Farmer/HH head born in region (no/yes)		
	Spouse involvement in HH decision-making (no/yes)		
Cocoa production: agricultural practices	Productive cocoa land used (ha)	+ + +	+ + +
	Fertilizer use (% of land)		
	Pesticide (% of land)		
	Fungicide (% of land)	– –	– –
	Pruning (% of land)		
	Weeding (% of land)	+ + +	
	Planting (% of land)		+
	% of land with productive trees		
	Shade trees (no/yes)	+ + +	
	Sharecroppers (no/yes)	+ +	+ +
	Number of GAP and GSP trainings		
Income diversification	Importance of cocoa in % to total (HH) income	– – –	– – –
	Number of income sources		
Financial planning and business	Farmer business skills (no/yes)		+ +
	Mobile Money account (no/yes)		
	Bank account (no/yes)		
	Amount of money borrowed	–	
	Saved money (no/yes)		
Observations		145	145

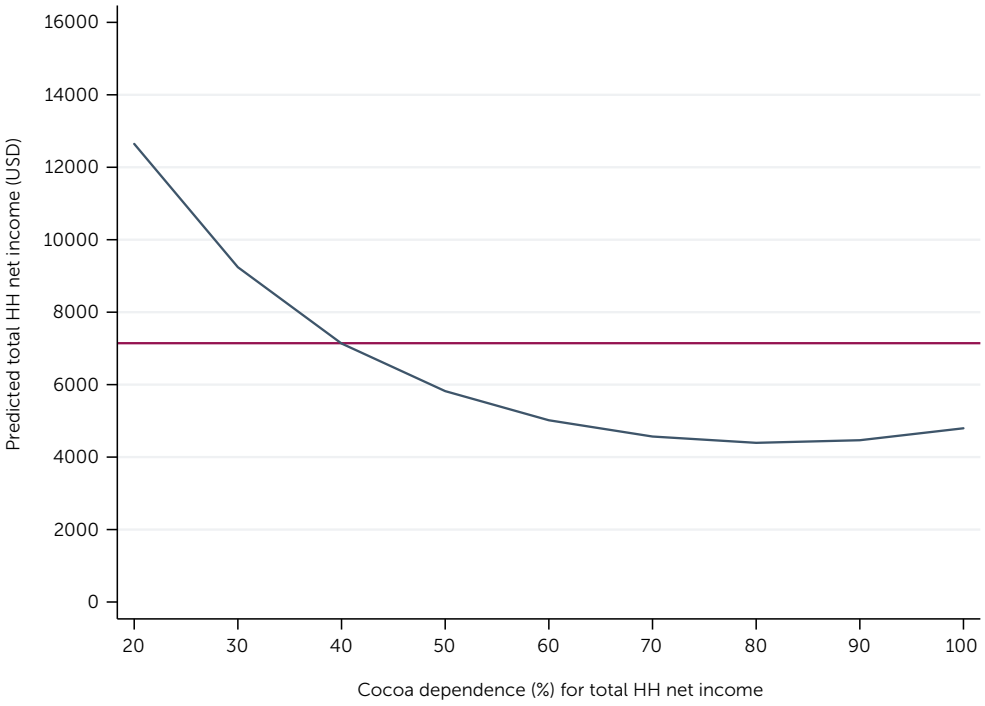
Notes: –/+ p<0.10, – –/+ + p<0.05, – – –/+ + + p<0.01.

[72] There is a negative effect between cocoa dependency and total HH income. Additional income sources increase HH income by simply adding income but also cause the relative importance of cocoa to total HH income to decrease.

[73] Generalized linear regression (Gaussian) with district dummies to control for potential variance in soil fertility and rainfall.

[74] Linear probability regression with district dummies to control for potential variance in soil fertility and rainfall. A logistic model would not converge.

Figure 19 Predicted effect of cocoa dependence on total HH net income in USD



Reaching an LI

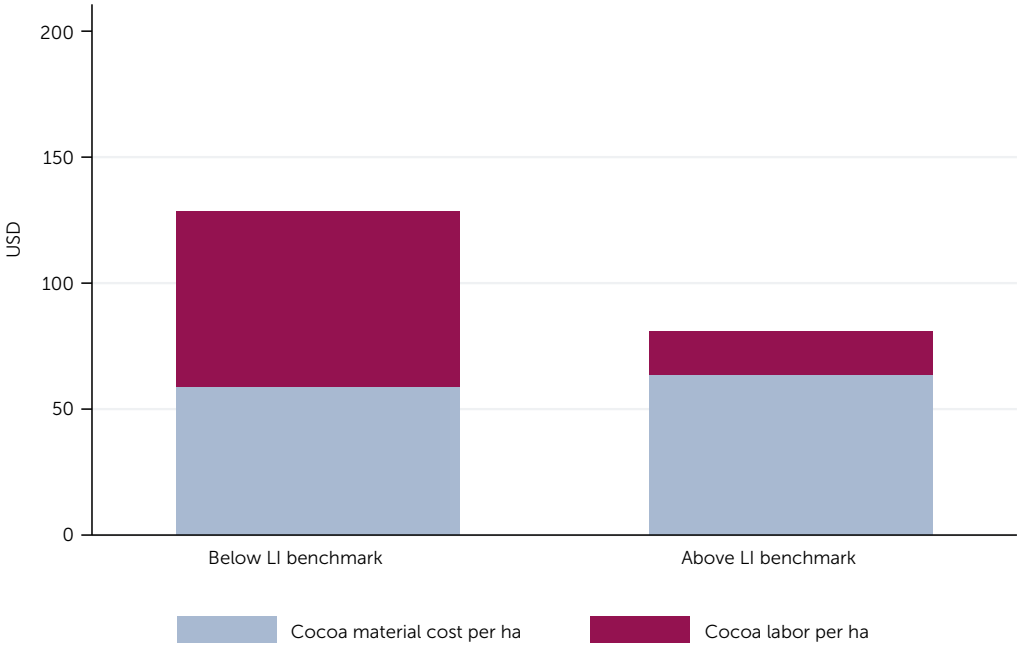
The second column of Table 17 presents the linear probability regression result on the determinants of whether or not a farming HH earns an LI. We find that:

- Age is negatively correlated with reaching the LI benchmark. The probability that a farming HH reaches the LI benchmark decreases as the HH head gets older.
- On average, farming HH with an LI have almost four ha more of productive cocoa land than farming HH below the LI benchmark[75]. This signifies that land remains key in obtaining a higher HH income.
- Although not included in Table 17, farming HH earning an LI have, on average, 225 kg more yield than farming HH below the LI benchmark.
- Farming HH who have sharecroppers on their land, possess farm business skills, and plant on a higher proportion of their land, are more likely to have an LI. This suggests that these farming HH approach farming more as a business, as they are more likely to report having farm business skills (50% of farming HH above the LI benchmark indicate having attending farm business school vs. 30% of HH below the LI benchmark), having arrangements with sharecroppers (75% of HH with an LI have sharecroppers vs. 30% of HH who do not have an LI), and revitalizing their plantations. Having sharecroppers on cocoa land may also indicate these farming HH have more household labor available to invest in other income-generating activities.

[75] Independent t-test: mean difference = 3.86ha, p-value = 0.000, N = 146..

- Nonetheless, as Figure 20 illustrates, HH who earn an LI invest, on average, almost US$50 less per ha in cocoa[76]. This observed difference is entirely explained by the difference in labor cost per ha (US$50 difference): as farming HH are more likely to have sharecroppers on their land, there is most likely less need to invest in additional labor.
- We find a negative effect of HH size on the probability that a HH earns an LI, The LI benchmark used in this study is adapted for HH size: the larger the HH, the larger the LI benchmark. As this methodology increases the LI benchmark for larger families, it makes it more challenging for HH to earn an LI[77].
- Farming HH that earn an LI are less dependent on cocoa for their income. On average, HH who reach an LI derive 59% of their total income from cocoa sales; whereas, those who earn below the LI benchmark derive, on average, 72% of income from cocoa sales.

Figure 20 Observed difference in cocoa production costs between HH above and below the benchmark



LI and income composition

In the next section, we take account that those who earn an LI are less reliant on cocoa for income compared to those below the LI benchmark. Therefore, we investigate the differences in income composition between HH who earn an LI and those who do not and find that[78]:

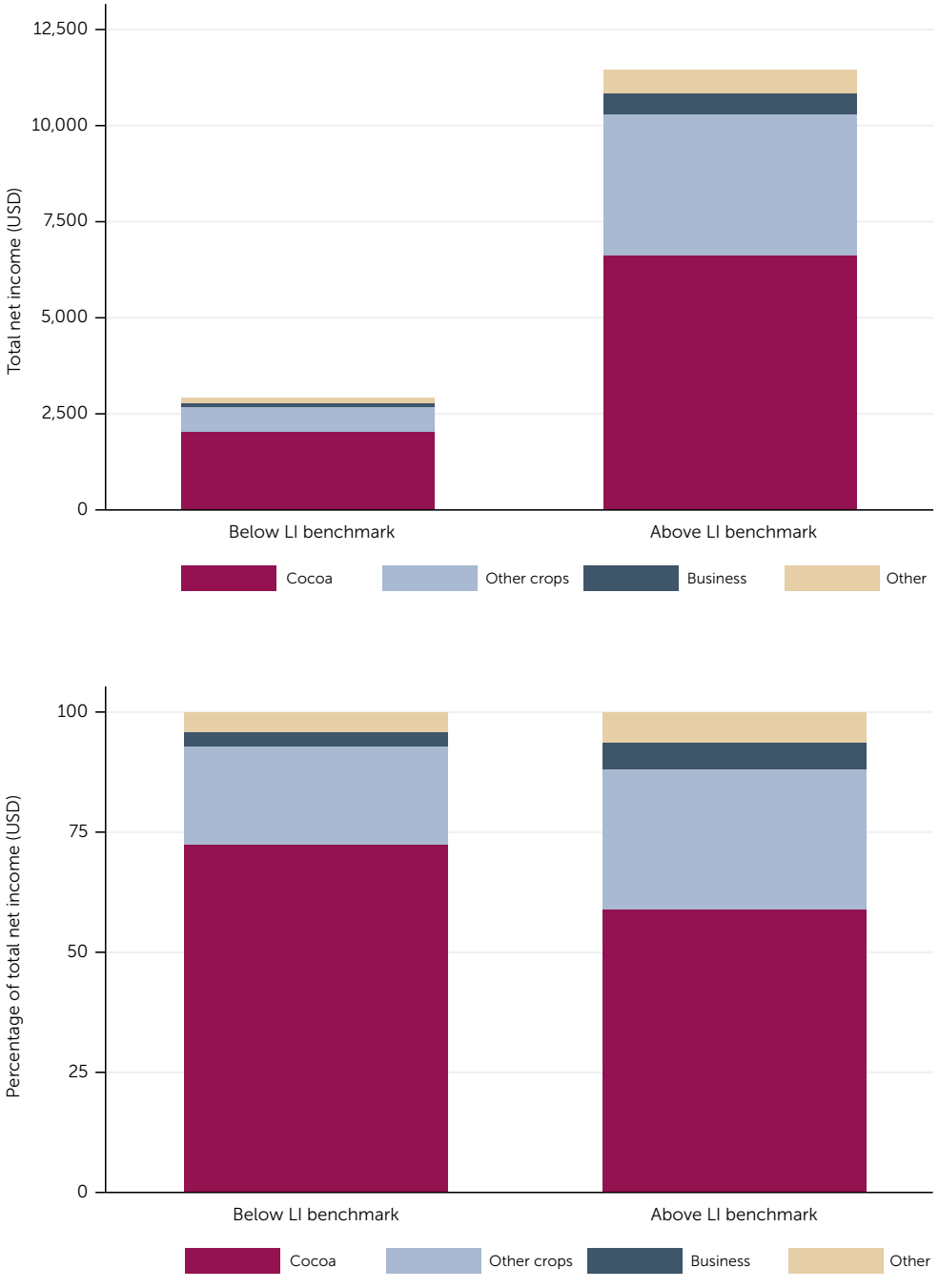
[76] As being above the LI benchmark and cocoa production cost are endogenous (they both have an influence on one another) we do not use a regression model and report the observed difference.

[77] More HH members translate into higher income levels as shown in Table 17. However, the returns per HH member appear to not outperform the increase in the LI benchmark per HH member.

[78] Based on observed differences.

- HH above the benchmark derive – both in absolute terms and relative terms – more income from sale of other (non-cocoa) crops. This observed relative difference is nine percent (approximately US$3000 more), as illustrated in Figure 21.
- HH above the benchmark derive – both in absolute terms and in relative terms – more income from business and trade. This observed relative difference is three percent (approximately US$440 more). Nonetheless, for HH above and below the LI benchmark, trade and business contributes only marginally to total income (six and three percent, respectively).

Figure 21 Observed components of income by below and above LI benchmark status (absolute and relative)



As HH above the LI benchmark earn statistically significantly more from selling non-cocoa crops, we also investigate differences in the importance of non-cocoa crops:

- A higher proportion of farming HH above the LI benchmark (49%) sell rubber than those below it (24%). After hot peppers (which HH below the LI benchmark sell significantly more than those above), the significant difference in proportion of HH who sell rubber is the only statistical difference we find in non-cocoa crop sales.
- This is further supported by the finding that a larger proportion of HH above the LI benchmark indicate that rubber is their most important non-cocoa crop (45%), compared to the proportion of HH below the LI benchmark (18%). This suggests that farming HH consider rubber as a valuable cash crop in which to invest[79]. Nonetheless, rubber production is regional and it takes time before a farming HH sees a return on investment[80]. This may also imply that rubber is considered a crop of interest by farming HH who have sufficient savings or loans which they can invest.

Conclusions

The results in this chapter reveal that the pooling of labor and financial resources (and land) through marriage or the higher number of adults in the household, has a strong effect on productivity, input use, production and cocoa income, income diversification, and, ultimately, total household income. HH with less labor available are more likely to attain lower production levels and have lower HH income.

The analyses on the first intervention bucket confirm that conventional agricultural practices, such as fertilizer application, weeding, and pruning remain important for cocoa productivity. Fertilizer application in particular has a notable effect on productivity, and access to finance seems to play a key role in the uptake and the application of fertilizer. As only 23% of farming HH adopt fertilizer, access to financial services could provide an avenue to increased uptake.

The section on cocoa production costs as second intervention bucket illustrated that almost all conventional GAPs - except planting - increase input costs, while fertilizer use and pruning are the most costly activities in terms of labor costs. Input costs and labor costs correlate positively showcasing that to apply inputs, labor is required. Production costs are positively correlated with cocoa revenue, and each US$ invested correlates with almost US$4 cocoa gross revenue.

[79] The differences in rubber as important crop between HH above and below the LI benchmark remain statistically significant when controlling for district-level fixed effects (to absorb the potential effects of different agri-ecological zones). The KIT Demystifying study (Bymolt, Laven & Tyszler (2018) confirms the importance of rubber for cocoa farm HH.

[80] Bymolt, Laven & Tyszler (2018)

Income diversification already takes place, and 99% of the cocoa farming HH have additional income sources. Cocoa sales contribute on average to 69% of total HH income. However, male-headed HH are relying more on cocoa than female-headed HH. In terms of interventions to accelerate income diversification (as third intervention bucket), the number of trainings a HH followed correlates positively with the number of income sources.

The fourth and last intervention bucket addressed the effect of price mechanisms. The results of scenarios where prices and premiums are artificially increased seem to confirm existing studies that show that they do not have a direct effect on income levels in the short-term. Although each additional US% price increase adds directly to the income of farming HH, the findings suggests that price mechanisms are mostly effective if combined with sustainable intensification (while taking account of the agricultural treadmill). The effects of conditional cash payments are mainly expected to be seen in the long-run as a result of behavioral change in the uptake of GAPs, increased production and income diversification.

Highlighted further is that internal locus of control is positively correlated with input use, cocoa income, and total HH income – and this finding could encourage greater focus on developing soft skills as part of agricultural support programs for cocoa producing HH. Combining both – adding soft skills training to more conventional technical programs aimed at increasing technology adoption and productivity – could yield great potential to substantially increase cocoa net income.

Access to productive cocoa land remains a very important determinant of income: for farming HH with less than three ha of land, reaching an LI through sustainable intensification of cocoa farming alone remains challenging. Yet, this does not imply that sustainable intensification of cocoa production is irrelevant for these farming HH. The opposite is actually the case as cocoa production also remains the most important source of income for them. Sustainable intensification of cocoa production, in combination with finding additional sources of income, is the only way to increase HH income.

Cocoa dependency is negatively correlated with HH income. However, it is important to bear in mind the effect of substitution, and shifting resources and labor to alternative sources of income does not mean that their revenues come on top of cocoa income. They can also substitute the income from cocoa sales, or lead to lower income levels if markets for alternative income sources are less viable (e.g. lower prices) than cocoa.

Farming HH who obtain an LI are not representative of the average farming HH: they are most likely to include a married or cohabiting couple (which holds for the majority of farming HH, but signifies that they have more labor available as a couple),

are less reliant on cocoa sales for income, have (a lot) more cocoa land, often have sharecroppers on their land, and possess relatively higher yields. Their agricultural practices also suggest they have business skills (training), have arrangements with sharecroppers (which results in much lower labor costs per ha), and rejuvenate their plantation by planting cocoa trees on a larger percentage of land. In terms of diversification, they derive more income from the sale of non-cocoa crops (particularly rubber) and trade and business.

5 Data-driven segmentation

(Refer to card picked at the beginning) Why did you select these characteristics? Can you explain them?	Se référer à la carte choisie au début Pourquoi avez-vous choisi ces caractéristiques ? Pouvez-vous les expliquer ?
Does any of the earlier mentioned characteristics make you different from others in your community? If so how? (e.g.)	Est-ce que l'une des 3 caractéristiques que vous avez cité, vous rend-elle différent des autres membres de votre communauté ? Si oui comment?(Ex)
Why these events? And how did they help you? If respondents report 'all events' ask them to select two? Ask them to refer back to the card / picture that they have selected at the beginning: how the events be linked to	Pourquoi ces événements ? Et comment ces évènements vous ont-ils aidé ? Si ils citent "tous

Introduction

Cocoa farmer segmentation and farm profiles is a widely discussed topic gaining increasing attention among cocoa stakeholders, particularly following the introduction of the concept of LI in the cocoa sector. The utility of farm profiles is based on the assumption that, using certain archetypes, interventions and extension services can be better tailored towards farmer groups to effectively address their (segment-unique) barriers and needs. Therefore, the main purpose of clustering is to identify like-minded groups that could benefit from a customized approach.

Although creating farm segments has its clear merits, it remains a challenging task – as farmers and farm-HH are unique in a multitude of ways. In the following sections, we discuss the existing clustering approaches, which are based on conceptually-driven clustering and data-driven clustering. We also explain our approach, which is based on four unique datasets, and discuss the clustering results of each dataset. The chapter concludes with a synthesis of identified segments, highlighting reoccurring clusters that will eventually feed into a selection of five high-potential segments.

Existing clustering approaches

Several studies have attempted to create farmer segmentation in cocoa and other crop sectors. Some were conceptually driven, based on theory and strong hypothesis or assumptions of what would separate different farmer groups from one another. Others were data-driven and more of exploratory in nature, based on different research methods. However, different research approaches were employed. Some studies were qualitative in nature[81,82,83], while others used data clustering techniques on large quantitative farm datasets to identify patterns and uncover unique farmer groups. The latter is the most relevant for this study, as a similar approach is implemented.

Quantitative data driven clustering is based on an iterative process whereby patterns emerge from the dataset. Nonetheless, strong assumptions on the cluster purpose (e.g., clustering for GAP uptake, yield levels, access to markets, HH income) and the variables that are hypothesized to have predictor power, underlay such explorative analysis. Well-known examples of farmer clustering include KIT's Demystifying study, which incorporated gender and land size as cluster variables and identified three farmer

[81] Van Heck, P. & Laven, A. (2015). *Ideation of Small Medium Enterprise (SME) Services in Cocoa Growing Communities in Ghana.* The Royal Tropical Institute (KIT). Available at: http://www.cocoaconnect.org/publication/ideation-small-medium-enterprise-sme-services-cocoa-growing-communities-ghana. This study was commissioned by Solidaridad and Marks & Spencer, and supported by Barry Callebaut.

[82] Laven, A. & Verhart, N. (2015). *Women in Cocoa Farming: 'Bridging the Gap'.* Presented at the World Cocoa Foundation Conference, Innovations in Sustainability session. Available at: https://www.worldcocoafoundation.org/wp-content/uploads/files_mf/womenincocoafarming_presentations.pdf

[83] Ataa-Asantewaa, M., Derkyi, M., Obeng-Ofori, D. & Ros-Tonen, M. (2016). *Diversity Among Ghanaian Cocoa Crop Farmers in the Ahafo-Ano North District, Ashanti Region*. Inclusive Value Chain Collaboration. Infosheet 03 - January 2016. Available at: https://www.researchgate.net/publication/299590258_Diversity_among_cocoa_crop_farmers_in_the_Ahafo-Ano_North_District_Ashanti_Region

groups across cocoa-farming HH in Ghana and Côte d'Ivoire: female-headed HH, male-headed HH with typical production land size, and male-headed HH with large-land size[84]. Ingram et al. (2015) also performed data-driven clustering on farmers in Ghana and Côte d'Ivoire for 'yield actionable insights', using variables on exogenous HH characteristics, farm characteristics, farm productivity GAPs, income, and production costs, which resulted in five unique and consistent clusters[85]. More recently, Dalaa et al. (2019) identified three clusters in Ghana based on efficiency and resourcefulness[86].

Clustering has also been performed on non-cocoa producing farmers and regions. Riquet at al. (2017) drafted a clustering of smallholder farming HH for financial access in Côte d'Ivoire[87]. Goswami et al. (2014) used a clustering approach to identify farm types with different income sources and resource-bases in India, while Striffler (2017) presented a clustering approach for farmers in Laos[88]. Finally, Owino et al. (2020) employed a clustering analysis to typify dairy farmers in Kenya[89] and produce a farm typology of farming HH in the Western Himalaya region of India[90].

Data-driven approach

Unlike many segmentation studies previously conducted on cocoa farmers, several datasets are available to us that can be utilized for our data-driven segmentation. For the clustering analysis, we use a set of demographics, behavioral, and outcome dimensions that have the potential to identify like-minded groups within an overall population rather than just one single variable. Clustering can help us understand similarities in terms of demographics, cocoa performance, income diversification, and attitude (if data is available). To examine different farming HH and different farmer segments, we investigate four unique datasets and perform a cluster analysis on each dataset to add to the external validity of cluster results. See Table 18 for a description of the datasets.

[84] Bymolt, R., Laven, A., & Tyszler, M. (2018). *Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire.* The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

[85] Rijn, F. van, M. Kuit, Y. Waarts and V. Ingram (2015). *Cluster Analysis Among UTZ Certified Cocoa Farmers in Ghana and Ivory Coast.* Den Haag, LEI, Wageningen UR

[86] Dalaa, M.A., Kofituo, R.K. & Asare, R. (2019). Cocoa Farmer's Segmentation in Ghana. CCAFS cocoa segmentation brief. Available at: https://cgspace.cgiar.org/bitstream/handle/10568/106678/U19UnpDalaaCocoaNothomNodev.pdf?sequence=1&isAllowed=y

[87] Riquet, C., Musiime, D. & Marita, C. (2017). *National Survey and Segmentation of Smallholder Households in Côte d'Ivoire.* CGAP. Available at: https://www.cgap.org/sites/default/files/Working-Paper-Survey-and-Segmentation-Smallholders-Coted%27Ivoire-Jul-2017.pdf

[88] Striffler, B. (2017). *Objectives and Priorities of Kham District's Famers. A Microeconomic Approach of Systemic Agronomy* (Doctoral dissertation, Montpellier SupAgro). Available at: https://agritrop.cirad.fr/590891/1/MEMOIREBrunoStriffler%20.pdf

[89] Owino, J.O., Olago, D., Wandiga, S.O. & Ndambi, A. (2020). A Cluster Analysis of Variables Essential for Climate Change Adaptation of Smallholder Dairy Farmers of Nandi County, Kenya. *African Journal of Agricultural Research,* 16(7), 1007-1014. Available at: https://edepot.wur.nl/540073

[90] Shukla, R., Agarwal, A., Gornott, C., Sachdeva, K., & Joshi, P.K. (2019). Farmer Typology to Understand Differentiated Climate Change Adaptation in Himalaya. *Scientific Reports,* 9(1), 1-12. Available at: https://www.nature.com/articles/s41598-019-56931-9.pdf

Table 18 Databases on cocoa farmers and farming HH in Côte d'Ivoire

	KIT/ NCP	Nestlé Supplier X	Nestlé Supplier Y	KIT Demystifying
Description	Data collected as part of a survey conducted in December 2020 in Côte d'Ivoire on measuring HH income and the LI gap among (elite and non-elite) cocoa farming HH who take part in the NCP. Elite farming HH removed from dataset as they already represent a segment.	Data on cocoa farmers in Côte d'Ivoire provided from the supplier's internal monitoring and evaluation and coaching system. The data contains 6000 observations on over 130 variables, including land size, production, HH composition, and agricultural performance indicators.	Data on cocoa farmers in Côte d'Ivoire extracted from supplier's Farmer Information System. The data contains more than 8300 unique baseline observations from 2015-2020 and observations (with potentially multiple observations per farmer) of an annual survey from 2015-2020.	KIT collected robust quantitative and qualitative data between November 2016 and March 2017 on current income diversification strategies and crop production activities involving 1500 farming HH in cocoa growing areas in Côte d'Ivoire.
Cocoa season	2019-2020	2017-2018	2019-2020	2015-2016
Retained N for clustering[91]	123	5716	5531	766

Clustering for HH income

We realize that different datasets contain information on different cocoa seasons, include assorted variables, cover a range of geographical areas, and are compiled differently (e.g., varying levels of measurement bias). Therefore, the cluster analyses are mainly aimed at uncovering qualitative similarities across clusters found in different datasets, which adds to the robustness and, ultimately, the validity of, identified segments (i.e., which qualitatively similar clusters emerge in most datasets?). The purpose of adding cluster analyses on multiple datasets is to increase the external validity of the segments found (i.e., to what extent are the segments found representative for all cocoa farmers and HH in Côte d'Ivoire?).

We cluster cocoa farming HH/farmers in Côte d'Ivoire for HH income (or the LI gap). This means we do not cluster for productivity (yield), agricultural inclusion, financial inclusion, access to markets, resources, inputs, or adoption of GAPs, amongst other potential purposes of clustering. The variables that we include should have predictive power towards HH income, or (conceptually) either contribute to or lower HH income in order to derive actionable insights during the remainder of the study.

The two suppliers' datasets do not provide information on total HH income and the LI gap. Therefore, to generate more insight into (the distribution of) net HH income, we estimate this on the basis of the following parameters:

- Among farming HH in the KIT Nestlé Cocoa Plan (NCP) dataset, approximately 70% of income comes from cocoa sales. The median is set at 75%. The KIT Demystifying the cocoa sector dataset reveals a median value of 70% for HH who provided production data. As such, we use a value of 70% to extrapolate total gross HH income[92].

[91] Cluster analysis requires non-missing values on the included cluster variables. Consequently, observations are removed if row-wise missing values occur.

[92] This approach implies a linear relationship between cocoa net income and total HH income, due to the average of 70% cocoa contribution to total HH income. However, the latter is often determined by the number of alternative income sources, which is not part of the suppliers' datasets. Therefore, total HH income averages presented in the tables per segment are merely rough estimates (except in the KIT NCP dataset, which contains detailed information on HH income).

- Cocoa production costs are estimated to be around 20% of cocoa gross income among HH in the KIT NCP dataset, with a median value of 15%. In the KIT Demystifying the cocoa sector dataset, the mean value is much lower, at 5%. As this seems relatively low, we decided to estimate cocoa production cost at 15% of the total gross cocoa revenue. Costs are also then extrapolated to HH income level (based on 70%) to estimate total net HH income.

HH income will not be part of the clustering variables. Instead, three dimensions – based on the analyses and existing literature presented in the previous chapter on the drivers of cocoa farming HH income – are deemed relevant for variable selection:

1 **Independent farmer or HH characteristics**, including gender, age, HH size, marital status, psycho-social indicators, regional location, and access to finance[93].
2 **Cocoa production**, including cocoa land used, yield, GAPs, input, and labor.
3 **Income diversification**, including importance of cocoa, non-cocoa land, non-cocoa crops, and alternative income sources.

Naturally, other cluster variables are also likely to influence cocoa production, net cocoa income, and net HH income – such as certification, level of farm investment, GAP knowledge, and agro-ecological zone. However, not all datasets contain information on these. To ensure the optimal cluster solutions are truly the result of the cluster analysis and not of differences in variable selection across the datasets, we decided to restrict clustering to a set of key variables present in almost all datasets (albeit sometimes measured differently). Table 19 presents the set of variables selected for the clustering by dimension, and indicates whether the information is available in the datasets.

Table 19 Set of variables for cluster analysis and availability

Dimension	Variables	KIT NCP ('19-'20)	Nestlé Supplier X ('17-'18)	Nestlé Supplier Y ('19-'20)	KIT Demystifying ('15-'16)
Farmer/HH	Gender of farmer/HH head	■	■	■	■
	Age of farmer/HH head	■	■	■	■
	HH size (adults/children)	■	■	■	■
	Psycho-social status	■	□	□	□
	Region	■	■	■	■
	Access to financial services	■	□	■	■
	Marital status	■	■	■	■
Cocoa production	(Productive) cocoa land	■	■	■	■
	Cocoa yield	■	■	■	■
	GAP: fertilizer | pruning | weeding	■	■	■	■
	Permanent labor/sharecroppers	■	■	■	□
Income diversification	Importance of cocoa to total (HH) income	■	□	■	■
	Non-cocoa land (ha)	■	■	□	■
	Non-cocoa crops	■	■	■	■
	Alternative income sources	■	□	■	■

Notes: □= variable not included in dataset, ■= variable included in dataset.

[93] A (limited number of) regional binary variable(s) were added to represent regional differences. Regional difference is deliberately not at district level, as many district 'dummies' would distort the principal component analysis and the final components retained.

Clustering method

In terms of clustering method and steps, we first transform the variables of interest into Z-scores to standardize mixed type variables and normalize the differing scales (e.g., age, HH size, and yield all have different scales)[94]. Next, we conduct a principal component analysis (PCA), as the set of variables consists of mixed type indicators (i.e., continuous, nominal, ordinal) and doing so reduces the effect of specific individual variables on the clustering solution. Moreover, variables that represent similar dimensions, but are constructed differently in different datasets, can still be captured (albeit in different datasets) through similar principal components and data reduction, representing comparable dimensions. Although it would have a purpose on its own to assess the latent construct that each component represents per dataset, we deem this to be less relevant in this chapter. In addition, the hierarchical clustering algorithm is based on analysis of variance, as is principal components analysis. The components identified are likely to be interdimensional, as they stretch across the three conceptual dimensions listed above. As we expect the selected variables to be correlated, PCA with varimax rotation produces uncorrelated (orthogonal) components. All in all, PCA reduces 'noise' in the data, consequently increasing the stability of the clustering and potentially leading to a better cluster solution.

The principal components of the PCA with an eigenvalue of more than one are used in a hierarchical Ward linkage cluster technique with Euclidian distance[95]. We also visually inspect the scree plots to determine how many principal components to retain. As the clustering is of an explorative nature, we assume a hierarchical cluster technique provides a suitable approach to separate clusters[96]. In terms of the best cluster solution, we base our decision on a visual inspection of the dendrogram and the Calinski/Harabasz pseudo F statistic[97]. Lastly, we test for cluster uniqueness and cluster quality (i.e., the extent to which clusters are unique) using a one-way ANOVA; the results from which reveal whether the clusters are significantly different from each other.

Cluster analysis KIT NCP dataset

The first cluster analysis is based on a dataset of 123 NCP farming HH. The elite farming HH discussed in the previous chapters are excluded as they are greatly overrepresented in the dataset and already conceptually 'segmented' by Nestlé. However, although only a few female-headed HH are included in the dataset, they are

[94] Not transforming scales can cause some variables to be more influential in determining principal components than others. A Z-score indicates how many standard deviations a raw value is below or above the sample mean.

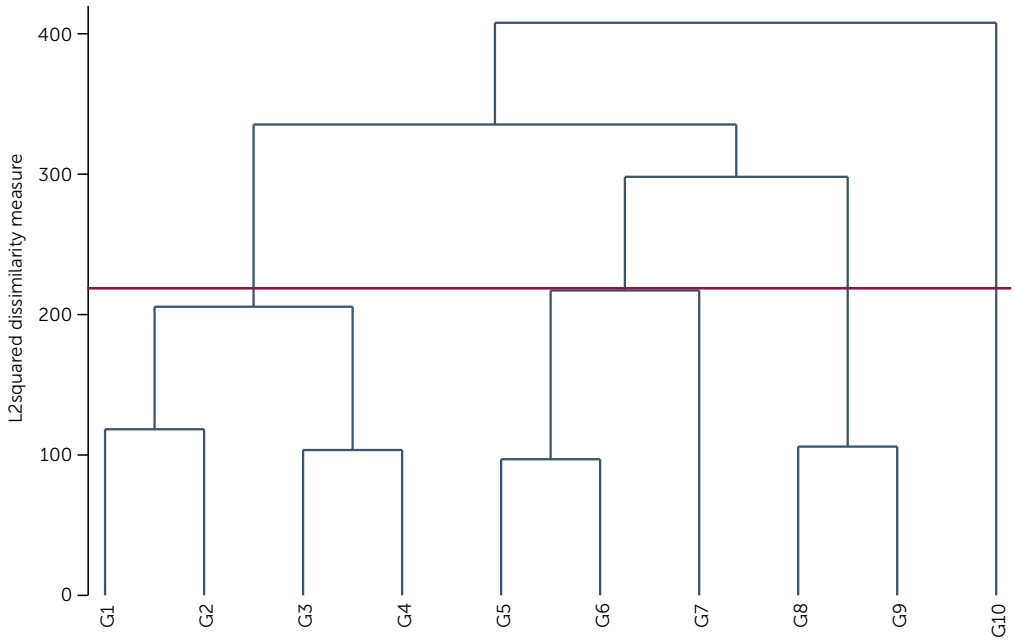
[95] A hierarchical Ward cluster technique is based on the analysis of variance (squared Euclidean distance as dissimilarity measure for continuous data), not on distance metrics.

[96] This approach of inputting principal components in hierarchical cluster analysis is also known as Hierarchical Clustering on Principal Components (HCPC).

[97] To illustrate cocoa farmer/HH diversity, we look for an optimal cluster solution of three or more clusters.

not removed from this analysis. Previous studies (e.g., KIT Demystifying the cocoa sector study) show that female-headed HH are a unique group with very specific characteristics. Therefore, to capture gender of the HH head, a gender indicator will also be added as cluster variable in the two suppliers' datasets. This will allow the cluster analysis to potentially separate clusters consisting of predominantly female HH heads and/or farmers (depending on the unit of observation) in a more robust manner.

Figure 22 Dendrogram for KIT NCP HH cluster analysis



After employing a PCA on the indicators defined in Table 19, we identify eight principal components with an *eigenvalue* of one or more, on which the cluster analysis is performed. The dendrogram for the cluster analysis is presented in Figure 22. Showing the hierarchical relationships between clusters, it reveals there are between two and ten clusters in the NCP KIT data set to consider; and the Calinski/Harabasz pseudo F statistic indicates that a solution of four to six segments is the most optimal[98]. To demonstrate the diversity of farming HH without fragmenting the relatively small sample too much, we present the five cluster solution. Table 20, below, shows the averages for each segment identified and reveals they differ statistically significantly from each other on most of the variables – except productive land and number of non-cocoa crops sold – which adds to the robustness of the uniqueness of the segments.

[98] We aim to explore a cluster solution of more than two groups to illustrate the variety of the farm HH sample. The F statistic of a five-cluster solution is 17.39, while the six-cluster solution has an F-statistic of 17.75.

Table 20 Segment overview, KIT NCP dataset

Variables	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Diff.
HH characteristics						
HH head is female	3%	100%	20%	0%	0%	***
HH head age	46	47	52	57	47	***
HH head followed secondary education or higher	34%	25%	53%	23%	28%	
Married or co-habiting	97%	0%	93%	77%	0%	***
Internal locus of control index	-0.22	-0.84	-0.04	0.16	0.71	***
External locus of control index	0.38	0.26	0.19	-0.14	-1.08	***
Number of adults in HH	3.55	2.38	4.07	6.38	3.72	***
Number of children in HH	3.03	1.13	1.67	6.23	4.52	***
Bank account	11%	25%	60%	77%	8%	***
Amount loaned (in US$)	77	7	186	404	20	***
Region (Comoé District)	42%	88%	80%	46%	0%	***
Cocoa production						
Productive cocoa land (ha)	3.93	2.61	5.16	4.08	3.14	**
Cocoa yield (kg/ha)	596	525	450	741	532	
Percentage of cocoa land fertilizer applied	16%	24%	14%	58%	25%	***
Percentage of cocoa land pruned	60%	30%	87%	56%	84%	***
Percentage of cocoa land weeded	97%	85%	11%	100%	100%	***
Sharecroppers on land	29%	88%	93%	62%	24%	***
Income diversification						
Non-cocoa land cultivated (ha)	2.36	1.97	4.08	8.00	1.48	***
Sale of cocoa as % of total HH income	69%	61%	53%	61%	78%	***
Number of income sources	5.0	4.3	4.9	4.8	4.3	*
Total non-cocoa crops sold	8.0	8.6	6.9	5.3	6.6	
HH income *(not included in clustering)*						
Gross cocoa income in US$	3085	1371	3510	4770	2430	**
Total HH net income in US$	4175	1755	6004	6313	2473	***
Above LI benchmark (adjusted for HH size)	20%	0%	46%	20%	0%	***
Observations	62	8	15	13	25	
% of sample	50%	7%	12%	11%	20%	

Notes: ANOVA test used to test for differences across segments and for cluster quality. All statistics present segment averages.

On the basis of the segments' mean characteristics and the differences across clusters in Table 20, we define the segments as follows:

- Segment 1: Couple HH with an average incidence of higher education and with large families. They are relatively productive and cocoa-dependent HH. This forms the largest group of the sample.
- Segment 2: Female-headed HH, relatively young and unmarried or cohabiting (most likely widowed). Small HH size with limited access to a bank account. They have a limited amount of land with average yield levels. There are also sharecroppers present on their cocoa land. HH are less relying on cocoa as the main source of income compared to other clusters, and HH have the highest number of crops sold. Nonetheless, they are by far the poorest group. However, this is a very small group with only eight observations, representing 7% of the sample.
- Segment 3: HH that are relatively well educated, have access to finance, and have a relatively large plot for cocoa cultivation. The fertilizer and weeding levels indicate low GAP implementation. They have more non-cocoa land than most other clusters, and are therefore not largely reliant on cocoa.

- Segment 4: Arrived, well-educated senior farming HH. Wealthiest cluster with the most ha of land (especially non-cocoa land). They also have high yield levels (based on productive land, not all cocoa land)[99]. Limited level of income diversion, but not very cocoa-dependent. Together with the female-headed HH segment, this group is the smallest in size, which may cause averages to be sensitive to outliers.
- Segment 5: Single, ambitious, cocoa-dependent farmers. The HH size indicates the respondent is most likely part of a larger HH. Relatively high GAP implementation and limited non-cocoa land and alternative income sources, and therefore most dependent on cocoa sales for income. Interestingly, they are not located in the main region. This group represents the second-poorest cluster identified.

As the analysis demonstrates, some identified segments have only a very limited number of observations. This is particularly the case for the female-headed HH and the arrived senior farming HH (with each group containing only eight and 13 respondents, respectively), which means the average presented is more likely to be sensitive to outliers. Furthermore, it limits the external validity of the segments found. However, when we run the same cluster analysis without the female-headed HH, we obtain qualitatively similarly proportioned segments which could be labeled in an identical way.

Nonetheless, to further examine the robustness of this cluster analysis result, similar analyses need to be conducted on the more substantial farmer datasets provided by Nestlé's Suppliers X and Y and KIT's Demystifying dataset[100]. Although these contain qualitative similar variables, they are constructed or elicited in a different manner, which means the variables input into the clustering analysis will deviate from the cluster analysis based on KIT's NCP database. Furthermore, in the KIT NCP database and the KIT Demystifying database, the unit of analysis is at HH level, but in the Suppliers' databases it is at individual farmer level. Due to the discrepancy between these, different cluster outcomes may be expected.

Cluster analysis of Supplier X dataset

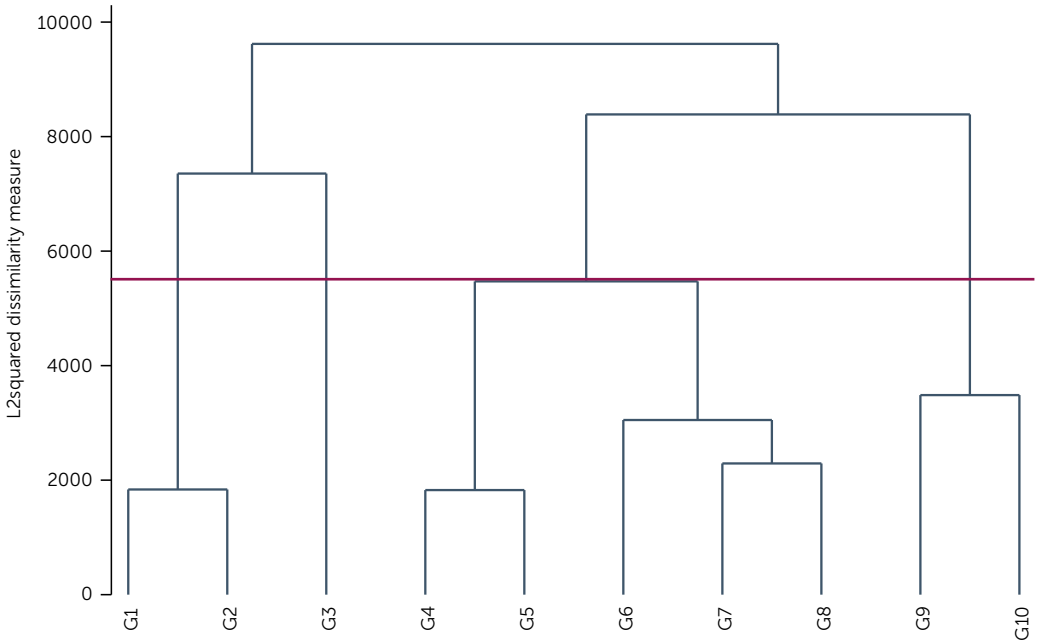
A similar cluster analysis is performed on the Supplier X farmer database, covering the cocoa season of 2017-2018. The database contains farmer demographics and cocoa production details of more than 5500 cocoa farmers (i.e., not at HH level). The Supplier X database has information on HH characteristics (e.g., sex, age of farmer, HH composition), but no psycho-social characteristics (e.g., risk aversion,

[99] The KIT NCP dataset reveals an average yield of almost 750 kg/ha for this group, but the median value of the cluster indicates a yield level of 600 kg/ha; which suggests this average is sensitive to outliers of a few farm HH.

[100] Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

locus of control) or financial inclusion variables. Moreover, the database contains information on cocoa production characteristics, including GAPs, land, production, and yield. To conform to the previous analysis, relevant variables will be added to the clustering model, although they may deviate slightly compared to the KIT NCP dataset. Instead of region, lowland presence (i.e. household is located in a lowland area) is added a proxy for regional variance, as location is only captured at community level in the dataset. The only income diversification variables (third component) from Supplier X's dataset that we can include in the clustering model are the number of non-cocoa crops and fallow land as part of the farm[101]. Other income information (e.g., importance of cocoa to income) is not available, which means the set of cluster variables included in this cluster analysis is smaller compared to the set of variables used for clustering in the KIT NCP dataset.

Figure 23 Dendrogram for Supplier X dataset



We use an identical approach to that of the KIT NCP dataset, and first convert values into Z-scores. A PCA is then implemented, from which we retain six principal components with an *eigenvalue* of >1. As the final step, we perform a hierarchical Ward linkage clustering on the retained principal components. The dendrogram presented above shows the hierarchical relationships between farmer clusters in the Supplier X dataset. We identify five clusters (see horizontal red line), and the Calinski/Harabasz pseudo F statistic also reveals a solution of five clusters to be the most optimal.

[101] Although fallow land is also not used for other crops, it may proxy for the potential to diversify or land holding in general. Unfortunately, more accurate indicators to capture income diversification are lacking.

Table 21 Segment overview, Supplier X dataset

Variables	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Diff.
HH characteristics						
Farmer is female	0%	0%	0%	0%	78%	***
Farmer age	54.63	51.77	50.97	47.53	53.62	***
Farmer followed secondary education or higher	8%	13%	1%	37%	8%	***
Married or co-habiting	100%	96%	100%	79%	78%	***
Number of adults in HH	5.82	3.71	2.42	2.89	3.04	***
Number of children in HH	10.23	6.91	5.58	5.89	6.68	***
Region (lowland presence)	0%	92%	0%	0%	5%	***
Cocoa production						
Cocoa plot area (ha)	4.49	5.34	3.55	3.08	2.64	***
Cocoa yield in 2017/18 (kg/ha)	633.62	565.91	611.94	533.09	590.85	***
Mineral fertilizer application rate (kg/ha)	127	183.24	55.94	56.73	55.55	***
% of cocoa trees pruned	71.23	73.93	75.3	69.59	71.06	***
Number of permanent workers on farm	0.29	0.26	0.12	0.47	3.55	***
Income diversification						
Total non-cocoa crops cultivated	7.48	7.56	4.77	7.47	6.89	***
Total area of fallow land as part of the farm (ha)	0.29	0.54	0.33	1.04	0.58	***
HH income *(not included in clustering)*						
Cocoa (gross estimated) income US$ (2017/18)	3615	3742	2820	2318	2079	***
Estimated total net HH income in US$	4389	4544	3424	2815	2524	***
Estimated above LI benchmark (adjusted for HH size)[102]	1%	10%	9%	6%	4%	***
Observations	1216	475	1921	1695	409	
% of sample	21%	8%	34%	30%	7%	

Notes: ANOVA test used to test for differences across segments and for cluster quality. All statistics present segment averages.

The last column of Table 21 reveals the five segments differ on each variable listed, confirming the uniqueness and quality of the identified segments. As indicated previously, the set of cluster variables deviates slightly from the previous cluster analysis, but has conceptual similarities. However, in the detailed information on financial access of Supplier X's database, income diversification and the importance of cocoa sales to total HH income are not included, which could lead to slightly adjusted clustering.

Based on the cluster averages and differences across clusters on the indicators included, we identify the following five characterizations:

- Segment 1: These farmers are all married and have large HH (and families, given the number of children). Their yield is among the highest of all segments, and they have relatively high fertilizer use. They are diversified in terms of non-cocoa crops, and have limited ha of fallow land as part of their farm.
- Segment 2: This segment consists of more arrived, senior farmers who are relatively higher educated and have the most ha of cocoa land. Their cocoa yields are average compared to others, although they have high fertilizer use and pruning levels. They are the most diversified in terms of non-cocoa crops cultivated.

[102] Income levels are based on the 2020 cocoa farm gate price to make them comparable with the NCP KIT dataset and LI benchmark.

The vast majority is located in a lowland area. This group is estimated to be the wealthiest, but also represents only a small proportion of the sample (8%).

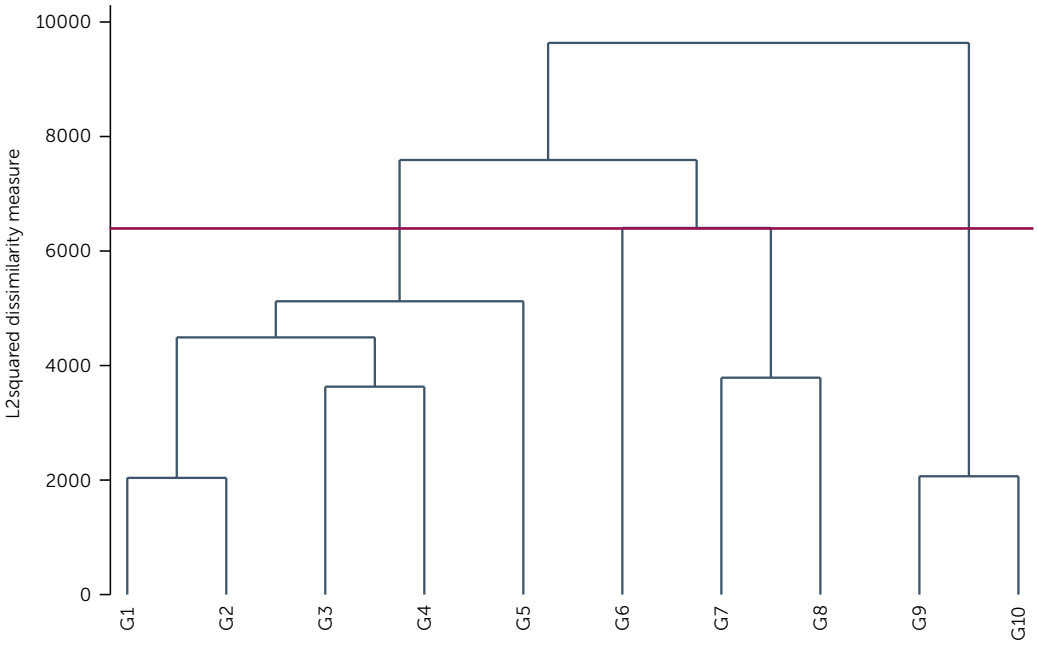
- Segment 3: The farmers in this group are low educated and all married. They have one the highest yields based on 3.6 ha of cocoa land, but their fertilizer use is among the lowest of the clusters. They cultivate a very low number of non-cocoa crops, but have one of the lowest ha of non-fallow land. Combined with higher yield levels, this may suggest they are more cocoa dependent than others. They represent the largest proportion of farmers.
- Segment 4: The farmers in this group are the youngest, are relatively highly educated, and have a lower proportion of married farmers (albeit still 79%) compared to the other groups. After the female segment, they have the smallest plot of cocoa land and low yield levels. Due to their limited land, they are among the poorest. They do represent a significant proportion of the farmer population
- Segment 5: Mainly female farmers who are relatively older, have low education levels, and have the smallest plot of cocoa land (average 2.6 ha) on average, compared to other segments. Their farm effectiveness is average, with low fertilizer levels compared to others. Among all identified groups, they have the most permanent workers on their land. The female farmers are the poorest and the smallest cluster.

Overall, the initial clusters found in the KIT NCP dataset are partly reflected in this cluster analysis of the first Supplier dataset. However, due to limited information on alternative income sources (except the number of non-cocoa crops cultivated), no clear segment stands out with regards to income diversification.

Cluster analysis of Supplier Y dataset

We conduct a similar and third cluster approach on the second Supplier farmer dataset, which contains data on approximately 5500 cocoa farmers in Côte d'Ivoire for the cocoa season 2019-2020. Using qualitatively similar variables for the PCA as in the cluster analyses of the KIT NCP and Supplier X's data, we identify five principal components which are input into the cluster analysis. In the cluster analysis of Supplier Y's data, we also intend to include a qualitatively similar set of cluster variables. However, some indicators are missing (e.g., number of adults in HH), or are formulated differently (e.g., income diversification variables). However, we can include financial inclusion variables, quality of weeding (for GAP implementation), and livestock (for diversification). Although the way variables are elicited is different to the previous dataset, the use of PCA is aimed at reducing the effects that different ways of data collection have on the clustering (i.e., we want to prevent that deviations in clustering are the result of different cluster variables, not because the farmer sample is truly different). The results are presented in the third dendrogram (Figure 24).

Figure 24 Dendrogram for Supplier Y dataset



The dendrogram in Figure 24 shows a rather ambiguous cluster solution. Nonetheless, the Calinski/Harabasz pseudo F statistic indicates that a solution of four segments is most optimal when searching for a cluster solution. Table 22 presents the average values for each cluster on the cluster variables.

Table 22 Cluster overview, Supplier Y dataset

Variables	Segment 1	Segment 2	Segment 3	Segment 4	Diff.
HH characteristics					
Farmer is female	0%	0%	0%	51%	***
Farmer age	46	44.95	60.7	49.85	***
Farmer followed secondary education or higher	3%	67%	13%	9%	***
Married or co-habiting	98%	98%	95%	34%	***
Number of children in HH	3.55	3.76	6.95	3.26	***
Bank account	2%	49%	24%	10%	***
Took out loan last cocoa cycle	20%	23%	13%	10%	***
Region (Centre Ouest)	49%	56%	64%	38%	***
Cocoa production					
Cocoa plot area (ha)	3.18	2.99	6.19	3.36	***
Cocoa yield in 2019/20 (kg/ha)	548.06	509.14	347.4	459.33	***
Mineral fertilizer application rate (kg/ha)	82.41	64.22	25.83	48.82	***
Pruned well (yes/no)	75%	75%	70%	75%	*
High level of weeding	71%	72%	56%	73%	***
Number of permanent workers on farm	0.31	0.34	0.94	0.58	***
Income diversification					
More than half of income comes from cocoa (yes/no)	86%	71%	75%	85%	***
Livestock (yes/no)	38%	32%	58%	32%	***
Total number of non-cocoa crops produced	3.73	3.02	4.20	3.49	***
HH income *(not included in clustering)*					
Cocoa (gross estimated) income US$ (2019/20)	2330	2145	2418	1955	***
Estimated total net HH income in US$	2829	2604	2936	2373	***
Estimated above LI benchmark[103]	8%	9%	14%	7%	***
Observations	3326	819	666	720	
% of sample	60%	15%	12%	13%	

Notes: ANOVA test used to test for differences across segments and for cluster quality. All statistics present segment averages.

[103]The LI benchmark is not adjusted for HH size as the variable is not included in dataset.

Given the mean characteristics of the four clusters, we extract the following descriptions:

- Segment 1: This group represents the largest group of farmers. They are low educated, almost all married, and with very limited access to financial services. They have, on average, three ha of land, are the most productive group of farmers, have relatively high GAP levels, and have the lowest number of permanent workers on the farm. Among the four clusters identified, this is the most reliant on cocoa for their income.
- Segment 2: Higher educated group of farmers with a relatively high level of access to financial services. They also have three ha of cocoa land, are productive compared to the two remaining clusters, and have average GAP implementation levels. They rely the least on cocoa for their HH income, but this is not automatically reflected in the number of crops they produce. This may suggest they have off-farm sources of income.
- Segment 3: This segment consists of arrived, senior farmers with large families. They have the largest plots of land but the lowest yield levels. Compared to other segments, they have more permanent workers on their farm, but low GAP implementation levels. Farmers belonging to this group are also more likely to have livestock and produce the most non-cocoa crops. This segment is the wealthiest group, but also the smallest group identified.
- Segment 4: This segment combines female farmers with male farmers. A low proportion of this group is married, which suggests they are either divorced, widowed, or single. The group has relatively low yield levels and average fertilizer use. They rely strongly on cocoa sales for their HH income. This segment is the poorest identified, but also among the smallest.

Although some discrepancies are noted, the four segments identified here with the highest internal consistency bear robust similarities to the optimal cluster solutions of the KIT NCP and Supplier X datasets. The clustering also reveals the arrived senior farmers have lower yield levels – reflective of the results from the Supplier X dataset, but in contrast to findings on farm effectiveness in the KIT NCP dataset.

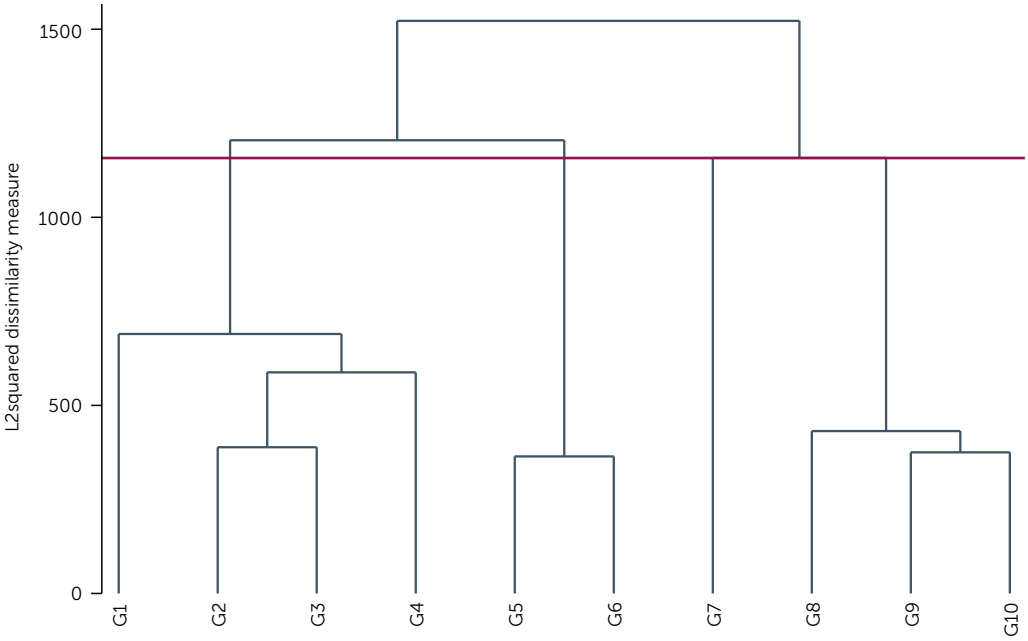
Cluster analysis of KIT Demystifying dataset

Finally, we perform a cluster analysis on the data collected for the KIT Demystifying the cocoa sector study[104]. The data of 766 farming HH (those with missing values on land size were excluded) are valid for the 2015-2016 cocoa season. What differentiates this dataset from the former three is that it contains data on farming HH who are not members of a cooperative and are not certified. All variables used in the KIT

[104]Bymolt, R., Laven, A., & Tyszler, M. (2018). Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

NCP dataset were included in the PCA, with the exception of a variable measuring hired labor or sharecropper presence (which is replaced with total labor days per ha, regardless of the labor source). The cluster solution is presented in Figure 25.

Figure 25 Dendrogram for KIT Demystifying dataset



Both the dendrogram above and the Calinski/Harabasz pseudo F statistic indicate a solution of four segments is the most optimal, and the descriptive statistics of the four clusters' solution are presented in Table 23. On the basis of the mean averages of each cluster, we identify the following groups:

- Segment 1: Largest group of male-headed HH with an average level of education. Almost all are married, with large families and limited access to financial services. They have limited ha of productive cocoa land, but are the most productive group with the highest GAP implementation levels. Across all segments, cocoa dependence is lower in the KIT Demystifying dataset compared to other datasets. However, cocoa dependence levels of this first segment are average compared to other segment. Moreover, the number of non-cocoa crops sold and income sources is the highest among the identified segments. As this group represents almost half of farming HH and, according to the dendogram, is the first group to be split into two if we look for additional cluster solutions, it might be interesting to explore what the two separated groups would look like:
  - Younger group with more than 40% who followed secondary education. Almost all are married, but have small HH size, are less likely to take out a loan, and have very small plots of land (~2 ha) but high yield levels. Nonetheless, GAP implementation levels are low but labor days per ha high. Non-cocoa land is

limited but, among all groups identified, they rely least on cocoa sales for HH income (53%). They have an average number of alternative income sources, but a very limited number of non-cocoa crops sold, which could suggest they rely more on off-farm income sources. This group represents 15% of the entire sample.

  - The second group consists of male-headed HH who are all married and have large HH. On average, they have almost three ha of land and are relatively productive, but indicate low GAP implementation levels and low number of labor days per ha. They have the largest plot of non-cocoa land, rely on cocoa sale for 54% of their income, on average.. They are among the segments with the highest number of alternative income sources and sell the most non-cocoa crops, which signifies they are the most diversified group. Consequently, they are the second-wealthiest group, after Segment 2. This segment includes almost one-third of the farming HH sample.

- Segment 2: This segment consists of relatively older, well-educated male-headed HH with relatively large families. The majority of the farming HH have access to financial services, and have the largest plot of productive cocoa land. They are also among the least productive segments, which is consistent with the 'senior' segments identified in previous cluster analyses. They have low GAP implementation levels, and the least number of labor hours spent per ha of cocoa land. This group has the largest plot of non-cocoa land, is the least dependent on cocoa sales for HH income, and has the highest number of alternative income sources. Similar to the previous cluster analyses, they are the wealthiest group, but represent only 16% of the farm population.
- Segment 3: The third segment consists of female-headed HH with low levels of education, who are unmarried or cohabiting (which may suggest, given theiraverage age, that they are either widowed or divorced), and a relatively small HH size. Access to financial services is limited, and they have the highest proportion of HH who took out a loan. Female-headed HH have the smallest plots of productive cocoa land and average GAP implementation levels, but many labor days per ha (which may suggest that workers are hired). This segment has a relatively average cocoa dependency level and, in terms of income diversification, they are not among the best, but also not the worst performing segments. This group is the poorest, mainly due to their limited ha of land, but also forms the smallest group of only 4% of included farming HH.
- Segment 4: This segment consists of farming HH with the second-largest cocoa plots (~3.75 ha of productive cocoa land) but with low productivity levels, limited GAP implementation, and low labor days per ha. Nonetheless, the HH in this segment are highly reliant on cocoa sales for their total HH income, which is also reflected in their low level of income diversification. More than one-third of HH have obtained a secondary education, and almost 25% of HH heads are unmarried or cohabiting. Access to finance is very limited, and more than a third of HH have taken out a loan. This group represents 34% of the farming HH sample.

The cluster analysis, based on the KIT Demystifying dataset, provides a diverse picture of farming HH groups, especially when dividing the first segment in two separate groups. Once again, some identified segments have strong similarities to those in previous datasets. This is particularly the case for the arrived seniors (segment 2), the female-headed HH (segment 3), and the diversified HH (segment 1b). The fourth segment represents cocoa-dependent HH, although it most likely also includes some of the single farmers, given the lower proportion of married HH. This segment also differs from other cocoa-dependent clusters, as their yield levels are the lowest; whereas, in other cluster analyses, cocoa-dependent HH seem to perform relatively well. Segment 1a is more ambiguous and the characteristics suggest they are likely a mix of young (but married) farmers and diversified HH.

Table 23 Segment overview, KIT Demystifying cocoa sector dataset

Variables	Segment 1	*Segment 1a*	*Segment 1b*	Segment 2	Segment 3	Segment 4	Diff.
HH characteristics							
HH head is female	0%	*0%*	*0%*	0%	97%	1%	***
HH head age	47	*43*	*48*	54	50	48	***
HH head followed secondary education or higher	26%	*41%*	*19%*	54%	10%	36%	***
Married or co-habiting	95%	*93%*	*97%*	95%	27%	76%	***
HH size adults	3.83	*3.12*	*4.18*	4.88	2.80	3.35	***
HH size children	3.73	*3.07*	*4.05*	3.36	1.67	2.07	***
Bank account	9%	*9%*	*9%*	67%	7%	7%	***
Loan taken out last cycle	21%	*11%*	*26%*	30%	40%	36%	***
Region (Sassandra-Marahoue)	35%	*79%*	*13%*	9%	17%	17%	***
Cocoa production							
Productive cocoa land (ha)	2.56	*1.92*	*2.87*	5.71	1.96	3.74	***
Cocoa yield (kg/ha)	444	*469*	*432*	407	432	374	***
Mineral fertilizer application rate (kg/ha)	15.21	*1.45*	*21.86*	10.33	14.43	4.87	***
Number of times cocoa trees pruned	0.40	*0.23*	*0.48*	0.26	0.27	0.33	
Number of times weeded	2.20	*2.32*	*2.14*	1.53	1.87	1.84	***
Total cocoa labor days (per ha)	46.17	*46.87*	*45.83*	27.86	51.22	33.55	***
Income diversification							
Non-cocoa land (ha)	2.73	*1.67*	*3.25*	3.50	1.30	1.38	***
Sale of cocoa as % of total household income	0.58	*0.53*	*0.60*	0.54	0.58	0.83	***
Number of income sources	2.48	*2.43*	*2.50*	2.74	2.27	1.82	***
Total non-cocoa crops sold	2.32	*1.56*	*2.69*	2.24	1.57	1.14	***
HH income *(not included in clustering)*							
Cocoa (gross estimated) income US$ (2015/16)	1606	*1170*	*1755*	2887	878	1631	***
Estimated total net HH income in US$	1950	*1420*	*2132*	3505	1066	1981	***
Estimated above LI benchmark (adjusted for HH size)[105]	1%	*0%*	*1%*	10%	7%	4%	***
Observations	353	*115*	*238*	126	30	257	
% of sample	46%	*15%*	*31%*	16%	4%	34%	

Notes: ANOVA test used to test for differences across segments and for cluster quality. All statistics present segment averages. Segments 1a and 1b are sub-segments where segment 1 is further broken down in two separate segments.

Reoccurring segments

The four individual cluster analyses highlight diverse groups, often presenting an optimal solution of four or five segments. Although each dataset covers a unique sample of respondents, represents a different cocoa season (ranging from 2015-2016

[105]Income levels are based on the 2020 cocoa farm gate price to make them comparable with the NCP KIT dataset and LI benchmark.

to 2019-2020), has a different unit of analysis (farmer vs. HH), contains distinctive variables, and reveals unique segments, there are similarities and consistencies between the segments identified across the datasets. The qualitative comparison, which establishes similarities across segments, adds to the robustness of the methodological approach and external validity of the identified segments. This is particular the case for the KIT NCP dataset, which has only a limited number of observations. Based on the four cluster analyses, we define the following five 'reoccurring' groups in Table 24:

Table 24 Consistencies in segmentsacross the four datasets

Cluster label	Dataset	Main features	Cluster size
Cocoa-dependent	NCP KIT (segment 1) Supplier X (segment 1) Supplier Y (segment 1) KIT Demystifying (segment 4)	• Low level of education • ~45-50 yrs. of age • Married • Low access to financial services • Low to high yield: ~350-650 kg/ha • 3-4 ha of cocoa land • Average to high level of GAP implementation • Cocoa-dependent for income (~70-~85%) • Low level of (on- and off-farm) income diversification • Average to high gross cocoa income: US$~1500-3000 • Average HH net income • Represents largest group of farmers/farming HH	30-40%
Young and single	NCP KIT (segment 5) Supplier X (segment 4) Supplier Y (grouped together with female farmers in segment 4) KIT Demystifying (grouped together with other HH in segments 1 and 4)	• Relatively high level of education • Relatively 'young' group: ~45-50 yrs. of age • Substantial proportion unmarried or cohabiting • Low access to financial services • High internal locus of control (only KIT NCP) • Small cocoa land size (~2-3 ha) • Low GAP implementation level • Low to average yield: ~ 375-525 kg/ha • Cocoa dependent for income (~80-85%) • Low level of (on- and off-farm) income diversification • Low gross cocoa income: US$ ~1500 to 2500 • Low HH income (second-poorest group)	10-20%
Diversified	NCP KIT (segment 3) Supplier X (segment 1) Supplier Y (segment 2) KIT Demystifying (segment 1b)	• High level of education • 45-55 yrs. of age • Married • Large HH (~4+ children) • Average access to financial services • Average cocoa plot size (3-5ha) • Average yield levels: ~400-600 kg/ha • Average GAP implementation level • Relatively low cocoa dependent for income • High level of (on- and off-farm) income diversification • Average gross cocoa income: US$~1500-3500 • High HH income (second-wealthiest group)	15-30%
Arrived senior	NCP KIT (segment 4) Supplier X (segment 2) Supplier Y (segment 3) KIT Demystifying (segment 2)	• Low to high level of education (mixed) • Relatively oldest group: ~55+ yrs. of age • Large HH • Average access to financial services • Large(st) cocoa land size: 4.5-6 ha • Low to average yield levels: ~350-750 kg/ha • Low to average GAP implementation level • High probability of permanent worker/sharecropper • Relatively low cocoa dependent for income • High level of (on- and off-farm) income diversification • High gross cocoa income: US$~2500-5500 • High HH income (wealthiest group)	5-10%
Female	NCP KIT (segment 2) Supplier X (segment 5) Supplier Y (segment 5) KIT Demystifying (segment 3)	• Low level of education • ~50 yrs. of age • Low proportion married • Low access to financial services • Small cocoa land size (1.5-3 ha) • Low to average yield levels: ~450-550 kg/ha • Low GAP implementation levels • High probability of permanent worker/sharecropper • Varying levels of cocoa dependence • Low to high level of (on- and off-farm) income diversification • Low gross cocoa income: US$~750-1800 • Low HH income (poorest group)	5%

Notes: 'Low', 'average', and 'high' adjectives for yield, diversification, and income levels refer to the comparison across segments within the same dataset.

Due to the multitude of segments, different variables, and cocoa seasons (which can be volatile) within segments, averages are difficult to pinpoint. As such, these are merely indicative, and used to provide more subjective labels to performance and HH characteristics, which allows for a broader comparison between segments to create final archetypes. Naturally, not every farmer or HH fits an identified segment, as cluster analysis and farmer segmentation are, by definition, data reduction methods.

Comparing the five archetypes with the Arrived elites and Aspirational elites, we find the former group has most similarities with the arrived senior, although they perform better in terms of cocoa production. The Aspirational elite are better placed between the young, single, and ambitious group and the cocoa dependent group. They share the high internal locus of control, age, marital status, and small plots of land as characteristics with the young, single, and ambitious group, but their productive cocoa characteristics align with those of the cocoa dependent group.

In terms of high potential farmers/HH, the cocoa-dependent group stands out due to their cocoa dependence, but also because they display average–to-high yield levels in some of the cluster analyses. Moreover, the diversified group is interesting due to its high level of income diversification and, consequently, high(er) HH income (and smaller LI gap). Those in the young, single, and ambitious group also indicate potential due to their relatively young ages and aspirational attitudes (although the latter is only demonstrated in the KIT NCP dataset).

Naturally, our clustering approach has weaknesses. Some of the identified segments fall 'in between' segments, such as the fourth segment in the Supplier Y dataset. Moreover, we realize that the cluster analysis does not include variables which may be deemed relevant for production and on-farm income diversification (e.g., growing rubber or coffee), like agro-ecological zone. Most of the datasets that we used lack this level of detailed information. In addition, all farming HH and farmers included are certified farmers, except for those in the KIT Demystifying dataset – which means the cluster analysis holds value primarily for certified farmers, but has less validity for those who are uncertified.

How to use the clustering outcomes?

The cluster analyses on four distinct cocoa datasets reveal unique and diverse segments for HH income across the four datasets. Due to the multitude of segments, we aimed to find qualitative consistency among the four clustering exercises. When assessing similarities and differences, we identify five unique segments with high intra-group correlation in which to segment farmers/HH. The cluster findings present insights into how considering multiple determinants of HH income

simultaneously distinguish subgroups of cocoa farming HH, and provide more comprehensive farmer segments/archetypes for future pathways to reach an LI.

Altogether, this clustering exercise serves three purposes:

1. **The results of this data-driven approach to identify groups will feed into identifying (high-potential) segments:** The exercise serves a more pro-active, enabling approach, and provides input for more the development of customized, tailored services.
2. **It can serve a more sophisticated Monitoring and Evaluation system** that assesses change for different groups. In allows for mapping of effectiveness of interventions, and determining which groups are more likely to be incentivized by programs and their interventions.
3. **It contributes to sector-level discussions** on how to achieve LI for cocoa farming HH.

6 Deep-dive into high-potential household segments

Selection of high-potential segments

In the previous chapter, we identified five groups of cocoa farming HH, of which three groups are considered to be high-potential:

1. The Young, single, and ambitious segment demonstrates potential because of their relatively young age, aspirational attitudes and relatively higher education levels.
2. The Diversified HH segment bears promise because of the high level of income diversification and, consequently, high(er) HH income.
3. The Cocoa-dependent segment stands out due to their cocoa dependence, but also because they display average-to-high yield levels in some of the cluster analyses revealing a within-group capability to reach higher farm productivity levels. They also represent the largest group of cocoa farmers/HH.

On top of these three high potential segments, we add two additional segments to the remainder of the analyses: the 'Aspirational elite' as a 'lookalike' of the Young, single, ambitious farmers and 'Female entrepreneurs'. In contrast to the 'Female farmers' segment identified in Chapter 5, women belonging to this group are relatively young (35-40 years old) and often married to male NCP members. Typically, they operate a business by themselves (or in a women's group), often allowing them to keep the proceedings for their own personal needs. Second, the women in this segment already participate in an income-generating activity and/or VSLA group initiated by Nestlé or partners.

We exclude the 'Arrived senior' and 'Female farmers' segments identified in Chapter 5 from further examination in this study as they are not perceived as 'high-potential'. The Arrived senior farm HH (as 'lookalike' of the Arrived elite), are already more established, relatively older and presumed to be less willing to change their practices. Female farmers are relatively older women, widowed or divorced, with limited access to land, labor, and finance. They form an unique group and contain many of the most vulnerable and marginalized cocoa farming HH.

In a second round of qualitative data collection through small FGDs we aimed to obtain an understanding of each high-potential segment's aspirations, needs, challenges and opportunities. Representatives of the segments Aspirational elite and Female entrepreneurs were pre-selected as respondents. Representatives of the other three groups were selected on the spot (by the research team), on the basis of a few easy–to-identify cluster characteristics, such as age, marital status, completed level of education, and land size[106].

[106]In practice, selecting participants based on cocoa land size proved challenging to do on-the-spot.

Table 25 summarizes the five high-potential segments on whom qualitative data was collected in the second round of data collection. To support the research team in purposively sampling respondents that fit the segments best, the features for selection were slightly 'overemphasized'.

In Appendix 3, we share 'personas' which provide a profile of each segment[107], reflecting our deeper understanding of each segment and what this means for potential solutions that will serve them. Naturally, the characteristics of these archetypes cannot be assigned to a particular person.

Table 25 Five high potential segments

Segment	Features for selection of respondents in 2nd round of data collection
Aspirational elite	Young elite farmers, who joined the Elite program after 2019 – pre-selected by Nestlé and cooperative from the Elite program
Young, single, and ambitious farmers	<40 years old, single, at least basic education (cocoa land <4ha) – selected on the spot by research team
Diversified HH	<45 years old, married, at least basic education (cocoa land > 4ha) – selected on the spot by research team
Cocoa-dependent HH	Uneducated, between 40-50 years old, married (cocoa land size 4-6 ha) – selected on the spot by research team
Female entrepreneurs	Organized women, female entrepreneurs– pre-selected by Nestlé and cooperative from VSLAs, women's association and/or alternative income generating activities

Demographics of high-potential segments

In total, 97 respondents representing high-potential segments participated in the second round of (qualitative) data collection. Looking at their specific characteristics, in addition to the average characteristics that were presented in the previous chapter, the following observations seem relevant:

- The HH size of the segments Diversified HH and Cocoa-dependent HH is generally larger than other segments, which is likely to increase their cost of living. Having a substantial nuclear family also suggests that they are more established in life.
- Most Female entrepreneurs are also involved in cocoa production, but indicate that the relative importance of cocoa for their income is low (even though cocoa is often their main income source of their HH).
- Income diversification is important for all segments, although to a lesser extent for Cocoa-dependent HH. Diversified HH and Cocoa-dependent HH generate additional income, mainly through other crops; while the other segments combine cocoa with other crops and off-farm economic activities.

[107] A persona is developed from a range of sources, pulling together common characteristics of similar people into an 'archetype' through which a group can be understood. Available at Personas Show How Social Norms Impact Women's Financial Inclusion (cgap.org).

- The relative importance of cocoa is high for all segments, except for Female entrepreneurs. The importance of cocoa seems highest for Young, single, and ambitious farmers and Cocoa-dependent HH.
- Cocoa-dependent HH tend to consider themselves to be less entrepreneurial than other segments.

Table 26 summarizes the demographics of the selected respondents in more detail.

Table 26 Summary of demographics of respondents per segment

Demographics *(averages calculated with median)*	Aspirational elite	Young, single and ambitious farmers	Diversified HH	Cocoa-dependent HH	Female entrepreneurs
Sex	All male	All male	All male	All male	All female
Age	40 (youngest 30, oldest 43)	33-34 (youngest 25, oldest 39)	41 (youngest 31. oldest 45)	46-47 (youngest 38, oldest 54)	38 (youngest 33, oldest 57)
Education completed	Diverse – min primary school – max bacc.)	Diverse – min unedu-cated – max bacc.)	Diverse – mostly primary school	No education	Mostly uneducated or primary school
Marital status	Mostly in co-habiting, some married	Mostly single, few married/co-habiting	Mostly co-habiting – some married	Mostly married – some co-habiting	Mainly co-habiting or married, few widowed/single
Average HH size	7 (min 4, max 14)	6 (min 1, max 9)	8-9 (min 4, max 9)	8 (min 7, max 18)	7 (min 4, max 10)
Average #adults	3 (min 2, max 7)	3 (min 1, max 6)	4 (min 2, max 7)	4 (min 2, max 6)	3 (min 1, max 7)
Average #children	4 (min 1, max 7)	3 (min 1, max 5)	3 (min 1, max 8)	4 (min 2, max 12)	4 (min 1, max 5)
Total land in ha	2.5 – 4 (min 1.5, max 6)	3 (min 1, max 6)	4 (min 2, max 16)	2.5-4.5 (min 2, max 11)	4.5 (min 0, max 42)
Total cocoa land	1-2.8 (min 1, max 4.5)	2.5 (min 1, max 28)	3-3.5 (min 2, max 12)	2.5 (min 1.5, max 8)	2-2.5 (min 0, max 25)
Main source of income	Almost all cocoa	All cocoa	Almost all cocoa	All cocoa	Most cocoa, also rubber and other businesses (catering, trade, transport)
Second source of income	Diverse *Crops*: cashew, rubber *Other*: Cassava processing, barbershop, trade	Diverse *Crops*: Rubber, cassava, rice *Other*: poultry, moto taxi, processing cassava, share cropping, trade	Diverse *Crops*: yam, rubber, cassava, café, cocoa *Other*: animal farming	Mainly rice	Diverse *Trade*: smoked fish, processed cassava, fabric, catering *Crops*: cassava, cocoa
Third source of income	Oil palm, rubber	*Crops*: Yam, rice *Other*: Coach	Diverse *Crops*: rice, palm tree, yam, rice, cassava, rubber *Other*: trade	Few responses (maize and peanuts)	Few but diverse responses: cassava processing, shoe shop, groundnut, yam, rubber, trade
Relative importance cocoa (1-5)	4-5	5	4	5	2
To what extent do you consider yourself entrepreneurial (1-5)[108]	4	4-5	5	3	5

For each segment, we collected qualitative data on their aspirations, needs, challenges and opportunities. In the next section, we first discuss four high-level aspirations, which is followed by an elaboration of the self-reported challenges and opportunities. We end this chapter with a concluding section that summarizes the most important insights.

[108]The numbers reflect an ordinal scale: 0 = lowest, 5 = highest

Aspirations

In FGDs of 3 to 5 participants, we asked farmers in a specific segment about their aspirations and plans for the future (defined as realistic plans that they want to have achieved in five years from now). Some aspirations that were mentioned are universal, while others are segment specific. databased on the qualitative data collected, we identify four higher-level aspirations:

1 Economic
2 Family
3 Assets
4 Social status

Table 27 summarizes the higher level aspirations for the different segments. Below, we share some key observations per aspiration, illustrated with direct quotes from farmers.

Economic aspirations

All segments seem to aspire diversifying their income streams. The income earned from cocoa sales is not sufficient to cover the increasing costs of living and for most families further income diversification has become a necessity.

For members of Cocoa-dependent HH who are mainly skilled in cocoa production, income diversification can be rather challenging. These HH tend to see cocoa farming as their destiny and/or a stepping stone towards a better life and some continue to set their hopes primarily on cocoa, as anecdotal evidence suggests.

> *"I want to continue working on my cocoa plantations. Because, it is the cocoa on which I can pay for my children's school. If I have a lot of money after the sale of cocoa, I intend to recruit more laborers to help me clean my plantations. Because here, if you don't have many laborers, and you have a large area of cocoa, it is difficult for you alone to clean your field. I am interested in cocoa because it is the only activity I have at the moment. Since I was a child, it is the activity I have been doing to feed myself, my family and my children's education."* (FGD, Cocoa-dependent households, May 2021)

> *"My father was a cocoa farmer. He fed us with cocoa money until he died. I am also a cocoa farmer. I intend to use the cocoa money to pay for my children's education so that they can have a great diploma to get a job in the future. Cocoa can help me achieve this goal. Because, it is the only activity that I do now."* (FGD, Cocoa-dependent households, May 2021)

> *"I will not leave cocoa because it is my basic source. And the land always feeds the man. So I will continue to do the work on the land that my parents have shown me since I was a child."* (FGD, Cocoa-dependent households, May 2021)

While for most Cocoa-dependent HH, cocoa farming is likely to remain their economic foundation, some show a similarity with Diversified HH and seem to aspire a new balance, whereby work on the cocoa farm becomes less fundamental as income generating activity.

> *"In addition to cocoa, in the next 5 years, I plan to have a rubber tree plantation. Because, the cocoa money alone is not enough for me anymore. I have a lot of expenses for my children's school, and for my family who lives here with me. My children go to Abidjan and Abengourou. For the one who goes to Abidjan, I have to spend 250,000 CFA francs per month for his studies. This is really a huge expense for me. That's why I want to do in addition to cocoa, the rubber plantation to have more money for my expenses. I know that with the rubber plantation, I could have money to complement the cocoa money I have now. I also want to have a store selling various items such as oil, Maggi seasoning cubes, soap, etc."* (FGD, Cocoa-dependent households, May 2021)

> *"In the next 5 years, personally, I plan to have an African chicken farm, and a sheep farm to supplement my cocoa money. Because, the money from cocoa is not enough now because of the high cost of living. Our families are large, and I have 3 wives and I also take care of my little brother and his wife. Because, after the death of our father, I am the oldest son who takes care of the other members of my family. This means that I have to look for a lot of money to supplement on the cocoa money to be able to make all these expenses."* (FGD, Cocoa-dependent households, May 2021)

> *"I will try to open a shop and sell cement, rice, oil and more. I will do this because, you know, for cocoa, there are some months in which you don't have incomes. So if I have other things that can allow me to get income, I will manage a bit."* (FGD, Cocoa-dependent households, May 2021)

> *"I would like to go back to my village and I will make a cashew nut tree farm and then I would also be a weaver, you know, I have so many children. I want to be able to get more money. I will buy land for doing that cashew nut tree farm. I'm thinking of this because I want to diversify the crops. It is very important to do that because the price of cocoa sometimes decreases so if you have another crop that you are cultivating, that will support you."* (FGD, Diversified households, May 2021)

> *"Me, I am thinking about having the possibility to have a place to make a poultry farm. I want to do this because I really like this job. I had this idea two years ago and I will try to extend this activity that I have started. I think it's important to have this because the expenses of my family are all the time, increasing more and more."* (FGD, Diversified households, May 2021)

> *"I plan to use another store to sell mattresses. Because here, there are not enough stores that sell this kind of merchandise. I see myself with a lot of money from my business from my 3 stores."* (FGD, Diversified households, May 2021)

> *"Right now I have a store selling cement, sheet metal, and tiles, in fact in my store I sell everything that can build a house. And all these goods are doing very well now. Because there is gold panning here, and people take advantage of it to build their houses. So, I know that if I have 3 more stores selling house building materials, I would have a lot of money to live in peace. Because if you don't have a lot of money, you're not at peace. Because you know you have expenses to make."* (FGD, Diversified households, May 2021)

Both the Aspirational elite and Young, single, and ambitious farming segments seem rather strategic and entrepreneurial in their ways to realize their ambitions, often recognizing market opportunities at an early stage and building on already existing activities, knowledge, and cocoa savings. Anecdotal evidence illustrates how the Young, single and ambitious farming segment perceives investments in cocoa as a stepping stone to reinvest cocoa profits in additional income generating activities. What they have in common with the Cocoa-dependent HH is that cocoa remains central in their income diversification strategy.

> *"I myself have a cocoa plantation. I buy frozen chicken in Ghana and sell it here in Zaranou because my cocoa plantation is located on the border with Ghana. So it's easier for me to buy the chicken there and sell it here. In addition to that, people here prefer the chicken from Ghana. Because they say that this chicken is sweeter than the chicken from Côte d'Ivoire. So, it's a good business for me here. Currently, I already have a freezer for the conservation of my fish and chicken that I sell. But, for the next 5 years, I wish to have 3 more freezers to increase my goods. I started my business of selling chicken and frozen fish with the sum of 500,000 CFA francs in 2016. I plan to increase my business by 2025 to 3 million CFA francs. I have saved the profits from the sale of cocoa in the bank to start my business of selling chicken and frozen fish. I continue to save my savings, my profits in the bank."* (FGD, Young, single, and ambitious farmers, May 2021)

> *"Market gardening products are very popular here. Because there are few people who do this activity. That's why I decided to grow vegetables here. I will employ two young people who use motorcycles that I bought to make cabs. So the day they don't go to my field to look for the market garden products, they will use my two motorcycles to make motorcycle cab to transport people who want to go to other cities. I bought my motorcycles with cocoa money. It is also with the money from cocoa that I created my market garden. So, I intend to continue working in the cocoa plantations. Because the money I earn after the sale of my cocoa allows me to maintain my market garden products. So these are my two sources of income that help me support my three children."* (FGD, Young, single, and ambitious farmers, May 2021).

> *"Currently, all my activities such as cocoa planting and market gardening are doing very well for me. So, I intend to increase my money by growing rice. Rice is widely consumed in Côte d'Ivoire. So I am sure to have many customers to buy my rice. This money will allow me to better take care of my children, myself, and my large family."* (FGD, Young, single, and ambitious farmers, May 2021)

> *"I do not plan to stop working on my cocoa plantations. On the contrary, I want to increase the area of my plots. Because with the cocoa money, I want to build a large store selling cosmetics. Because here, the city is growing. So I can do this business in addition to my cocoa plantations, and the hair salon that I want to open. The money that I will have from these activities, will allow me to build several houses in the form of a city for each member of my family. I will also build a large house for myself."* (FGD, Young, single, and ambitious farmers, May 2021)

Many of the Female entrepreneurs aspire to become successful in trade such as fabrics and foods/spices and many aspire to own a shop, next to their work on the (cocoa) farm, so they can earn sufficient income to take care of their children and can gain financial independence. This financial independence is a shared aspiration among most Female entrepreneurs, as women who don't earn any income are highly dependent on their spouse, parents, and in-laws, and vulnerable if their spouse passes away.

"It is my dream to do something that will bring me more money to be comfortable. I wish to have a shop like this one, because it is good and will allow me to have money on me every day, so I will take this money to take care of myself and to meet the needs of the children [to pay the school of the children and to register them with the contest because the contests are expensive in Côte d'Ivoire]." (FGD, Female entrepreneurs, May 2021)

"I know that if I sell the fabrics in my shop then I can have all this well-being in the future. I also know that this is the business I have to do because other women are doing it and there are no problems, there are customers for it in the village here. It's profitable. You make a good living from it." (FGD, Female entrepreneurs, May 2021)

"I would like to be involved in a fish shop. I want to do this because this is something when I try to analyze the market here, it will be profitable because people will need more fish, and there is no fish shop. In addition to the fish shop, I am thinking of doing something like trade because I think trade will give me much money and I will be involved in some other activities." (FGD, Female entrepreneurs, May 2021)

"I would like to have a big shop to sell clothes for women. In fact, selling clothes for women has always been a passion for me. This activity will allow me to make a lot of money in addition to the fact that I will be living my passion." (FGD, Female entrepreneurs, May 2021)

"In five years, if God allows me, I would like to make my own fabric shop. I want to do that. Even if my husband passes away, I can take care of my children. In addition to that, I can also sell wigs, plates or more items in my shop. I know that there are not many clients here in this village but I can also sell in the city. I think all these activities are important for me. So that in the future, my children do not complain or do not regret their mother or envy people but not be happy to be my children. I think it's very important to have much money [laughs]. I think that if I do this, this will allow me to get much money and also take care of my children." (FGD, Female entrepreneurs, May 2021)

"Right now, the parents or the relatives of our husbands are complicated. If I have my own money, I can support my children until they get a job and as soon as they have a job, I would be completely relieved because they will be self-sufficient." (FGD, Female entrepreneurs, May 2021)

"The problems are going to increase and as there will be enough problems you need to have enough projects and enough money to respond to these problems. That's why I say in 5 years I will have a shop but in addition to the shop I will have laborers who will work for me in my cocoa farm. So, I will be able to get my cocoa money back and put it in an account and finally I will use this money to solve problems such as schooling for the children or paying for the children's exams, but I won't have to look for money from someone else, I will have everything myself." (FGD, Female entrepreneurs, May 2021)

A final economic aspiration is savings. Different segments mention to aspire to using cocoa savings to make on- and off-farm investments, and to try to avoid going into debt. Female entrepreneurs aim to save money in a group to invest in future income generating projects.

"I already have my cocoa plantation. I plan to save and part of my income after the sale of my cocoa to realize my projects. My savings will allow me to build my houses by 2025 years. For example, I can save between 150,000 CFA francs and 200,000 CFA francs per year after selling my crop to the CAPRESSA cooperative. If I do this every year, my savings can increase. And the day I need a loan from the CAPRESSA cooperative, I will be able to get it. The cooperative will be able to withdraw the repayment of this loan according to the quantity of cocoa that I will deliver to them after my harvest. " (FGD, Cocoa-dependent households, May 2021).

"We save money at the level of the association, to be able to carry out future projects. We also sell the crops from our farm such as bananas and taro on market days, so that we can save money for the COOPEC." (FGD, Female entrepreneurs, May 2021)

Family aspirations

The different segments represent HH in different life-stages, which influences aspirations related to both family and in other domains. On average, the Young, single, and ambitious farmers are the youngest and quite eager to start a nuclear family, but only after having achieved some financial success. For these men, the need to pay a dowry can also stand in the way of formalizing a marriage[109].

"We want to have the means before starting a family. We should not take people's daughters to live with them and make them suffer. Otherwise, we also want to get married, but not in our current condition. We have plans because we don't want to limit ourselves to field work. So any support would be welcome to enable us to achieve our goals and realize our plans." (FGD, Young, single, and ambitious farmers, May 2021)

"We also feel that we are getting married tomorrow, we will be even more boosted and energized by our family, because well-being is important to you. If we are still single, it is not because it is our choice. We don't want to take a wife when we ourselves have problems. We don't want to make our wives and children suffer. That's why we decided to wait until we could afford it before we get married." (FGD, Young, single, and ambitious farmers, May 2021)

"I love children so I want to have means because I see people here who are married, but it's not that much. I don't think they are happy. They don't have means and often their children are excluded from school. I don't want that for my children." (FGD, Young, single, and ambitious farmers, May 2021)

The Aspirational elite segment, who are also relatively young but often already married or cohabiting, shared their aspiration to collaborate more with their spouses and act as strong couples. Also, the other segments see it as beneficial when both husband and wife contribute to the HH income. Male members of Diversified HH and Cocoa-dependent HH are keen to support their spouses (for example, by setting up a shop), just as married Female entrepreneurs expressed the desire to financially support their husbands.

[109]van Heck, P. & Laven, A. (2021) The Resilience Journey Empathy Generation (Phase 1) – Executive Summary. Mars Wrigley. Available at: https://www.kit.nl/publication/the-resilience-journey-empathy-generation-phase-1-executive-summary/

"I just started this collaboration [joint financial management] with my wife. But before, my wife was doing it alone. But now I have decided to help her. Because by helping her, it's like helping myself. For example, I told her to buy a notebook in which we write down all our expenses, and our income during the whole month. We also do our expenses for the month in relation to the notes we take about my wife's attiéké sale. For example, I also help to clean the cassava that she takes to make attiéké, I often put the pot on the fire before she starts cooking attiéké." (FGD, Aspirational elite, May 2021)

"My wife and I have the same goal. And because of that, we save every month to be able to build our house one day". (FGD, Aspirational elite, May 2021)

"At the moment I don't always have a lot of money to buy fertilizer. That's why my current production is low. So I think that if I have a lot of money to buy fertilizer, my production will be good and I will have money for my wife's loincloth business. And I think that in the next five years, my family is happy because we don't have money problems." (FGD, Cocoa-dependent households, May 2021)

"I want to do business to support my husband in his expenses and so together we can invest and also take care of our children." (FGD, Female entrepreneurs, May 2021)

We can't just sit around and do nothing, but we want to do business to help our respective husbands to take better care of our family and also, we ourselves need to feel really independent and very useful again. Otherwise we are currently [just] helping our husbands in the cocoa fields and on the side, we are doing small yam, groundnut, some market gardening. And small businesses. For our lives to change, we have to fight and do our current work with great courage and strength." (FGD, Female entrepreneurs, May 2021)

All HH with children aspired for their offspring to be in school and become successful in life. However, for some HH, this turned out to be challenging – particularly among the Female entrepreneurs and Cocoa-dependent HH.

"I am planning to have embroidery machines and sewing machines for my own needs and sell some as well. This will give me enough money to support my family so that we can move forward together. Right now, we have difficulties supporting our children's education. You know, education has become very expensive. This money can help us educate our children. If I get enough money, I will do additional business like a poultry farm or something else." (FGD, Female entrepreneurs, May 2021)

"We also have problems with money to pay for our children's education. This means that our children often do not finish the school year. Because we can't send them money to pay for their rent in the cities for their studies, we often can't send them money for food." (FGD, Cocoa-dependent households, May 2021)

Assets

Owning a house provides security[110], and to own one or several houses is a shared aspiration across segments, either as an investment, to diversify their income, to provide a source of regular income, or utilize for 'retirement' and/or as inheritance.

[110] Remarkably, previous cocoa studies pointed out similar benefits of owning cocoa land (as safety net, pension, inheritance, etc), the data suggests that with the growing scarcity of land, house has become an increasingly important asset. Anecdotal evidence suggests that gold mining has also been a recent trigger for investment in housing.

Income from cocoa sales and savings were often put forward as a means to achieve this goal. Earlier studies confirm that income earned through cocoa sales is regularly (at least partly) used to undertake house construction or renovation[111].

> *"In the next 5 years, I see myself building my houses to rent them out. I want to do this to diversify my sources of income."* (FGD, Aspirational elite, May 2021)

> *"If I have money in the next 5 years, I plan to build several houses here in Zaranou and also in Abengourou to rent them out. And the money from this rental will allow me to pay the young people who will clean my plantations. It is to allow my wife to rest, and also to ensure the future of our children. Because, when you rent out houses, you earn money at the end of each month. So you will have less money problems."* (FGD, Diversified households, May 2021)

> *"If all goes well in the next 5 years, I plan to continue working in my cocoa plantations. Because, I didn't go to school. The only work I do here is cocoa planting. So, I want to continue working in my cocoa plantations to have a good production. Because if I have a good production, I will have a lot of money to build several houses and I will rent some of my houses. Because the money from renting my houses will allow me to pay for my children's education and to take care of my wife. And when I am old and can no longer go to work on my plantations, this money will be used to pay for the expenses of the house, the food, my wife, and myself."* (FGD, Cocoa-dependent households, May 2021)

> *"We keep working on our cocoa farms to get money to build our own house. When you have a house built with cocoa money, you realize that you have not worked unnecessarily. But now we are sleeping in houses that do not honor us. Because, we want to live in nice houses, big houses, and even rent others to have more income."* (FGD, Cocoa-dependent households, May 2021)

Aspirational elite farmers primarily view the building and rental of houses as an effective and sustainable way to increase their income – but others also emphasize additional benefits. For example, Young, single, and ambitious farmers, who often still live with their parents, want a house for themselves so they can 'settle down' with their (future) spouses. For Female entrepreneurs and Cocoa-dependent HH, owning a house was seen as more a future safety net and as a form of inheritance. However, putting small shares of income aside from cocoa sales for building a house can be quite challenging.

> *"If everything goes well in my life during the next 5 years, I will use my savings that I have deposited in the bank to build my own house. I already have the land on which to build my own house. I want to have a house with 3 living rooms. After that, I plan to marry a woman and have 5 children."*(FGD, Young, single, and ambitious farmers, May 2021).

[111] Bymolt, R., Laven, A., & Tyszler, M. (2018). 'Chapter 7: The Importance of Cocoa', in: Bymolt, R., Laven, A., & Tyszler, M. (eds.) Demystifying the Cocoa Sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). Available at: https://www.kit.nl/wp-content/uploads/2020/05/Demystifying-complete-file.pdf

"Currently the farm I am doing is for my dad. We farm it together and so we share all the income we earn. I work on two shared farms and there what I earn is split in half with the person who owns the land." [...] "In five years when you come back, you won't even recognize me. I'll have a place of my own, I won't be living in my family's backyard, and if all goes well, I'll have built my own house. I'll have a family, and why not a child who will give me a boost to go forward. Because I'll have enough means to defend myself and my family from need." (FGD, Young, single, and ambitious farmers, May 2021)

"We are women. We also need to build our house. If you tell your husband to build the house for your family, if he builds that house, that house will belong to your children, but not to you because if your husband dies one day, his own brothers will come and take that house. If you have your own house, you can go and live in that house with your children. Nobody will come and tell you to go away. So to avoid all these problems, I prefer building my own house now." (FGD, Female entrepreneurs, May 2021)

"I want to build houses to rent out so that I have more money to pay for my children's education. At the moment I have already got a space where I can build my houses. But I haven't yet got the money to buy the building materials (cement, sheet metal etc) because all my children are still going to school. And I am the only one to pay their expenses. So it's a little difficult for me to get the money right away to start building my houses." (FGD, Cocoa-dependent households, May 2021)

Compared to other segments identified, a large proportion of Female entrepreneurs aspire to own income generating assets such as (processing) equipment and machinery.

"When you come, you will find me selling my onions and other condiments as I do today but on a larger scale. I will buy a freezer to sell fresh fish and smoked fish. I think that with all this in 5 years I will be able to take care of my family and I will even be able to give money to those who need it." (FGD, Female entrepreneurs, May 2021)

"I'm trying to buy a freezer that I can use for selling fish. I'm sure the business will work for me because people would buy it. This will work a lot and I will get a lot of money." (FGD, Female entrepreneurs, May 2021)

"I think I will go and purchase machines to sell here because you see, I can see many young girls who want to learn sewing, and I'm quite sure that if I sell the machines for sewing here, that will be profitable for them, because it will be close to them. These machines will allow me to get much money and this will help me and that will also allow me to help other people and for the members of my family, it will give them the possibility to evolve. It will also allow them to move forward. It will help me support husband so that we can take care of the children. This is what I think." (FGD, Female entrepreneurs, May 2021)

Social status

Being respected in the community and by family members is a widely shared aspiration. Among the Aspirational elite and Young, single, and ambitious farmers, there was a desire to share their future financial success with others and support their family and community members. Among the Cocoa-dependent HH, some had family members abroad to whom they are expected to send money to. Cocoa-dependent HH in particular stressed the importance of avoiding humiliation due to debts or inability to contribute to social events.

"In the next five years, I will have another plot of land with at least 1 hectare of cocoa and 1 hectare of maize in addition to what I already have. This is to diversify my crops. I want to build a loincloth shop for my wife. For my two younger brothers, I want to have money to help them get their driving licenses. I want to do all this to reduce my expenses and poverty. Because a poor person is not respected. That's why we want more for our income. When you are poor, you get nervous, you have to borrow money." (FGD, Aspirational elite, May 2021)

"A young person has to work to help his family and decrease the unemployment rate in society. That's why I am working with two people now. In fact, it is social work that I do. And I want to increase the number of young people working with me now. For example, in the next 5 years, I plan to recruit 12 young people to sell my market garden products. This way, they won't have time to drink excessively and walk around the village unnecessarily. But, they have money to feed their children, and take care of their families. And gradually, I could partner with these young people to create a business and hire others as well. So it's social!" (FGD, Young, single. and ambitious farmers, May 2021)

"In the next 5 years, I still see myself owning several houses built and in Abengourou. I also see myself owning several stores selling house building materials. Because in addition to being a cocoa farmer, when you own several houses, no matter what expenses are presented to you, you are serene! Because you know that you have money to meet your expenses. When you can do that, people respect you the most. Because they know that you are useful in their lives." (FGD, Diversified households)

"Because I am Beninese but I was born here in Côte d'Ivoire and I have all my activities here. But from time to time, when there are financial problems of my large family in Benin, they contact me and I often send them money. But often I can't send them money because I don't have any. [...] When the family needs money and they ask for you, it is important to give them some money, so that the family members can respect you. So, currently I am respected in my big family in Benin. But, I will be much more respected if I manage to make my business for a lot of money in the next 5 years to come." (FGD, Cocoa-dependent households, May 2021)

"When you don't have a nice house, people make fun of you. I don't want to be humiliated." (FGD, Cocoa-dependent households, May 2021)

"The cocoa money is not enough anymore. And the price of cocoa is too low now. This means that we cocoa farmers always have money problems. We are forced to get into debts with our friends here to meet our expenses. And often, some of our friends make fun of us when we go to borrow money from them. Personally, I don't want to experience this humiliation anymore. That is why I want to do this business in addition to cocoa." (FGD, Cocoa-dependent households, May 2021)

"In our country, funerals are very important. And when you don't manage to pay your contribution, you become the object of mockery by other family members. I don't like to be humiliated. So I make the effort to give this amount to be honored despite the little means I have." (FGD, Cocoa-dependent household, May 2021)

Table 27 summarizes these higher level aspirations and shows the similarities and differences between the segments.

Table 27 High-level aspirations for farmer segments

Aspirations	Aspirational elite	Young, single and ambitious farmers	Diversified households	Cocoa-dependent HH	Female entrepreneurs
Economic	• Become successful business men. • Substantial and modern farms.	• Expansion of farm (cocoa and other crops). Use cocoa savings as investment for other businesses. • Financial security before settling down.	• Income diversification as a must to cover costs of living. • Support spouse to set up own income generating activity.	• Increase income from cocoa. Additional income in the cocoa-off season; cocoa remains the foundation. • Shops for their spouse to contribute to HH income. • Savings to invest in their cocoa plantations.	• Successful in trade • and cocoa farming (to afford hiring labor for cocoa farm). • Setting up shop. • Financial independence. • Savings (as part of a group) to invest in income generating activities.
Family	• Strong couple and collaborate with spouse. • Children in school.	• Marriage.	• Children in school. • Support their spouses (for example, by setting up a shop)	• Children in school. • Support their spouses (for example, by setting up a shop).	• Take care of their children and pay for education/school, competitions/exams. • Financially support their spouses.
Assets	• Houses/real estate to live in and to rent out, and as inheritance for children. • Expand (farm) land. • Invest in modern equipment and transport to facilitate trade.	• Houses/real estate to live in and to rent out. • Expand (farm).	• Farm and house as inheritance for wife and children. • House to live and rent out.	• Owning a house as a future safety net and as a form of inheritance.	• Owning a house as a future safety net and as a form of inheritance. • Small equipment such as freezers and bigger equipment such as processing machinery and machines for sewing.
Social status	• Move out of poverty and gain respect from community members. • Share financial success with others and support family and community members (creating informal safety nets).	• Take care of family members and create job opportunities for other youth.	• Gain respect by becoming financially independent.	• Avoid humiliation due to debts, or inability to contribute to social events. • Financially support family members who live abroad (e.g. Burkina Faso).	• Financial independence.

Pains and pain relievers

In FGDs of 3 to 5 participants, open discussions were held with participants from different segments on 'pains' (challenges) and 'pain relievers' (opportunities) related to their main income generation activity. We made sure to probe for possible underlying reasons and asked FGD participants to prioritize their main challenges and opportunities[112]. Based on their responses, we categorized these as:

- Access to financial resources and services
- Access to land and labor
- Access to training, inputs and equipment
- Access to markets/poor infrastructure
- Costs of living and emergencies
- Lack of healthcare

[112] For each segment participants' responses were validated in a subsequential FGD with other participants belonging to the same segment, allowing them to add additional pains and gains.

Access to financial resources and services

The low and unpredictable cocoa price and high input costs affect HH financially, particularly those who largely depend on cocoa for their income. The cocoa price is announced during the harvest period, by which time expenses have already been made. According to the FGD participants, this makes it challenging for farm HH to plan in general, while forcing some HH into (risky) debts. Some members of Cocoa-dependent HH complained that in addition to the low cocoa prices they suffer from delayed payments by cooperatives, which can create challenges in meeting their household needs.

> *"Sometimes we say cocoa money decreases. After harvest, you can sometimes get only two bags of cocoa and within these two bags, you have to deduct what you used for fertilizers and pay."* (FGD, Cocoa-dependent households, May 2021)

> *"There is also the fact that the price of cocoa is often set at a very low level compared to the expenses that the farmers make to maintain their plantation. For example, this year I decided to keep my cocoa from December until now, hoping that the government would increase the price per kg to at least 1,500 CFA francs. But now the price has gone down to 750 CFA francs per kg. So I have lost by keeping my cocoa until now!"* (FGD, Diversified households, May 2021)

> *"There is also the instability of the price of cocoa which prevents us from planning our income. For example, if the price of cocoa was known to everyone before the harvest, just as a civil servant knows his salary, then we would be able to make a good plan without any problem. But we don't even know how much the price of cocoa will be, it's only in October that we are informed of the price per kg of cocoa. And often we learn today that a kg of cocoa costs 1000 CFA francs, and sometime later we hear that the price has dropped to 750 CFA francs. But perhaps the farmer has taken out a loan of 200,000 francs to maintain his plantation. And when we say that the price is fixed at 750 CFA francs per kg of cocoa, when you have spent more money on your plantation, you already realize that you have worked at a loss. How can you plan in such conditions?"* (FGD, Diversified households, May 2021)

> *"When you give your farm as a guarantee for a loan you've taken, you have one week to pay back. Beyond this deadline, you would have to pay or the person who gave you the loan will have the possibility to use your farm as they want. After that, if you come and you want to pay exactly the money that you collected from him, he will not agree because he will say that he used more money for doing additional work in your plantation. And then you will have to pay for those additional expenses plus interest for the efforts used for improving your farm."* (FGD, Young, single, and ambitious farmers, May 2021)

> *"I think we need our cocoa to be bought on time by the cooperative so that we can have our money. For example, often the cooperative can make us wait for 1 or 2 months before giving us the money for the quantity of cocoa we have delivered. So we often have to wait for them before we can spend our money." […] "often the cooperative does not have enough money to pay cash when the farmers deliver the cocoa to them. Afterwards, when the cooperative has the money, it pays the rest of the money that it could not pay during the first payment."* (FGD, Cocoa-dependent households, May 2021)

Most segments lack access to financial services, and they often put this as one of their priority concerns. The Aspirational elite and Cocoa-dependent HH segments argue they face problems when trying to access credit from an official financial institution, which would help them make the required on-farm investments to maintain their plantations.

Female entrepreneurs indicate that, for women, it is generally (even) more difficult to access finance, especially as they lack information on existing financial services.

> *"There is no financing for women. It's very difficult or even impossible to get financing from banks or any other institution."* (FGD, Female entrepreneur, May 2021)

> *"We want to have access to bank loans to buy fertilizer for our cocoa plantations. Because when you have money, you can easily buy fertilizer to increase your production. And when you have a good production, you can have a lot of money to build houses for your family, you can even build other houses to rent. You can easily send your children to school, you can give money for your wife to do business, that's really important for us."* (FGD, Cocoa-dependent households, May 2021)

> *"The bank loan is much more important to us because without money it is difficult to turn ideas into projects and actions. We didn't go to school, but we have plans to get out of poverty. And it is the bank loan that will give us the opportunity to realize our projects."* (FGD, Cocoa-dependent households, May 2021)

Young, single, and ambitious farmers put emphasis on their preference for savings and investments, especially following cocoa sales, rather than taking out a (risky) loan. Some Cocoa-dependent HH reveal how their savings provide them access to cooperative loans, and how they value the support that the cooperative gives to keep track of their transactions. Other Cocoa-dependent HH emphasize the difficulty they have in saving money, due to poor financial planning and inadequate service delivery.

> *"Those who save their money at the cooperative, each have a booklet in which all their money payments are noted. The booklet is made in two copies. The producer has kept a notebook in which all the notes concerning his payments are clearly specified by the cooperative and the cooperative another copy of the same notebook with the same amounts of money paid by the producer after the harvest. These are facilities that the cooperative offers us here to encourage us to save our money after the harvest in order to realize our projects."* (FGD, Cocoa-dependent households, May 2021)

> *"Farmers don't have the possibility to save money. Farmers don't make an adequate farming schedule. I mean a very good financial plan for savings. I think savings can give farmers the possibility to get loans from banks". [...] "We farmers want to save money sometimes but we can't. When we sell our cocoa beans, we get a huge amount of money. Unfortunately, for this huge amount, we cannot save in our mobile money account. Simply because of the unavailability of sufficient funds locally."* (FGD, Cocoa-dependent households, May 2021)

Access to land and labor

Lack of available land is a challenge for most farming HH, and is one of their major concerns, hindering them from expanding their land for growing cocoa and other crops. According to the Cocoa-dependent HH, this problem can be even more pertinent for migrants, as they can only access land through buying/renting/sharecropping arrangements.

"We have problems with land to increase the size of our plantations. Because we are foreigners, we don't have land here. We have to rent the land or work for the landowners before sharing the harvest with them. But if there was a lot of land and if we had our own land, we could easily increase the size of our land. Because we want to work, we want to increase our income. Because cocoa alone is no longer enough." (FGD, Cocoa-dependent households, May 2021)

"We have problems with money to buy or rent other plots to increase our plantation areas. Because we want to get more money by selling cocoa. But to do that, we need a large area. But we are foreigners in this village. So we don't have any land here. So we have to rent or buy land. But we don't have the money to do that." (FGD, Cocoa-dependent household, May 2021)

"We are Baoulé who came from the center of Côte d'Ivoire to settle here because our land was not suitable for cocoa but more for cashew nuts. This is what brought us here! As the Dida land is fertile and favorable for cocoa cultivation."[...] "Often when we need new plots of land to increase the size of our plantations, the Dida, the inhabitants of the village, refuse to give us space or plots of land to cultivate cocoa, cassava or bananas. Because they say that we will take all their land and their children will not have any in the future. And they often give away the part of their plots that is less productive when we agree with them to share the harvest." (FGD, Cocoa-dependent households, May 2021)

"Today there is a lack of forests. We can no longer expand our farms. We have to rent the land or guarantee it. Otherwise we can't rely on the land. The land is finished. While we have grandchildren and large families." (FGD, Female entrepreneurs, May 2021)

"We have a problem of plots to diversify our crops. We want to have cassava and yam farms. But there is not enough land here." (FGD, Aspirational elite, May 2021)

"I have participated in several elite trainings but I don't have a plot to put my knowledge into practice." (FGD, Aspirational elite, May 2021)

Some Aspirational elite argued that it is not so much the lack of land that is the issue but rather the lack of laborers to work on their cocoa plantations. While Aspirational elite emphasize that they lack resources to hire laborers, both the Diversified HH and Cocoa-dependent HH report that no family labor is available as all their children are in school, which creates a shortage of labor. Young, single, and ambitious farmers argue that, if your land size is moderate (i.e. less than 3 ha), you can do most work yourself and only need extra pairs of hands to carry the pods during harvest. Some Cocoa-dependent HH who migrated from the center of Côte d'Ivoire experience a lack of social cohesion between community members with a different ethnic background, standing in the way of working more collectively.

"I know there is land available here for anyone who would like to get a plot for farming. Last time, an uncle of mine came here and he purchased a big land. The only issue is to get some people who will be available to work on the land." (FGD, Aspirational elite, May 2021)

"The problem with labor is the lack of money to pay the labor. Because if you have the money, you can easily get the labor." (FGD, Aspirational elite, May 2021)

"I know some people in this village who have a land of three hectares and they are working on this farm by themselves. The only one thing that they will solicit the help of people will be to carry the pods after harvest." (FGD, Young, single and ambitious farmers, May 2021)

"Because a farmer alone cannot maintain his plantation. So our families are the labor force for our plantations." (FGD, Aspirational elite, May 2021)

"We can't find youth because they all go to school so it's really difficult to get support in terms of labor in our fields." (FGD, Diversified households, May 2021)

"We also have labor problems. Because my children all go to school in town. I have no one in the village to help me clean my farm." (FGD, Cocoa-dependent households, May 2021)

"We want there to be an understanding between the farmers in this village. Because here, the Baoule and Dida farmers don't often get along. But when we get along, we can work together, we can go and work on each other's plantations so that they can make progress in cleaning up their plantations. But if we don't get along, we won't be able to work together, and that will slow down our work on our plantations." (FGD, Cocoa-dependent households, May 2021)

Access to training, inputs and equipment

Aspirational elite were appreciative about the training they received as elite farmers, but emphasized the need for more follow-up and coaching. Aspirational elite and the Young, single and ambitious farmers expressed the need for alternative income generation training, including a module on marketing of other crops and products. In addition, the Young, single and ambitious farmers indicate that they would benefit from a farmer business school training to encourage better financial planning. Female entrepreneurs indicate that for new income generating activities they would benefit from training/skills, for example on how to make soap.

"The training of elite farmers is an opportunity." [...] "But alongside these trainings, there is no follow-up."[...] "The agricultural technicians should visit our plantations to see the problems we encounter in our farms, they should visit our families to see the problems we encounter in order to give us advice." (FGD, Aspirational elite, May 2021)

"What is a problem is that we lack training on commercial activities about other crops besides cocoa such as maize." (FGD, Aspirational elite, May 2021)

"The training they give us is only focused on cocoa farming practices, cooperative partners, such as Nestlé could, for example, train us in [chicken] breeding techniques and trade in all areas." (FGD, Aspirational elite, May 2021)

"We would like to have a training for women on how to make local soap KABAKRO, which is used a lot in our households and we think that it is the most used soap in Côte d'Ivoire. So, if we have a training on how to make it we will be able to increase our income." (FGD, Female entrepreneurs, May 2021)

Most farmers consider the poor availability and affordability of inputs (e.g. fertilizer, pesticides, seedlings) and the lack of access to equipment to be a major problem. Cocoa-dependent HH and the Aspirational elite both emphasized the high cost of fertilizer as being problematic, which affects the amounts of fertilizer they are able to apply on their cocoa farm, influencing their productivity levels. Both the Young, single, and ambitious farmers and the Cocoa-dependent HH specifically mentioned they

lacked access to spraying machines to apply inputs on their farm when needed. The Young, single, and ambitious farmers and Female entrepreneurs added that a lack of processing equipment (e.g. for cassava and oil palm) was a big problem, constraining them in increasing their HH income (e.g. from selling Attieke and palm oil). Some of the Female entrepreneurs who manage alternative income generating activities said that they lacked equipment and wholesale opportunities to purchase materials at an affordable price in order to be competitive.

> *"We also have problems with fertilizer. Because we don't have money to buy the amount of fertilizer we need for our plantations."* (FGD, Cocoa-dependent households, May 2021)

> *"But the high cost of fertilizer prevents some farmers from getting fertilizer. This means that many farmers are unable to register with the cooperative to receive fertilizer to maintain their farms. And when it's like that, you can't increase your production and have more income."* (FGD, Aspirational elite, May 2021)

> *"There is also the lack of inputs. The first reason for this lack is because they're expensive and we don't have enough means for buying them. When I say inputs, I mean fertilizers, crop protection products, herbicides and others."* (FGD, Diversified households, May 2021)

> *"The inputs are unaffordable for us because we don't have means to purchase the inputs that we need."* (FGD, Diversified households, May 2021)

> *"We don't have machines to pump our plantations. At the moment I am alone, all my children are at school! I am old. I have no one to help me clean my plantations. So if I have the machine, I will be able to pump my cocoa farm to have a good production."* (FGD, Cocoa-dependent households, May 2021)

> *"There is a lack of cassava grinding and squeezing machines (for making Attieke)."* (FGD, Female entrepreneurs, May 2021)

> *"Processing cassava is a big problem because of lack of machines in this village. In the past, they were sufficient but the village has become big now."* (FGD, Female entrepreneurs, May 2021)

> *"There should be a sewing material shop in the village, it would be good because sometimes what we purchase is too expensive, even when we purchase it in this village, it is too expensive or when we travel to the city. For purchasing the materials that we need, it will become more expensive because of the transportation."* (FGD, Female entrepreneurs, May 2021)

In addition to enhancing access to physical inputs and equipment, Cocoa-dependent HH suggested that improving the extension services could help them adopt the correct cocoa farming practices. According to them, different organizations sometimes offer contradicting advice.

> *"We have a serious problem about finding the right product to protect our plants. For example, the fertilizers and the pesticides that we use, we use them because people say they are efficient for us to get a better yield. Later, another person will come and say 'no, use another one' so we don't know all these things. What we want is that we should get better information about which products to use to treat our farm. So, for Swollen Shoot for example, if we could have a good product that can allow us to make our cocoa trees resist to this disease, it would be good."* (FGD, Cocoa-dependent households, May 2021)

Poor infrastructure/access to markets

Poor roads are a problem for many farming HH, as they delay transportation from the farm to the village or market, resulting in the rotting of perishable products. Poor roads also add substantial costs to transportation. Transport itself (e.g., tricycles or trucks) is also lacking, and buying a motorbike is considered to be (too) expensive for most HH. Female HH explain that without transport they need to carry heavy loads from their farms to the village, which can be challenging.

> *"We have built bridges with wood ourselves. But these bridges don't hold. And it is often difficult to get our products out of our farms. We often have to travel several distances to find a good road before we can return to the village with our produce. And then we need motorbikes to transport our produce from the farm to the village, we don't have money to buy motorbikes."* (FGD, Aspirational elite, May 2021)

> *"We have problems with roads to transport our cocoa from the farm to the village. For example, we put boards to cross the shallow water that links our fields with the village. We often fall over with our bags of cocoa and our motorbikes because the roads are impassable."* (FGD, Cocoa-dependent households, May 2021)

> *"To transport our products from the VSLA, it is difficult. Often our produce rot. Whereas with a KIA truck, we can enjoy our activities. Also the secondary school for our children, it is complicated when they are assigned elsewhere."* (FGD, Female entrepreneurs, May 2021)

> *"There is a lack of tricycles because today we load all our crops on our heads to send to the village. It is very difficult."* (FGD, Female entrepreneurs, May 2021) *"-We want to have tricycles:*

The lack of (access to) running water is considered to be another major challenge. Cocoa-dependent HH argued this is a particular problem for women, as they are usually the ones tasked to fetch water. They have to walk long distances, losing a lot of time which could have been used more productively. Female entrepreneurs confirmed this problem.

> *"The problem that we have is about running water. We don't have taps here. Our wives will go and fetch water very far in addition to the work on the farm. That becomes too tiring for them. This village is very big and unfortunately the hydraulic pump that was made for the village is broken so, our wives have to go and fetch water maybe in the river or somewhere far from the village."* (FGD, Cocoa-dependent households, May 2021)

In relation to market access, Female entrepreneurs highlight that they find it challenging to sell their products for the right price, such as fabrics. They mention a lack of wholesale opportunities and materials in the villages, which makes their end product too expensive from the customers' perspective. They argue that the purchasing power of their local clients is too low, and fierce competition can force them to lower their prices.

"The prices set by the other tailors and us are not homogeneous [...] the raw materials that we purchase are very expensive." (FGD, Female entrepreneurs, May 2021)

"The expensiveness of the items we purchase. In fact, our clients complain about the price of our goods compared to the one of some of our competitors. However, our prices depend on the price set by our suppliers which are too high. We are sometimes obliged to sell without any margin if we don't want to lose our working capital." (FGD, Female entrepreneurs, May 2021)

"We face the problem of space for our market because the market is very small for trading and this encourages price discussions" (FGD, Female entrepreneurs, May 2021)

Pests, droughts and diseases

A number of external threats can affect cocoa production. Young, single, and ambitious farmers and Cocoa-dependent HH complained that viruses such as CSSVD and Black Pod affect farmers' yields. Droughts and/or heavy rainfall also cause problems. Cocoa-dependent HH indicated how drought has affected their cocoa yields. The Female entrepreneurs who set up a nursery indicated that droughts are damaging their seedlings.

"Because of that disease [CSSVD], I couldn't get money to support the education of my children. Two of them came back home because I could not finance their education." (FGD, Cocoa-dependent households, May 2021)

"Swollen Shoot disease is so terrible... In the past, there was enough land and people had less problems. Today, it is the contrary, this is why we can't be happy." (FGD, Cocoa-dependent households, May 2021)

"We also have problems with money to pay for our children's school. Because the cocoa doesn't produce enough as it used to because of the decrease in rainfall. So it is difficult for us to have enough money for our children's education." (FGD, Cocoa-dependent households, May 2021)

"The problem of drought makes us tired out of 100 cocoa plants planted. Only 30 manage to grow and until that succeeds well another 15 may die so if we have had too much it is 15 plants that succeed in the end." (FGD, Female entrepreneurs, May 2021)

Cost of living and emergencies

Education costs are a major expenditure, particularly when a HH has children in secondary school. Diversified HH, Cocoa-dependent HH, and Female entrepreneurs indicated this as being one of their most pressing concerns. Secondary schools are usually absent in the village, meaning children have to move to larger towns, where costs for rent and food are high(er). Insufficient means can prevent children from finishing the school year. An additional challenge is that households are required to paying school fees when there is little income derived from cocoa (i.e. not after a harvest period). This is a challenge, and one that is amplified further when payment for cocoa is delayed.

"We also have problems with money to pay for our children's education. This means that our children often do not finish the school year. Because we can't send them money to pay for their rent in the cities for their studies, we often can't send them money for food." (FGD, Cocoa-dependent households, May 2021)

"Currently, when they [children in city/secondary school] ask me to send them money, it can take two to three months before I send them money. Because I don't have enough right now." (FGD, Cocoa-dependent households, May 2021)

"The secondary school for our children, it is complicated when they are assigned elsewhere. Our expenses increase because we have to send them money to feed themselves and even pay for their houses. The expenses are enormous but if there is a secondary school here, they stay with us." (FGD, Female entrepreneurs, May 2021)

Some cost of living are unexpected, such as funerals and other life events, and usually involve high costs. Farming HH can feel socially pressured to take a loan to cover funeral costs, as traditionally the celebration of a funeral is big and costly. The Young, single and ambitious farmers argue that these funeral traditions should be changed as they pose huge costs and risks for farmers.

"Funerals are the main money eater of farmers. This tradition of spending huge amounts of money for the funerals should be changed." (FGD, Young, single, and ambitious farmers, May 2021)

"In our community, when there is a death, we give our plantations as collateral for taking a loan. When there is a funeral, the funeral lasts 2 weeks. During this period, you will spend much money buying food and drink for the people coming to soothe you." (FGD, Young, single, and ambitious farmers, May 2021)

"I am also happy when during the funeral, despite the struggle, I manage to raise the sum of 150,000 CFA francs or 200,000 CFA francs as my contribution to the organization of the funeral. I am respected when I manage to give this amount." (FGD, Cocoa-dependent household, May 2021)

Lack of healthcare

The Aspirational elite and Female entrepreneurs emphasize the lack of access to (affordable) healthcare, and farming HH often lack resources to pay for health costs. The former segment argue that good health is highly important in being able to undertake physical farm work. Female entrepreneurs highlight the importance of having access to an ambulance, particularly for pregnant women. According to them, without this type of health service, lives are lost for no reason.

"Our families are often sick because of the work in the fields. Health is important because when you are healthy, you can do your activities." (FGD, Aspirational elite, May 2021)

"When we women are pregnant and it is serious, there is no ambulance to take us. There have been deaths here that could have been avoided." (FGD, Female entrepreneurs, May 2021)

Table 28 provides a summary of 'pains'.

Table 28 Summary of 'pains'

	Aspirational elite	Young, single, and ambitious farmers	Diversified HH	Cocoa-dependent HH	Female entrepreneurs
Access to financial resources and services	• Lack of credit to maintain farm and/or trade.	• Lack of access to loans to start a business. • Using land as collateral for emergency loans poses the risk of losing your farm.	• Cocoa price is announced late and costs of cocoa production are high, making an economic analysis of cost-benefits challenging.	• Cocoa's return on investment is decreasing. • Lack of funding to financially empower women and to set up a business for spouses.	• Lack of financial means and working capital. • Women are considered less bankable than others.
Access to land and labor	• Lack of available farm land: Lack of land to put Elite training into practice, such as planting other crops. • Affordability of labor: Lack of funding to pay laborers.	• Lack of available land.	• Availability of labor: All their children are in school.	• Lack or resources to buy/rent/ sharecropping more cocoa land: This is particularly a problem for migrants. • Availability of labor: All their children are in school. • No exchange labor groups.	• Lack of available land or forest.
Access to training, inputs/equipment	• Lacking training on non-cocoa commercial activities. • Need for additional coaching/follow-up. • Affordability of fertilizer: Without fertilization, cocoa production and cocoa income remains low.	• Lack of equipment for cocoa and non-cocoa income sources: • No access to spraying machines, lack of processing equipment for cassava, oil palm. • Lack of affordable cocoa inputs, including fertilizer and crop protection products.	• Affordability of inputs.	• No access to spraying machines. • No money available to buy sufficient fertilizer.	• Lack of training in (some) alternative income generating activities. • Lack of inputs/equipment for nursery and other income generating activities. • Lack of processing equipment for cassava, oil palm. • Lack of wholesale opportunities in the village.
Access to markets/poor infrastructure	• Lack of transport: transporting products from the farm to the village is time-consuming and expensive.	• Lack of transport: transporting products from the farm to the village is time-consuming and expensive. • Lack of running water which redirects time away from income generating activities.	• Poor roads: Roads are in poor condition, which makes transport difficult. • Lack of electricity.	• Poor roads hinder cocoa transport. Lack of running water; women have to walk long distances to fetch it, requiring time that could otherwise have been invested in income-generating activities.	• Lack of rewarding market. • High level of competition with others. • Small village markets. • Poor roads/lack of transport • Carrying heavy loads from farm to village. • Lacking access to running water (need to walk long distances).
Pests, droughts, and diseases	-	• CSSVD, Black Pods, droughts affect cocoa yields.	-	• CSSVD. • Decrease in rainfall affects cocoa yields.	• Drought affects seedlings (nursery).
Costs of living and emergencies	-	• Unforeseen emergencies, such as funerals, traditionally involve high costs and can lead to risky loans.	• High education fees, particularly at the beginning of the academic year, when there is no income from cocoa available.	• Delay in cocoa payment to pay for school fees in time. • Lack of funding to pay for secondary school enrolment, including boarding costs.	• Lack of money to support children, for example, for competitions/exams. • No secondary school in village, this in combination with lack of transport results in children moving to towns. The cost of boarding are usually high.
Access to healthcare	• No money to pay for healthcare. • Poor health due to physical work on farm.	-	-	-	• No ambulance, which is a particular problem among pregnant women who need immediate care.

Pain relievers

In FGDs participants discussed potential solutions ('pain relievers') to their main challenges and identified stakeholders to be involved. In the next box we summarize the pain relievers. In Appendix 4 we present the complete list of suggestions by representatives of different HH segments.

Box 1 Summary of pain relievers

To address the lack of financial resources, the Young, single and ambitious farmers suggested a partnership between their cooperative and banks to provide them with favorable loans and highlighted the importance to promote savings at the right time (i.e. directly after the cocoa sales). This segment sees the cooperative as a key stakeholder to provide them with access to inputs (on credit). Diversified HH suggest independent microfinance institutions for farmers as alternative financial service provider. The Female entrepreneurs put emphasis on the role of women's associations or NGOs to support them with accessing (information on) loans and setting up saving groups, and they seem to have less trust in cooperatives to represent their interests. To address the lack of training, the Aspirational elite provide suggestions on how to improve elite training, putting emphasis on additional training modules and coaching. The Young, single and ambitious farmers suggest FBS training and training on alternative income generating activities as part of the regular NCP curriculum. Both the Young, single and ambitious farmers and Cocoa-dependent households see a role for public extension agents to provide accurate and timely advice on diseases and the use of inputs. For challenges related to infrastructure, HH segments emphasize the role of the (local) government on the construction of roads to facilitate transport and reduce costs of living. For challenges related to high HH expenditures, both the Cocoa-dependent HH, Diversified HH and Female entrepreneurs put emphasis on the education costs for children in secondary school and suggest banks can help setting up a school fund.

Conclusions

In this chapter, we presented a deep-dive into five high-potential segments based on qualitative data collection. This approach led to the following insights:

The identified high-potential HH segments represent HH who are in a different phase of life, for example the Young, single and ambitious farmers are relatively young and still single, while the majority of the Aspirational elite is slightly older, married and have young children. Both Diversified HH, Cocoa-dependent HH and Female entrepreneurs represent married HH with relatively more (and relatively older) children. To some extent these different 'life-stages' translate in different

aspirations, for example the Young, single and ambitious farmers aspire to earn enough money to build a house and start a family, while the Aspirational elite are already more established and aspire to strengthen their collaboration with their spouse to become successful as a couple.

Next to someone's life-stage, there are also other factors that influence segment-specific aspirations and needs, such as the level of education, land-size, dependency on cocoa, ethnicity and gender. Therefore, the HH segments should not be considered as sequential. Only for Young, single, and ambitious farmers, as look-a-likes of the Aspirational elite (both being relatively young, entrepreneurial and confident), we see potential for them to following in the footsteps of the Aspirational elite.

Most aspirations of the high-potential segments are in the economic sphere. Economic success is often put forward as a pre-condition for realizing other aspirations, such as social status and family aspirations. As the income earned from cocoa sales is not sufficient to cover the increasing costs of living all segments seem to aspire income diversification as pathway to increase their HH income. What the Young, single and ambitious farmers have in common with the Cocoa-dependent HH is that cocoa remains central in their income diversification strategy, while other HH are particularly interested in increasing their income through alternative income generating activities. Both the Aspirational elite, the Young, single and ambitious farmers and Female entrepreneurs indicated that they would benefit from additional training on income diversification and marketing.

Most segments lack access to financial services, and they often put this as one of their priority concerns, hindering them in achieving their ambitions. The Cocoa-dependent HH stress the need for formal loans from banks for making on-farm investments, while the Young, single and ambitious farmers prefer to make investments on the basis of savings, rather than taking out (risky) loans. The latter HH segment suggests to make FBS and financial planning part of the NCP training curriculum to promote savings.

Another major constraint are the high prices of cocoa inputs, particularly fertilizer. To support HH to access affordable inputs and increase their cocoa yields, the Cocoa-dependent HH, Diversified HH and the Young, single and ambitious farmers suggest that the cooperatives could provide inputs on credit.

The Young, single and ambitious farmers and the Female entrepreneurs face the problem of lacking access to processing equipment and machinery to increase their HH income. While the Young, single and ambitious farmers suggest that the cooperative could provide them with access to equipment, the Female entrepreneurs prefer support from women's associations, VSLAs and NGOs instead of cooperatives, by whom they don't necessarily feel represented.

Another major concern for HH with children in secondary school are the high education costs, including costs of boarding and food. Both the Cocoa-dependent HH, Diversified HH and Female entrepreneurs suggest banks could help setting up a school fund.

Finally, the poor infrastructure, including poor roads, small markets and a lack or running water, affect all HH, particularly female HH members, and increase their costs of living and affect their health. To improve the infrastructure the different HH segments agree that this is mainly a role for the (local) government.

7 Potential pathways towards achieving a living income

Introduction

This final chapter explores potential pathways towards achieving an LI per segment, providing details on recommended actions and their envisioned impacts. The starting point for each pathway is an understanding of segments' specific needs and aspirations, which helps identify a first entry point within Nestlé and/or its suppliers and implementing partners' sphere of influence. A process of incremental change is then anticipated to follow. Although there are limits to the extent Nestlé can control this rather iterative process, it can accelerate outcomes by 1) putting in place enabling factors and/or additional interventions and 2) being responsive to new needs and opportunities that derive over time.

We use the insights from previous chapters as input for the pathways. Table 29 provides a re-cap of the main determinants of farm performance and HH income, reflecting on the findings from Chapters 3, 4 and 6. In this table, we have listed potential interventions that are within Nestlé and its partners' sphere of influence – of which some already exist but can be optimized, while others might be new or in their pilot phase. These interventions contribute to sustainable intensification and/or income diversification, which are identified as the main intervention directions to achieving an LI. In the proposed pathways, we do not explore further structural-focused changes, such as land reforms or the introduction of effective supply management systems (in combination with price increases and/or sustainable intensification), as we instead **focus on proposed interventions at HH and community level**. Nonetheless, structural changes are highly necessary to lift a larger proportion of cocoa farming HH out of poverty[113]. In the last column of Table 29, we reflect on the relevance per high-potential segment.

[113]Van Vliet,J., Slingerland, M., Waarts, Y. & Giller, K. (2021) A Living Income for Cocoa Producers in Côte d'Ivoire and Ghana? Frontiers in Sustainable Food Systems. Available at: A Living Income for Cocoa Producers in Côte d'Ivoire and Ghana? (wur.nl)

Table 29 Key determinants of farm performance and HH income, promising interventions cand their relevance per segment

Factors and interventions	Effect on farm performance and HH income	Potential interventions	Relevance for each segment (not an exhaustive list)
HH size and composition	• The LI gap is calculated at HH level. • The cost of living is higher when there are more children to cater for, particularly when they are in secondary school. • More adult HH members do not necessarily increase income proportionally to the increase in the HH-adjusted LI benchmark. The probability of earning an LI is negatively correlated with the number of adults in the HH. • The number of children negatively correlates with income diversification and the probability of earning an LI (as they add to the cost of living but are not productive HH members). Childcare requires time and resources that could otherwise been directed towards income generating activities[114]. • Married (and co-habiting) couples get more cocoa out of a hectare than farmers who are single, divorced, or widowed. • Strong couples are reported to support more effective decision-making, HH expenditures, and planning, leading to higher HH production[115]. • Existing evidence shows that if women have more decision-making power in the HH, this influences HH investments. Women tend to prioritize their families' health, nutrition, and education when spending their own income[116].	• Training for couples (and other HH members that contribute to farming): promote the participation of co-farming spouses to existing training on GAP, income diversification, and financial planning. • Involve the co-farming spouse in drafting a Farm Development Plan (FDP). • Gender-sensitive couple training (develop a joint HH vision, financial planning, trust, decision-making) – building on existing tools, such as Gender Action Learning System (GALS). • 'School fund' or (timely) conditional cash transfer(s) to support school fees for children in secondary school[117]. • Timely payment of cocoa and/or premium to avoid HH needing to take out an unfavorable loan to pay for education of children. • Information/module on Family planning and Sexual and Reproductive Health Services (SRHS) to improve HH decision-making on family size.	• Diversified, Cocoa-dependent, Aspirational elite, and Female entrepreneurs are usually married or co-habiting and would benefit from training for couples. • Diversified and Cocoa-dependent HH tend to have larger HH size, and are more likely to have more children in secondary schools and would benefit from 'School fund'. • Young, single, and ambitious and Aspirational elite are likely to benefit most directly from access to SRHS and family planning (being single or 'younger' couples).
Access to labor	• Married couples spend less on hired labor and is an effective way to pool labor. • Having sharecroppers on cocoa land reduces labor costs (per ha). • Labor costs are correlated with fertilizer application and pruning, which are considered more labor-intensive activities. • Labor costs positively correlate with input costs, suggesting that labor is needed to apply inputs. • On a relatively small farm (less than 2 or 3 ha), HH labor is reported as seeming sufficient for cocoa farming.	• Skilled pruning gangs equipped with labor saving devices (e.g. motorized pruner). • Setting up a farm labor service group[118] to help cocoa farming families to optimize yields. This would enable them to allocate HH labor towards alternative income sources. • A targeted pilot program for the training of sharecroppers/laborers to assist HH in increasing their yields (and at the same time increase the income of these laborers). Skilled laborers might be more expensive to hire, but will also contribute to higher productivity (i.e. return on investment). • Investments in childcare, labor-saving devices, and running water will support women in reallocating non-paid HH labor to paid or income generating labor.	• Due to their limited land-size, Young, single, and ambitious can participate as paid laborers in pruning gangs and groups offering farm management services. • Diversified, Cocoa-dependent, and Female entrepreneurs lack access to affordable labor and could benefit from labor services. • Cocoa-dependent HH and Female entrepreneurs make relatively more use of sharecroppers, and could benefit from a trained labor force. • Spouses of Aspirational elite and Diversified HH, and Female entrepreneurs are particularly more likely to benefit from childcare and/or labor saving devices and running water.
Internal locus of control	• Internal locus of control correlates positively with input use, cocoa income, and total HH income. • The relation between income, production and internal locus of control is endogenous: higher income and productivity levels can also lead to a higher internal locus of control. • Adding soft skills training (i.e., non-cognitive skills like leadership training, (financial) planning, and communication training to stimulate perseverance, long-term orientation/time preference, and self-esteem) to more conventional technical programs aimed at increasing technology adoption, could yield great potential to substantially increase cocoa net income[119].	• Introduce a soft skills (non-cognitive skills) module as part of the agricultural trainings and farm business schools. Soft skills enhance preferences which lead to action, and therefore serve as a pre-condition for the adoption of modern technologies. • Introduce soft skills training as part of VSLAs to enhance the success rate of loans and investments.	• All HH segments would benefit from financial planning skills. • Young, single and ambitious and the Aspirational elite would benefit most from acquiring leadership skills. • Female entrepreneurs would benefit from acquiring more self-esteem and leadership skills.

[114] This holds particularly for younger women who recently started their own household. See Westeneng, J., and D'Exelle, B. (2011). 'The influence of fertility and household composition on female labor supply: Evidence from panel data on Tanzania.' Available at https://ueaeprints.uea.ac.uk/id/eprint/25749/1/WP29.pdf.

[115] This is also supported by extensive literature. See Doss, C. (2013) 'Intrahousehold bargaining and resource allocation in developing countries.' Available at: https://documents1.worldbank.org/curated/en/935701488194125819/pdf/Special-issue-on-gender-equality-and-development.pdf#page=56.

[116] World Cocoa Foundation. (2019). 'Gender Integration Guidance Note'. Available at https://www.worldcocoafoundation.org/wp-content/uploads/2019/04/WCF-Gender-Integration-Guidance-Note-Final_pub.pdf

[117] Digital Credit Helping to Put Kids in Classrooms in Côte d'Ivoire (cgap.org)

[118] See for example https://emfedfarms.com/about-us/

[119] Several studies show the role of non-cognitive skills in agriculture. See Montalvao, Frese, Goldstein, Kilic and Frese (2017). 'Soft skills for hard constraints: Evidence from high-achieving female farmers'. Available at: https://documents1.worldbank.org/curated/en/938611496941808624/pdf/Soft-skills-for-hard-constraints-evidence-from-high-achieving-female-farmers.pdf.

Access to productive land	• Productive cocoa land remains one of the most important determinants of cocoa net income[120].	• Access to sustainable finance (savings and long-term loans) for rehabilitation/rejuvenation and to cover long-term grace period of multiple years while upholding a smallholder's livelihood. Finance for rehabilitation/rejuvenation can also be organized at cooperative level if the organizational infrastructure is considered sufficiently robust. • Financial incentive payments for rehabilitation/rejuvenation (e.g., conditional cash transfers/premium). • Setting up farmer service groups (e.g. via the cooperative structure) that deliver rehabilitation/rejuvenation services. • Promote/incentivize new land tenure agreements to break through customary tenure arrangements that are barriers to cocoa farm rehabilitation. • Promote/incentivize land tenure agreements to improve land access and ownership for sharecroppers and youth.	• The cocoa trees of Cocoa-dependent HH are relatively old and they would benefit most from subsidized rehabilitation/rejuvenation. • Cocoa-dependent HH have relatively high costs of living and find it more difficult to save, which makes it difficult for them to finance rehabilitation/rejuvenation by themselves. • In particular, Young, single, and ambitious and Aspirational elite lack access to land to expand cocoa production and invest in alternative crops. This while both segments have the strength, skills and motivation to work hard. • Migrant HH, which seem over-represented in Cocoa-dependent HH have relatively more difficulty in acquiring land and/or access favorable land tenure arrangements.
Access to inputs	• Agricultural practices, such as fertilizer application, pruning, weeding, and shade trees, all are likely to have a positive effect on cocoa yields. • Input costs have a strong positive correlation with gross cocoa revenue (per ha and in absolute terms) and cocoa yields. Although endogenous (i.e., higher cocoa revenue allows buying more inputs), this relationship demonstrates that investing in the cocoa farm results in higher production and revenue.	• Sustainable intensification of cocoa production: GAP training and intensive coaching of elite farmers to stimulate knowledge on input use and promote their correct application, enabling elite farmers to function as lighthouses for other farmers. • Improved access to affordable (and high-quality) inputs, shade trees, and labor to apply inputs, including spraying machines. • Access to sustainable finance (savings and loans) for application of inputs (e.g., cash transfers or in-kind delivery of loan/inputs on credit). • Leverage input suppliers/agri-businesses to provide after-sales-support and training on inputs acquired (e.g., fertilizer, pesticide). • Incentives for planting shade trees (e.g., incentive payment for environmental services/conditional cash transfers).	• Young, single, and ambitious and Cocoa-dependent HH depend highly on cocoa for generating an income but poor access to finance (as they are not considered 'bankable') to make the required on-farm investments. They would benefit from arrangements with the cooperative (e.g. inputs on credits and access to spraying machines).
Income diversification	• Farming HH that are less reliant on cocoa sales for their total income have higher total incomes. • Couples and HH with more adult members have more income sources. • Access to financial services (e.g., bank account) correlates negatively with dependence on cocoa sales, while savings correlate positively with income diversification.	• Income diversification training on- and off-farm for couples (and other HH members that contribute to farming), followed up with coaching, allows for a more optimal allocation of labor. • Commercial training for non-cocoa products for couples (and other HH members that contribute to farming). • Access to processing equipment (provided by the cooperative and/or women's association), including a process in place that facilitates good governance/maintenance. • Wholesale stores in communities to reduce costs for purchase inputs/raw materials/ingredients (e.g., for fishponds, fabrics, construction). • Access to market linkages for selling non-cocoa crops/food. • (Affordable) transport services for trading produce. • Access to savings (VSLA) in combination with seed money and business plan. • (Conditional) cash transfers to provide incentives and start-up capital to explore on- and off-farm income diversification, thus reducing entrepreneurial risk for HH.	• All segments would benefit from income diversification and better transport (or better roads) to bring their products from farm to market. • Cocoa-dependent HH would benefit most from intercropping with cocoa and learning more about income-generating activities in the cocoa off-season. • Diversified HH tend to focus more on additional cash crops, and would benefit from improved access to markets. • Young, single and ambitious farmers and Female entrepreneurs would benefit most from access to processing equipment and machinery. • Aspirational elite and Young, single, and ambitious farmers tend to invest in both cash crops and non-cocoa activities. They would benefit most from commercial training/skills on off-farm economic activities. • Female entrepreneurs and diversified HH would particularly benefit from wholesale opportunities closer to their homes. • Diversified HH, Aspirational elite, Young, single, and ambitious, and Female entrepreneurs would benefit from access to seed money and support with business plans.
Access to finance	• Farming HH with access to a bank account apply fertilizer on a higher percentage of cocoa land than HH without access. • We find a positive correlation between the amount of money borrowed and fertilizer application. • Access to finance correlates negatively with dependence on cocoa sales for income.	• Distribution of more transparent information on financial services. • Access should be sustainable: involving technical assistance to farming HH, and more customized services, like in-kind delivery or mobile transactions, to limit transaction costs. • Provision of input finance, such as fertilizer on credit scheme (in-kind loans). • Mobile money to promote financial discipline and savings. • Facilitate access to bank accounts. • Savings groups. • Promote crop insurance to safeguard against price volatility and exogenous weather shocks. • Financial planning for couples and business skills, followed up by (financial) coaches. • Access to soft loans and seed money. • Timely payment of cocoa. • (Unconditional) cash transfers.	• Female entrepreneurs lack access to information on loans and are perceived to be less bankable. • Mobile money is particularly attractive to Aspirational elite and Young, single, and ambitious, and helps facilitate savings. The other segments seem hesitant as they prefer to have money in their pockets and/or fear that the money is not available when they need it. • Female entrepreneurs (often partners of male cooperative farmers) are usually targeted by VSLAs. • Couples potentially benefit from joint financial planning and a shared vision, under the condition that there is a sufficient level of trust within the HH. • For Cocoa-dependent HH, the timely payment of cocoa money is crucial to avoid that they become (further) indebted. • Unconditional cash transfers have proven to be successful for more vulnerable HH[121]. It is assumed that conditional cash transfers can help stimulate behavioral change and avoid debts (if handed out in smart way).

[120] Although not part of our analysis, land fragmentation remains one of the most pressing issues for smallholders in sub-Saharan Africa. Many, especially poorer, households have land sizes too small to earn a decent income from cocoa and other on-farm income sources. Therefore, in the long-term, better land governance policies are needed to address fragmentation (also see Waarts, Y.R., et al. (2021). 'Multiple pathways towards achieving a living income for different types of smallholder tree-crop commodity farmers'. Available at: https://link.springer.com/content/pdf/10.1007/s12571-021-01220-5.pdf

[121] Social protection and cash transfers Source: https://www.unicef-irc.org/research/social-protection-cash-transfers/

Pathways for selected HH segments

In this section, we explore potential pathways for each 'high potential' segment, which are tailored to their reported aspirations, challenges and opportunities and correspond with their life-stage. These pathways are not full, chronological blueprints for reaching an LI, but instead aim to inspire Nestlé and its partners in developing a more tailored approach that enable cocoa farming HH to achieve an LI. These pathways do also not intend to replace the currently implemented NCP interventions, but are instead meant to bridge the gap between available services offered on the one hand, and needs and demand of farming HH on the other hand.

For each high-potential segment, we identify different 'entry-points' that are likely to function as an LI accelerator if enabling factors are put in place. Entry-points are defined as initial, practical avenues that provide a first self-evident opportunity to start exploring how existing and newly-proposed interventions can be best tailored towards the segments. They should not, however, been considered as pre-defined points of interventions, excluding the relevance of other promising support services.

Pathway for Aspirational elite farmer

Aspirational elite comprise a small part of the Elite Farmer program. They are relatively young, have an entrepreneurial attitude, and eager to make something of their lives. They already produce relatively high yields (between 700 and 800 kg/ha) but, due to their small land size (<3 ha), do not earn sufficient income from cocoa and therefore remain relatively poor.

The vast majority of Aspirational elite farmers have their own nuclear HH (i.e., are married or living together with a spouse). As part of the Elite training, Aspirational elite have participated in training on HH management, which is frequently been reported to be an eye-opener with regards to the value of developing a shared goal and the benefits of working together as a couple. Therefore, strengthening their performance as a joint HH is a potential **entry point (1)** to effectively pool labor and resources and to enable them to make well-informed, joint HH decisions on the allocation of time, investments, and expenditures. This is anticipated to result in more bargaining power of the spouse, more involvement of the spouse in income generating activities (which results in higher HH incomes), more HH savings, and more effective expenditure allocation that would benefit the entire HH (i.e., education, health and nutrition, and reinvesting income into productive means). Moreover, a joint HH income plan is anticipated to result in a more optimal allocation of HH labor across different income sources.

"My wife and I have the same goal. And because of that, we save every month to be able to build our house one day". (FGD, Aspirational elite, May 2021)

Strengthening elite couple's performance could be activated through the Elite Farmer program. Aspirational elite can be offered the opportunity to invite their spouse (and/or other productive adult HH members) to the Elite refresher training, and additional HH management modules could be provided to couples to help them develop a joint vision and build trust. Achieving a successful follow-up of the existing modules would require the support of well-trained gender-sensitive coaches, which underlines the need for additional gender training for trainers and coaches. Furthermore, the outcome of a joint HH management module is anticipated to be further accelerated by a training module on soft skills development to stimulate the non-cognitive skills of the spouse in particular.

In more practical terms, such an approach can be piloted by taking inventory among the Aspirational elite to capture their interest in involving their spouse. Moreover, several existing tools are available to develop a joint HH vision and implementation plan. For example. the Gender Action Learning System (GALS) has already been widely tested and accepted, while other tools have proven their merit[122].

A potential spin-off of a more integrated HH approach for Aspirational elite farmers, which bears relevance to Nestlé and its partners, is the creation of a local pool of male and female ambassadors taking on the role of lighthouses for other farmers and couples – willing to test innovations and new approaches while distributing knowledge on agricultural technologies to others in the community. Such role models have been shown to lead to spill-over effects to others who have not participated in the program, conditional on bearing strong similarities with like-minded individuals in their community. Consequently, the impact of the program has potential to expand beyond its participants.

A second **entry point (2)** for the Aspirational elite segment emphasizes the need for an integrated Elite refresher training on the commercialization of non-cocoa crops and products/services, while simultaneously supporting Aspirational elite HH in establishing linkages with peri-urban markets. Aspirational elite have limited available land, which automatically limits the possibilities of on-farm diversification. However, as they are relatively highly educated in comparison to other cocoa farmers, they are more likely to engage in attractive off-farm activities with higher returns. Such an integrated diversification training would assist the Aspirational elite in benefitting more from other sources of income for a prolonged period of time, and not just resort to increased cocoa cultivation (as the most profitable crop) when markets are less supportive. Figure 26 envisions a potential pathway for Aspirational elite.

"What is a problem is that we lack training on commercial activities about other crops besides cocoa such as maize" (FGD, Aspirational elite, May 2021)

[122]https://www.care.org/wp-content/uploads/2020/05/FFBS_4_Gender_Tools.pdf

Figure 26 Potential pathway for Aspirational elite

Pathway for Young, single and ambitious farmers

The Young, single, and ambitious segment forms between 10-20% of the NCP farmer's population. They are usually male and relatively young (~45 years), are relatively high(er) educated, have an entrepreneurial attitude, and are eager to achieve financial success before 'settling down' and starting their own family. They produce relatively low yields (~375-525 kg/ha) and their land-size is generally small. This group relies largely on cocoa sales for income, which is generally low. Consequently, they are amongst the poorest cocoa farming HH.

Although the farming HH in this segment belong to the poorest HH, this segment is still considered to be high potential, as these relatively young men demonstrate motivation, perseverance, and a stronger belief that they are in control of their lives. They also tend to be rather strategic in the livelihoods decisions that they make. To some extent, they are the younger 'look-a-likes' of the Aspirational elite farmers (but in an earlier life-stage). However, these relatively young farmers report lacking access to resources and/or knowledge required to implement their strategies. This segment tends to consider growing cocoa as a stepping stone to other income generating activities:

> *"I do not plan to stop working on my cocoa plantations. On the contrary, I want to increase the area of my plots. Because with the cocoa money, I want to build a large store selling cosmetics. Because here, the city is growing. So I can do this business in addition to my cocoa plantations, and the hair salon that I want to open. The money that I will have from these activities, will allow me to build several houses in the form of a city for each member of my family. I will also build a large house for myself."* (FGD, Young, single, and ambitious farmers, May 2021)

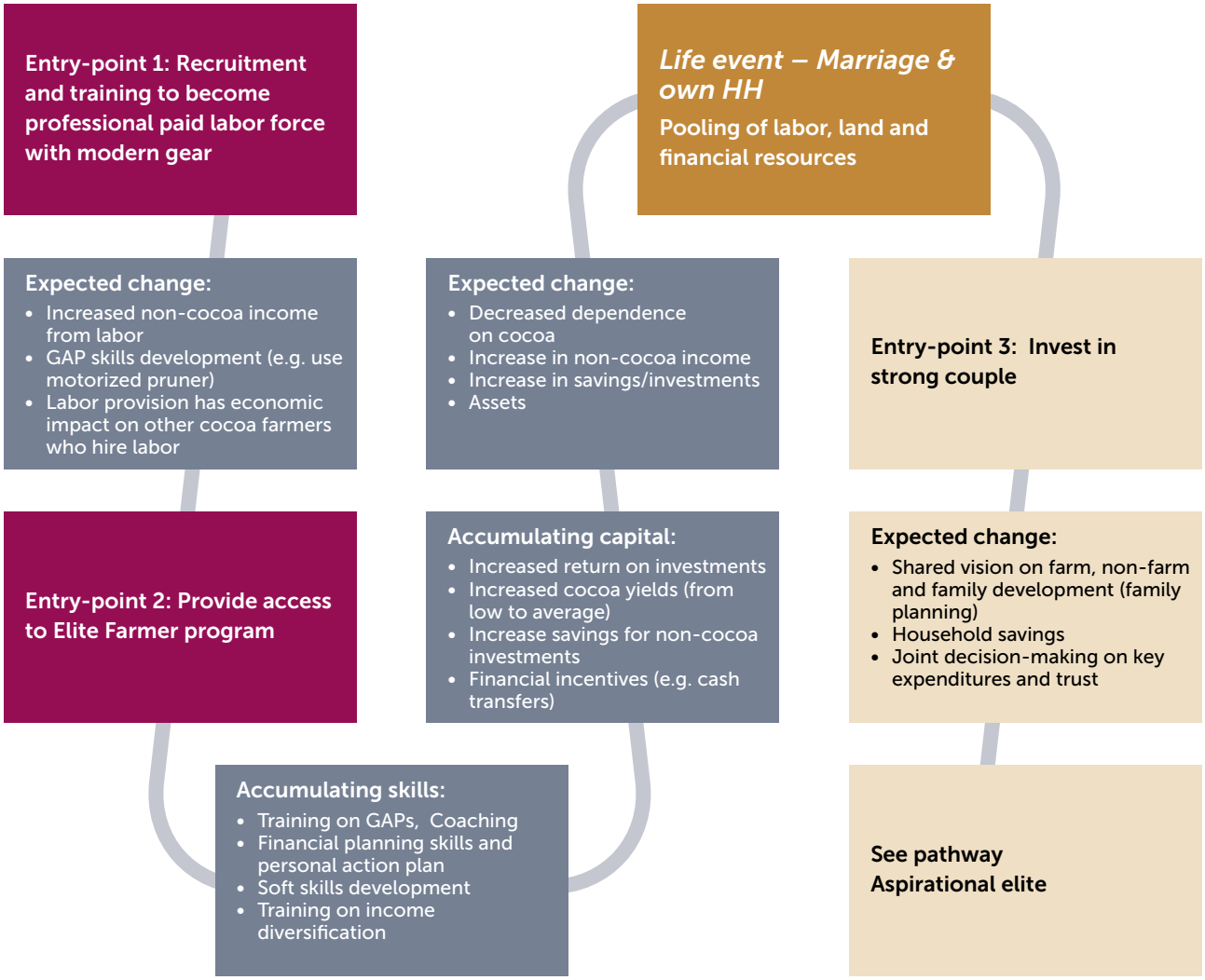
Exemplary about this segment is that they exert solidarity towards each other and share labor, serving as a pool of resources on which they can rely. As their cocoa plantations are rather limited in size, they are often with time left to assist others if necessary. This network of solidarity, in combination with a willingness to assist, means these men are also well-positioned to provide skilled, paid labor to other farmers if trained well. Therefore, a potential **entry point (1)** for Nestlé and its suppliers might be to recruit young ambitious men as preferred candidates for pruning gangs and farm labor services groups. This could also be activated by cooperatives. Specialized training on GAPs is considered to be highly effective, given these farmers' relatively high education levels and non-cognitive skills – resulting in a highly-skilled workforce which can be organized at cooperative level. This farm support group, especially when provided with modern equipment, holds strong potential to increase the cocoa productivity of farming HH struggling with labor due to larger plots of cocoa land. Although better skilled laborers will be more expensive to hire, their contribution to higher productivity levels are anticipated to outperform the increase in labor costs.

A second **entry point (2)** emphasizes the potential to select this group of Young, single and ambitious farmers as a new cohort for the Elite Farmer program. Based on the lessons learnt from this program (presented in the third chapter of this study), financial planning skills and an FDP will likely enable them to make better informed, strategic choices; while, at the same time, increasing their technical agricultural knowledge of GAPs and modern cocoa farm technologies. Additional modules can be further tailored towards this segment, including 'soft skills' development (e.g., communication, planning and leadership skills, but also life skills such as HH decision-making and gender-sensitivity training when starting a nuclear HH). Monetary resources are needed to further develop their plantations, primarily to acquire inputs. Young, single, and ambitious farmers put emphasis on their preference for savings and investments, especially following cocoa sales, rather than taking out a (risky) loan. Financial planning skills and mobile money will likely help to promote savings. Conditional cash transfers, in-kind delivery, or input credit schemes are additional alternative financial incentives that might help this segment to access finance. Combined with the anticipated income from labor, savings and access to finance might enable them to break through the structural poverty barriers and allow them to make the necessary investments to execute their planned farm improvements and/or acquire the necessary inputs to gradually increase on-farm productivity and cocoa income. Cocoa profits could be reinvested in additional income generating activities and help to further increase their HH income.

A third **entry point (3)** emerges when the high value that is traditionally placed on young and single farmers to create a nuclear HH in an early life-stage culminates in marriage. In Nestlé's Elite refresher training, this potential new cohort might be given the option to invite their spouse and follow the pathway that is proposed for the Aspirational elite in their first entry-point. Starting an own HH will increase the cost of living, but also leads to the pooling of labor and resources which can further augment HH productivity and resilience through income diversification. A gender-sensitive HH approach can accelerate that development. A potential pathway for Young, single, and ambitious cocoa farmers is visualized in Figure 27.

> *"We also feel that we are getting married tomorrow, we will be even more boosted and energized by our family, because well-being is important to you. If we are still single, it is not because it is our choice. We don't want to take a wife when we ourselves have problems. We don't want to make our wives and children suffer. That's why we decided to wait until we could afford it before we get married."* (FGD, Young, single, and ambitious farmers, May 2021)

Figure 27 Potential pathway for the Young, single, and ambitious cocoa farmer



Pathway for Diversified HH

Diversified HH comprise between 15-30% of the NCP population. They are middle-aged (between late 40-55 years), married, and have a relatively large HH (4+ children). Their cocoa yields are average (between ~400-600 kg/ha) and, compared to other segments, they invest relatively more in non-cocoa income activities. In addition to their cocoa plot, they have access to land suitable for cultivating other crops. Their income from cocoa is average (gross income is estimated to be between US$1500-3500), but their total HH income is relatively high compared to others.

As the segment name suggests, Diversified HH have a high(er) level of income diversification compared to others. This is mainly achieved via non-cocoa crops, including crops suitable for intercropping with cocoa, such as cassava, and 'competing cash crops', such as rubber and coffee. The qualitative data collected on aspirations suggest that, in addition to their current cocoa income, Diversified HH aspire to derive a large proportion of their total income from alternative non-cocoa sources. They display eagerness to try-out new income generating opportunities, such as poultry farming, setting up a shop/store, or investing in real estate. As those in this segment are wealthier cocoa farming HH, they are more likely to have access to (formal) financial services. They also have better opportunities to diversify their income, as they have access to larger plots of land compared to the other segments identified. However, achieving their aspirations remains challenging, as they often report lacking more advanced business skills and/or the right formation. Moreover, they comprise a large nuclear family, which increases the cost of living and usually puts a double burden on the spouse, who is traditionally expected to take care of both the children and HH tasks. It is widely-accepted that such demands often put a limit on the amount of time and resources a caretaker can commit to other income-generating activities, even if these are around the house.

> *"Right now I have a store selling cement, sheet metal, and tiles, in fact in my store I sell everything that can build a house. And all these goods are doing very well now. Because there is gold panning here, and people take advantage of it to build their houses. So, I know that if I have 3 more stores selling house building materials, I would have a lot of money to live in peace. Because if you don't have a lot of money, you're not at peace. Because you know you have expenses to make."* (FGD, Diversified households, May 2021)

For this segment, a first practical **entry point (1)** constitutes of a diagnosis/screening of the HH income and income-generating activities, as part of an FDP, to assist in developing a joint HH income generation plan and prioritize HH investments towards implementation. To optimize and enhance their existing sources, advanced training on income diversification, with specific attention to market information and business skills development, is highly recommended. Follow-up coaching is anticipated to work as an accelerator, supporting them to correctly incorporate newly-developed skills into their existing income-generating activities (**entry point 2**).

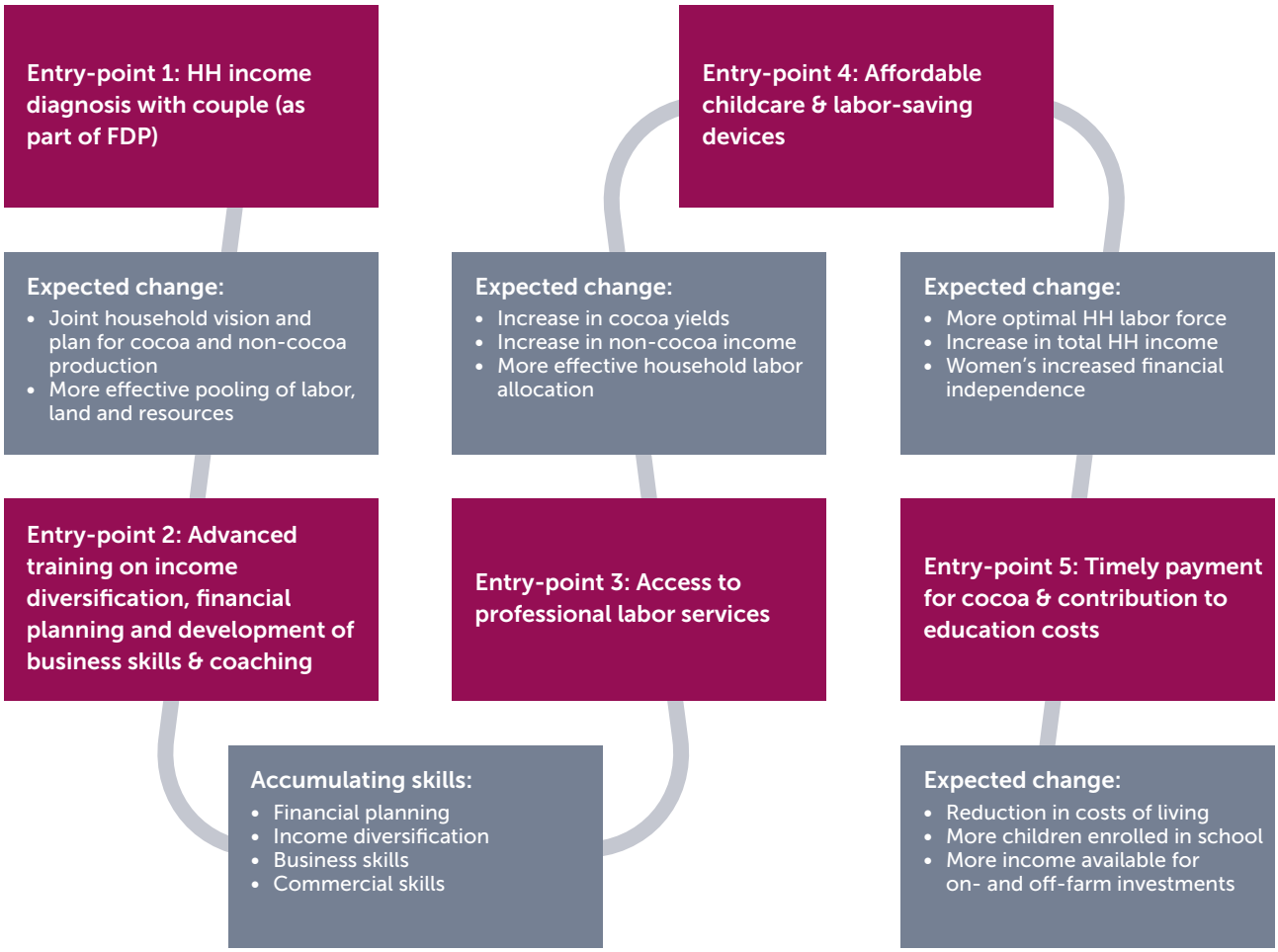
The multitude of income generating activities requires an efficient allocation of HH labor. The income diagnosis proposed in the first entry point provides insights into how to optimize HH labor allocation, and for which activities additional (hired) labor is needed. Especially with regards to more labor-intensive, on-farm activities, access to centrally coordinated professional labor services ('Young, single, and ambitious labor force', **(entry point 3)** might support the more efficient allocation of HH labor to alternative income generating activities, while still maintaining their cocoa farm to ensure adequate production levels. Although hiring a skilled labor force will add to the cost of cocoa production, the increased productivity resulting from this is envisioned to deliver a comfortable return on investment. The cooperative can function as central vehicle for coordination and brokering, efficiently linking HH requiring affordable, skilled labor with a labor force that is well-trained to ensure increased productivity levels.

Fourth, as stated above, larger nuclear families often put a burden on women, as they demand time and resources for childcare and HH tasks. However, the results presented in Chapter 4 of this study suggest the availability of HH labor increases farm productivity and income levels, as spousal participation in HH income-generating activities adds to the existing pool of labor. At the same time, childcare correlates negatively with income diversification. As such, investing in (affordable) childcare and HH labor-saving devices (including amenities such as access to running water) is considered an impactful intervention **(entry point 4)** that is known to liberate married women from demanding care work tasks. In turn, this support is anticipated to increase their labor-force participation and enhance their economic empowerment. Practical interventions to increase the uptake of HH labor-saving devices include stimulating the commercial distribution of improved cook stoves, which also have potential to decrease the risk of deforestation as they require less biofuel (thus lowering HH fuel expenditures) and have health benefits. Women's associations or NGOs could support Nestlé with the introduction and distribution of labor-saving devices.

Finally, Diversified HH can benefit from timely cocoa payments to pay for school fees, timely contributions to school fees (especially those for secondary education) and measures to reduce distances to secondary schools, which would make costly boarding less necessary. Secondary schools are usually absent in rural communities, meaning children have to move to larger towns where costs for rent and food are higher. Insufficient means can prevent the child from finishing the school year or put those who remain at risk. In the needs assessment, HH mentioned 'school funds' as a relevant initiative that they would likely benefit from **(entry point 5)**, referring to Advans' digital savings products[123].

[123]Digital Credit Helping to Put Kids in Classrooms in Côte d'Ivoire (cgap.org)

Figure 28 Potential pathway for Diversified HH



Pathway for Cocoa-dependent HH

Cocoa-dependent HH are the largest segment identified, making up between 30-50% of the NCP population. On average, their HH head is middle-aged (45-50 years old), married, and often uneducated. They are, however, highly experienced in cultivating cocoa. Their average cocoa yield differs (large within-group variation), ranging from low to relatively high (between ~350-650 kg/ha), and they rely greatly on cocoa sales for their total income, which implies that they have a low level of income diversification. Their gross income from cocoa tends to be relatively high (between US$1500-3000), but their average HH income remains average at best.

In general, Cocoa-dependent HH are dedicated to cultivating cocoa. However, despite their extensive cocoa experience, they are not always able to produce high yields – and some argue that price fluctuations, high input costs, pests, diseases, and climate change all make it increasingly difficult to create a living out of cocoa sales. Cocoa-dependent HH have a low-to-average level of income diversification and tend to produce only a few non-cocoa crops. Consequently, they are likely to spend part of their income on food crops, while they could intercrop some of these (such as cassava, plantain, and pineapple) with cocoa. The HH in this group who already diversify their income

sources can benefit from gaining knowledge on how to commercialize their food crops and gain access to (urban) markets. A lack of education and a dominant sentiment that 'cocoa is all they know' are the main challenges facing this segment. Furthermore, their relatively large HH and the corresponding high costs of living hinder them in putting a share of their income aside for savings, investments and emergencies.

> *"Because the money I earn [with cocoa] now cannot cover all my expenses. And life is getting more and more expensive. So I see that I have to prepare myself to have other sources of income if I don't want my family to suffer."* (FGD, Cocoa-dependent households, May 2021)

To support this segment, a first **entry point (1)** could be to invite both spouses in the HH (and other productive adult HH members) to receive training on on-farm income diversification. Due to their high dependence on cocoa sales for income, resilience levels to deal with shocks (like changes in weather or price volatility) remain low, leaving them with few strategies to adapt to changing circumstances. Furthermore, a lack of crop diversification is likely to impact food security and dietary diversity, especially with their relatively large(r) nuclear families. To best tailor such on-farm diversification training, a specific focus is required on intercropping and economic activities that demand labor (and provide an economic return) outside the main cocoa season, which is the period when HH needs (in terms of lack of sustainable income streams and food security) are highest and when more HH labor is available.

The second entry-point is connected to the first, and proposes that this segment can benefit from basic financial planning and trading skills being integrated into a follow-up training module and coaching – as this would enhance their access to local markets at which to sell crops that arise from intercropping (**entry point 2**). As spouses are usually heavily involved in the production and trade of food crops, we recommend that both trainings are offered to both spouses (and possibly other productive adults living in the same HH) to optimize the distribution of income diversification across the HH and optimize HH labor allocation. Altogether, due to the size of the segment, this has the potential to generate increased rural economic development outside the main cocoa season.

Third, given that this segment is among the poorest in terms of total HH income and also the least diversified, HH can benefit from financial incentives (e.g., cash transfers) that allow them to make timely, more substantial on-farm investments for both cocoa and non-cocoa activities (**entry point 3**). Farming HH in this segment indicate that saving money to reinvest in productive means or deal with emergencies remains one of their main challenges. Access to (formal) finance remains low for this group, emphasizing that more innovative and sustainable financial services and packages need to be developed. These can range from combinations of in-kind delivery or input credit schemes, to loans that should be offered in combination with technical assistance on how best to invest them. In addition, sustainable crop insurance (under advantageous

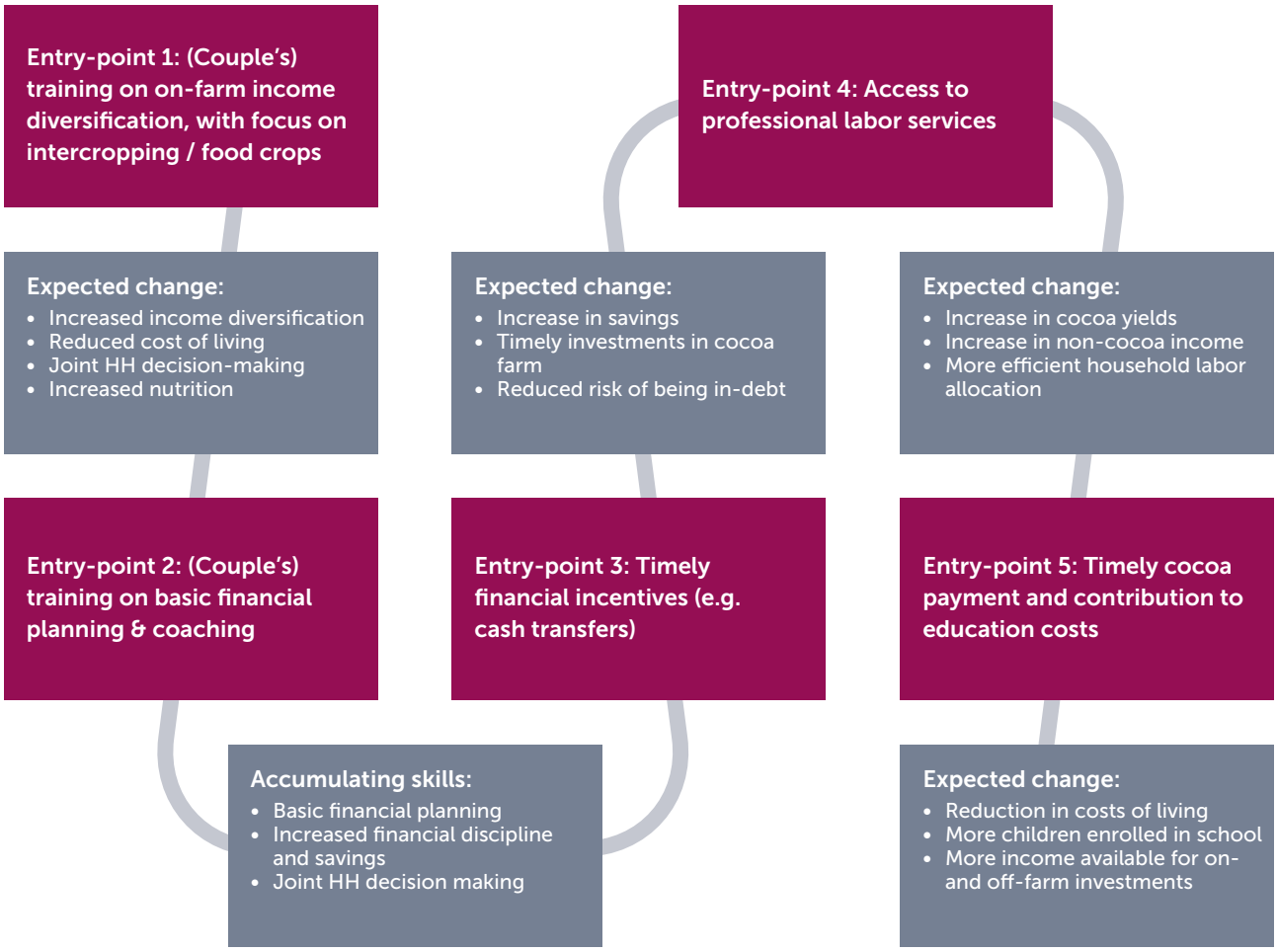
conditions) seems very relevant for this group, as they depend to a high extent on only one crop[124]. HH members can also be encouraged to join a VSLA.

Furthermore, similar to the Diversified HH segment, Cocoa-dependent HH report struggling with hiring affordable labor to increase farm productivity. This suggests they would also benefit from professional labor services, such as skilled pruning gangs (**entry point 4**). Although the labor costs would be relatively higher for this segment, farm productivity would proportionally increase.

Lastly, similar as the Diversified HH, they too would benefit from timely payment for their cocoa and a sustainable contribution to the education costs of their children (**entry point 5**) through a school fund or a cash transfer conditional on school enrolment. A pathway for cocoa-dependent HH is visualized in Figure 29.

> *"We also have problems with money to pay for our children's education. This means that our children often do not finish the school year. Because we can't send them money to pay for their rent in the cities for their studies, we often can't send them money for food."* (FGD, Cocoa-dependent households, May 2021)

Figure 29 Potential pathway for Cocoa-dependent HH



[124]Afotey Anang, S., Nakuja, T., and Sarpong, A. (2020). *Willingness of cocoa farmers to participate in crop insurance in the Dormaa Municipality of the Bono region*. Ghana Department of Agricultural Economics, Agribusiness and Extension, University of Energy and Natural Resources, Sunyani, Ghana. Journal of Development and Agricultural Economics. Vol. 13(1), pp. 45-55, January-March 2021. Available at: 247cec8693b4c4fb977e0907c41b8a142b67.pdf (semanticscholar.org)

Pathway for Female entrepreneurs

The women in this segment are relatively young (35-40 years old) and more entrepreneurial, and often married to NCP cocoa farmers. They are generally motivated to becoming successful in business and financially independent, demonstrating their high potential.

The women belonging to this segment bear similarities to the spouses of the farmers in other segments. However, in contrast to the latter, they already participate in an income-generating activity (in which their spouse is often not involved in) and/or VSLA groups, initiated by Nestlé or partners. What typifies them is that they operate a business by themselves (or in a group of women), often allowing them to keep the proceedings for their own personal needs. They also differ from the 'Female farmers' identified in the cluster analyses in Chapter 5 of this study, as the Female farmers are often more engaged in cocoa farming, older, widowed or divorced, with limited access to land, labor, and finance.

Female entrepreneurs report that they lack access to finance required to realize their business ambitions. Generally, women face more difficulties opening a bank account and getting access to a loan than men, as they often lack collateral or a sustainable source of income, making them largely 'un-bankable'. For some Female entrepreneurs, their participation in a VSLA might be a perfect entry-point (**entry point 1**), as this enables them to save small amounts of money while also presenting the opportunity to take out small loans under favorable conditions. Small loans allow Female entrepreneurs to buy the necessary tools and equipment, such as fridges, cook stoves, or sewing machines, to start and expand their businesses. As many Female entrepreneurs lack education, they are also anticipated to benefit from additional support in developing a practical business plan and follow-up coaching to realize their business ambitions.

> *"I sell special fabrics that women take to go only to the farm "[...]. "We want to trade because we did not go to school and we do not know how to read or write so trading is the best option. Also, we have not learnt small trades such as sewing, hairdressing etc."*
> (FGD, Female entrepreneurs, May 2021)

VSLAs would therefore benefit from the development of a module on how best to support their members in developing a plan for professionalizing their business. Financial planning, marketing, and soft skills development are also considered essential elements of this training module. Moreover, Female entrepreneurs can be incentivized to involve their partners in this development trajectory to avoid potential backlash (i.e., being accused of hiding activity from their spouses), for example by offering training modules to couples, using HH tools to develop trust and a shared vision. In addition, feasible business plans can be reviewed and rewarded with soft

loans, access to equipment, or a coaching trajectory. For such a pilot, NGOs or local banks need to be involved to assist the Female entrepreneurs in opening a bank- or mobile money account. Successful Female entrepreneurs can be celebrated and can become role models to other Female entrepreneurs. Various suppliers and partners have already started adding a range of services/trainings to VSLAs, of which some are still in a piloting phase. In collaboration with Nestlé's suppliers, VSLAs can be further expanded in NCP communities.

Despite the anticipated increased access to small loans or in-kind delivery of financial support services to acquire small(er) tools and equipment, Female entrepreneurs still experience limited access to more substantial processing equipment – which is also often out of reach in terms of cost. Processing raw produce, like cassava or palm oil, allows for value to be added locally and is considered a valuable source of income diversification. Moreover, processing food crops is also envisioned to reduce food waste, adding to the food security of the HH and helps to avoid income losses. Access to and maintenance (including coordination) of such equipment could be facilitated most optimally through an association or NGO (**entry point 2**). Female entrepreneurs would also benefit more from improved access to (peri-urban) markets so they can obtain better prices for (food) products (**entry point 3**). Improved market access not only relates to distance, but also to receiving market information on prices, new production technologies, and market demands.

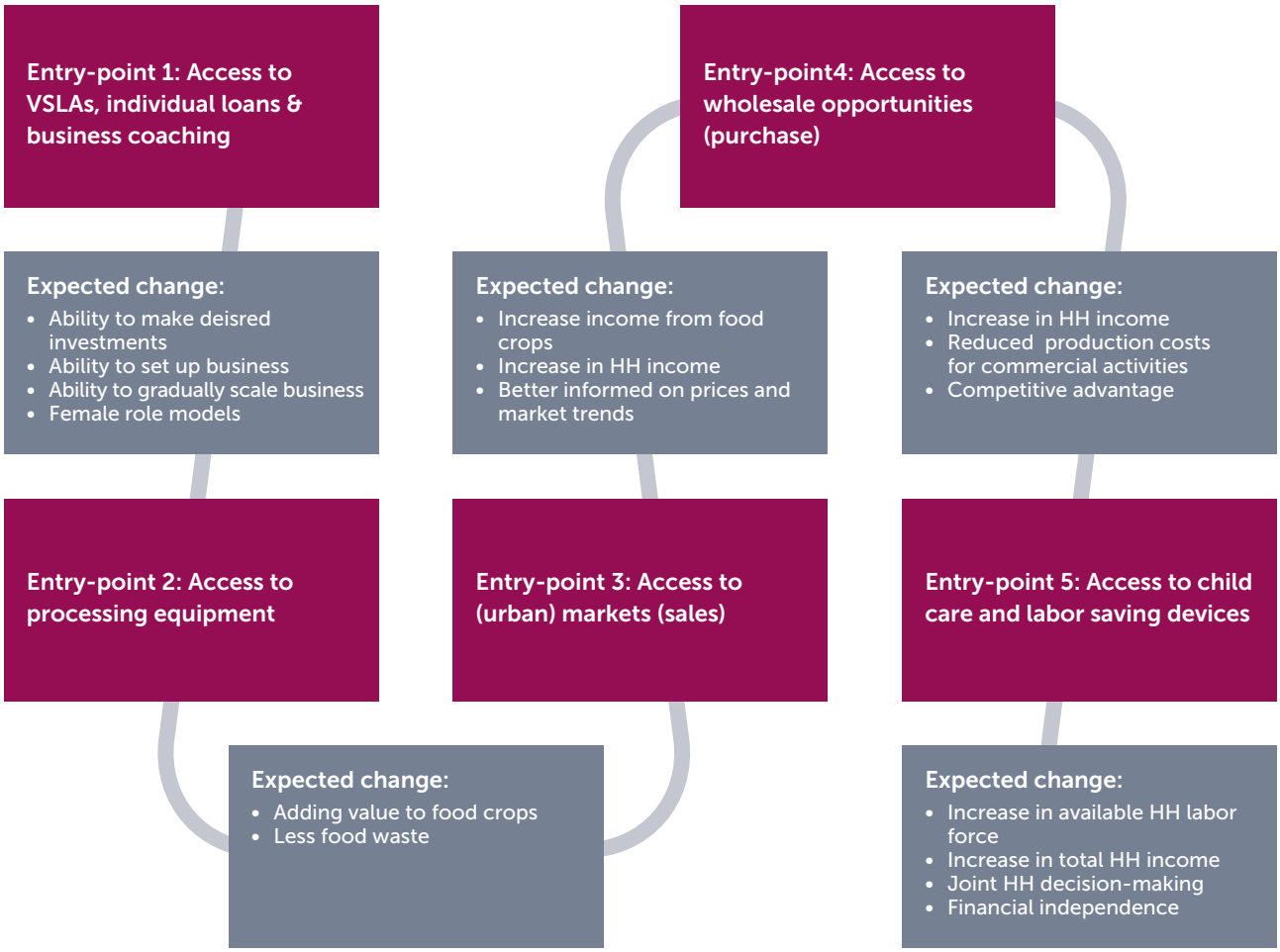
Depending on the type of business, some Female entrepreneurs may benefit from nearby wholesale opportunities (**entry point 4**), as these would provide easier access to small items – primarily input-related – that they use for trade for which many currently have to travel to the nearest town. For example, items such as zippers and buttons are needed for sewing, while animal feed is required for poultry farming or fish ponds. Both these inputs are difficult to access and/or expensive, and the traveling distance to obtain them adds to this expense. This ultimately makes the end products that they trade expensive or reduces their profit margins. A 'one-stop-shop' for inputs for different income-generating activities would not only help female entrepreneurs but all community members. An existing local cocoa input shop or a cooperative could facilitate this.

> *"There should be a sewing material shop in the village, it would be good because sometimes what we purchase is too expensive, even when we purchase it in this village, it is too expensive or when we travel to the city. For purchasing the materials that we need, it will become more expensive because of the transportation. Concerning the activities here. I think it would work perfectly because people purchase the items that we sell. So if we have the means to do our trade or sewing, I'm sure that it will work very well."* (FGD, Female entrepreneurs, May 2021)

Last, as many of the women are mothers who have to balance income-generating activities with child bearing and child raising, accessing childcare and labor saving devices can free-up time that can instead be invested in business endeavors (**entry**

point 5). The benefits are anticipated to be similar as to those for Diversified and Cocoa-dependent HH. Altogether, gender equality as a result of the improved economic empowerment of women is considered a high potential spin-off, while these Female entrepreneurs also serve as lighthouses for other (young) women in the community who aspire to set up their own economic activities. A pathway for Female entrepreneurs is visualized in Figure 30.

Figure 30 Pathway for Female entrepreneurs



We realize that Nestlé depends highly on its suppliers, cooperatives and other implementing partners in the activation of the different pathways and most of the entry points, and their engagement is key. Box 2 provides suggestions for their involvement.

Box 2 Engagement of stakeholders in the activation of pathways

For the Aspirational elite and the Young, single, and ambitious farmers, Nestlé can use its existing Elite Farmer program and coaches to activate the suggested pathways. External partners (e.g. certifiers and NGOs) with experience of HH methodologies, such as GALS, could support Nestlé in outreach to couples, the building of coaches' capacity to understand and respond to intra-household dynamics, and contribute to the building of HH trust. The recruitment and training of Young, single, and ambitious farmers as a skilled labor force could be organized via suppliers and cooperatives, with selections made on age, marital status, and education. All community members willing/able to pay for the labor services could be given the opportunity to access this service.

For the activation of the pathways and entry-points of the Diversified and Cocoa-dependent HH, Nestlé can channel its interventions through the NCP. Together, the Diversified and Cocoa-dependent HH comprise between ~45-70% of the NCP member base. Therefore, the offering of training on income diversification, financial planning, and business skills could be offered to all NCP members.

The organization of childcare and labor saving devices could potentially be developed and piloted with VSLAs or together with NGOs and/or suppliers, based on an assessment of the users of this service and devices, starting with Female entrepreneurs and spouses of male farmers that belong to Diversified HH and Cocoa-dependent HH. The contribution to a school fund requires the engagement of a financial institute and involvement of the local government. A school fund could be offered to HH who have children in secondary school, which are mainly Diversified HH, Cocoa-dependent HH and Female entrepreneurs.

Female entrepreneurs could be best reached via women's associations, VSLAs or alternative income-generating activities in which they are already involved. Activation of their pathway requires the involvement of a bank, NGO, and/or supplier.

For the activation of the entry-points and pathways, all relevant partners and experts should be involved in the design and testing phase; including representatives of the targeted segments, as they are ultimately the customers. In addition, relevant stakeholders should be involved in the monitoring, evaluation, and learning (MEL).

Conclusions

In this chapter we started with listing potential HH and community interventions that contribute to sustainable intensification and/or income diversification and showed their relevance per high-potential segment. This exercise generated input for the development of segment-specific pathways. For each high potential segment we identified initial, practical avenues that provide a first self-evident opportunity to tailor existing and newly proposed interventions towards their aspirations and needs. As the pathways are enabling rather than directive, and because they offer a multitude of inter-correlated interventions that can accelerate one another, any attempt to estimate the expected income levels would be somewhat speculative and based on aspiration rather than accurate prediction. However, our analyses suggest that the identified entry-points can function as LI accelerators if enabling conditions are met. We gained the following insights:

Our analyses confirm that the relevance of interventions that potentially increase HH income differs per segment, although we also see some overlap in the entry-points identified. For example, Aspirational elite, Diversified HH, Cocoa-dependent HH and Female entrepreneurs would all benefit from a gender-sensitive household approach whereby both spouses are included in training, coaching and the development of a FDP. These HH would also benefit from investing in (affordable) child care and HH labor saving devices. Such support is anticipated to lead to an increase in women's labor-force participation, support HH income and advance women's decision-making in the HH, which is known to benefit the whole HH. Another area where we see overlap in entry-points is the potential of adding business and soft skills training to existing training modules, including planning skills. Business skills and financial discipline will promote savings and support HH in making well-informed decisions on HH expenditures and investments. In addition, as cocoa sales in itself do not generate sufficient income, training on income-diversification, including commercialization and market-linkages, is likely to benefit all HH segments, whereby follow-up coaching will help optimizing its impact.

We also identified a number of unique entry-points per segment. For example, the Young, single and ambitious farmers might benefit from being recruited and trained as professional labor force to provide labor services to HH who are short of labor, such as Diversified HH. We also identify this younger segment as potential successor of the Aspirational elite; access to the Elite program is likely to give them an economic boost and would be highly motivational. Diversified HH might benefit first of all from a diagnosis/screening of current income-generating activities, as part of an FDP, to assist in developing a joint HH income generation plan and prioritize HH investments, including the allocation of HH labor. Cocoa-dependent HH, for whom cocoa remains the core of income diversification strategies, will benefit from income-diversification training and financial skills that focus on inter-

cropping and/or generating alternative income outside the cocoa season. Female entrepreneurs, who are often already involved in alternative economic activities, will benefit first of all from having access to finance to realize their business ambitions. Generally, women are perceived as 'un-bankable', so rather than accessing a loan via a bank, participation in a VSLA might be a perfect entry-point. As many Female entrepreneurs lack education, they are also anticipated to benefit from additional support in developing a practical business plan and follow-up coaching to realize their business ambitions.

For the activation of most of the pathways and entry points, Nestlé depends highly on suppliers, cooperatives, women's associations, NGOs and other implementing partners. Relevant partners and experts should be involved in the design and testing phase, including representatives of the targeted segments as they are ultimately the beneficiaries.

The suggested pathways provide a number of positive spin-offs for the wider community, such as creating a local pool of female and male ambassadors as lighthouse for youth, advancing gender equality, increased rural economic activity outside the cocoa season, increased nutrition and diet diversity, better educated youth and a skilled labor force that can be employed to increase farm productivity.

Executive summary and recommendations

This final chapter presents an executive summary of the findings of this independent study on pathways towards an LI for cocoa farmers in Côte d'Ivoire carried out by KIT Royal Tropical Institute in 2021, commissioned by Nestlé.

Executive summary

Objective

The objective of the study was to learn from the Elite Farmer program launched by Nestlé in 2015 and identify other high-potential cocoa farming Nestlé Cocoa Plan (NCP) households (HH) who could benefit from more tailored services that meet their specific needs and aspirations. The end goal is to develop pathways which show how a significantly larger proportion of cocoa-growing HH can achieve a living income (LI), and provide actionable recommendations for Nestlé.

Methodology

Based on quantitative and qualitative methods, the study developed potential customized pathways for cocoa farming HH. This was based on four steps: 1) Take learnings from the NCP Elite Farmer program; 2) Identify interventions which are successful in closing the LI gap; 3) Data-driven segmentation for LI; and 4) Deep-dive into high potential HH segments. In total, 417 respondents, of which almost a quarter were women, participated in two rounds of data collection in Côte d'Ivoire. In the first round, we included different groups of elite farmers in a living income survey: farmers who joined before 2019, and farmers who joined the program more recently. Additionally, we collected data through FGDs with both groups of elite farmers and through semi-structured interviews with elite farmers and their spouses. In the second round of data collection (through FGDs) we included mainly non-elite farm households, who were considered to be high potential to closing their living income gap. The findings are summarized by step.

Learning from the Elite Farmer program

The Elite Farmer program was launched in 2015 in Côte d'Ivoire, with the aim to differentiate the better performing from other NCP farmers and further unleash their potential; 155 farmers enrolled in different cohorts since its inception. Elite farmers were selected based on recommendations from local cooperative managers in combination with a set of loosely applied criteria (linked to age, land size, education, attitude and importance of cocoa). The Elite Farmer program consists of a three-day intensive training course at a central location, an individual action plan, and individual coaching to support the realization of these plans.

Our data suggest participation in the Elite Farmer program contributed to increases in Good Agricultural Practices (GAP) implementation and yields among its participants. Furthermore, better financial planning and discipline, and improved HH relations enhanced the quality of their lives. The first cohort of elite farmers, which we label the Arrived elite, owe their relative success in particular to their large land sizes, often (partly) under a sharecropper arrangement. The average total HH income for Arrived elite is almost double the income of the younger cohort of elite farmers, which we label the Aspirational elite. Although the Aspirational elite's production level tends to be above average, their HH income remains low due to their small land sizes. Table 30 summarizes some of the main differences between the Arrived elite and the Aspirational elite.

Table 30 Summary of significant differences between Arrived elite and Aspirational elite

Demographics	Arrived elite	Aspirational elite
Age (years)	49	34
Proportion marries/co-habiting	83%	65%
Senior high school education completed	21%	47%
Years in cocoa	20.55	8.53
Productive cocoa land size (ha)	6.72	2.72
Making use of sharecropper	62%	18%
Cocoa yields (productive land)	624	844
Total HH income (median value)	US$5293	US$3350

Notes: All statistics are mean averages per elite group.

Despite its success, the majority of elite farmers do not (yet) attain an LI. When assessing the income distribution (see Figure 3 in Chapter 3), we find that 43% of the Arrived elite earned an income above the LI benchmark, while for the newer cohort this was only 19%.

Besides excellent performance, the Elite Farmer program was expected to stimulate elite farmers to operate as lighthouse for other farmers. We identified an opportunity to strengthen elite farmers to operate as role models, particularly the Aspirational elite cohort. This might require additional coaching and training in non-cognitive skills (i.e. 'soft skills', such as planning, time discounting, leadership and communication skills), to channel knowledge effectively to other likeminded farmers.

Interventions to enhance productivity, diversification and household income

Data on 176 NCP households (including those participating in the Elite Farmer program) collected in 2020, gave us further insights into the drivers of cocoa productivity and HH income. Although based on a small, non-random sample, our data suggests that HH who obtain an LI are most likely to include a married or cohabiting couple, are less reliant on cocoa sales for their income, have more cocoa

land, are more likely to have sharecroppers on their land, and benefit from relatively higher yields than traditional HH. Their agricultural practices also suggest they have business skills, obtained through experience or dedicated training, and rejuvenate their plantation by planting cocoa trees on a larger percentage of land. In terms of diversification, they derive more income from the sale of non-cocoa crops (particularly rubber) and from other forms of trade and business activities.

However, HH who obtain an LI are not representative of the average HH. Given that a substantial proportion of HH has limited access to productive cocoa land, sustainable intensification remains highly relevant to increase HH income. To enhance cocoa productivity, conventional GAPs, such as fertilizer application, weeding, and pruning remain important. Fertilizer application in particular has a notable effect on productivity, and access to finance seems to play a key role in the uptake and application of it. Another promising route to increase HH income is an increased focus on non-cognitive development as part of agricultural support programs. Our results show that the perception to which farmers feel in control of their lives correlate positively with HH performance. GAP training in combination with 'soft skills' development as a basic standard support package is therefore believed to better enhance sustainable intensification for all HH.

For HH with less than three ha of land, reaching an LI through sustainable intensification of cocoa farming alone remains challenging, which highlights the importance of income diversification. Analyses reveal that HH who are less relying on cocoa sales for their income have higher incomes (and vice versa). Yet, this does not imply that sustainable intensification of cocoa production is irrelevant for HH with small farm sizes. In fact, the opposite is the case as cocoa production remains their most important source of income.

In addition, pooling of labor and financial resources (and land) through marriage or number of adults in the HH has a strong effect on productivity, input use, production and cocoa income, income diversification, and, ultimately, total HH income. HH with less productive members available are more likely to have lower cocoa income, fewer income sources, and lower HH income. Although not a new insight, this result underlines the importance of approaching LI interventions from a more integrated HH perspective, including spouses or other productive household members in training and coaching sessions.

Although a moral imperative, our findings suggest that increased pricing mechanisms as singular LI instruments have limited effect on income levels in the short-term, and also indicate that they would be more effective in combination with viable income diversification and sustainable intensification of cocoa production while requiring supply management. The effects of cash payments are known to be most effective for the poorest HH and conditional cash transfers are mainly

anticipated to be seen in the long-run as a result of behavioral change in the uptake of GAPs, increased production and income diversification.

Data-driven segmentation to identify high-potential segments

Cocoa farmer segmentation and farm profiles have gained momentum among cocoa stakeholders, particularly following the introduction of the concept of LI. The utility of farmer profiles (or HH profiles) is based on the assumption that, using certain archetypes, interventions and extension services can be better tailored towards farmer groups to effectively address their barriers and needs. The purpose of data-driven segmentation (through cluster analysis) is to identify these like-minded groups that could benefit from a customized approach. Naturally, the segmentation approach has limitations. Most importantly, most HH and farmers included are certified farmers which means the analysis holds value primarily for certified farmers but has less validity for those who are not certified.

Four unique datasets were utilized for our data-driven segmentation approach (based on 12,000 farmers/ households). Through cluster analysis, we defined five unique segments, from which we selected three high-potential ones:

1. 'Young, single, and ambitious' (~10% - 20% of the NCP farm population)
2. 'Diversified' (~15% - 30% of the NCP farm population)
3. 'Cocoa dependent' (~30% - 50% of the NCP farm population)

HH in the Young, single, and ambitious segment demonstrate potential due to their relatively young ages, aspirational attitude and relatively higher education levels. The Diversified HH segment is promising due to its high level of income diversification and, consequently, high(er) HH income (and thus smaller LI gap). The Cocoa-dependent HH segment stands out due to their cocoa dependence, but also because they display average-to-high yield levels in some of the cluster analyses revealing a within-group capability to reach higher farm productivity levels. They also represent the largest HH segment.

On top of the three segments identified through data-driven clustering, we add two additional groups in the remainder of our analyses: the Aspirational elite as a 'lookalike' of the Young, single, ambitious farmers and Female entrepreneurs, who are relatively young women (35-40 years old) and often married to NCP members. What typifies them is that they operate a business by themselves (or in a group), often allowing them to keep the proceedings for their own personal needs. The women belonging to this segment already participate in an income-generating activity and/or VSLA group, initiated by Nestlé or partners.

The identified high-potential HH segments represent HH who are in a different phase of life, which, to some extent translate in different aspirations. But there are also other factors that influence segment-specific aspirations and needs, such as the level of education, land-size, dependency on cocoa, ethnicity and gender. Therefore, the HH segments should not be considered as sequential. Only for Young, single, and ambitious farmers, as look-a-likes of the Aspirational elite (both being relatively young, entrepreneurial and confident), we see potential for them to following in the footsteps of the Aspirational elite.

Most aspirations of the high-potential segments are in the economic sphere. As the income earned from cocoa sales is not sufficient to cover the increasing costs of living all segments seem to aspire income diversification as pathway to increase their HH income. What the Young, single and ambitious farmers have in common with the Cocoa-dependent HH is that cocoa remains central in their income diversification strategy, while for other segments work on the cocoa farm seems to become less fundamental as income generating activity.

Potential pathways towards achieving an LI

For each selected segment, we identified initial, practical avenues that provide a first self-evident opportunity to start exploring how existing and newly proposed interventions can be best tailored towards the aspirations and needs of the segments. These pathways provide a number of positive spin-offs for the wider community, such as creating a local pool of female and male ambassadors as lighthouse for youth, advancing gender equality, increased rural economic activity outside the cocoa season, increased nutrition and diet diversity, better educated youth and a skilled labor force that can be employed to increase farm productivity.

As part of the Elite Farmer program training, **Aspirational elite** have participated in training on HH management, which is frequently reported as an eye-opener regarding the value of developing a shared goal and benefits of working together as a couple. Therefore, strengthening their performance as a joint HH is a potential entry-point to effectively pool their labor and resources enabling them to make well-informed, joint HH decisions on the allocation of time, investments and expenditures. This is anticipated to result in more bargaining power for the spouse and more involvement in income generating activities, resulting in higher HH incomes, more savings and more effective expenditure allocation. Moreover, a joint HH income plan is anticipated to result in a more optimal allocation of the HH labor across income sources. Strengthening elite couple's performance could be activated through the Elite Farmer program, inviting their partner (and/or adult children) to the Elite refresher training, while providing additional HH management modules to couples to help them develop a joint HH vision and build trust. Several existing tools are available to develop such as HH vision, for example the Gender Action Learning

System (GALS) has already been widely tested and accepted. For such a successful follow-up of the existing Elite Farmer program modules, this would require the support of well-trained gender-sensitive coaches.

We consider the **Young, single and ambitious** as well-positioned to provide skilled, paid labor to other farmers allowing them to earn an extra income. Specialized training on GAP is considered to be highly effective given their relatively high education levels and non-cognitive skills, resulting in a highly-skilled workforce which could be organized at the cooperative level. This segment can also be invited as new cohort of elite farmers. Based on the lessons learnt from the Elite Farmer program, financial planning skills and a Farm Development Plan (FDP) will likely enable them to make better-informed strategic choices while at the same time increasing their technical agricultural knowledge of modern cocoa farm technologies. Especially for this segment, additional modules can be further tailored, including soft- and life skills like household decision-making and gender-sensitivity training (when starting an own household). To further develop their plantation, monetary resources are needed, primarily to acquire quality inputs. Young, single, and ambitious farmers put emphasis on their preference for savings and investments, especially following cocoa sales, rather than taking out a (risky) loan. Conditional cash transfers, in-kind delivery, or input credit schemes are possible alternative financial incentives that might help this segment to access finance. Combined with the anticipated income from labor, savings and access to finance might allow them to make the necessary investments to execute their planned farm improvements, acquire the necessary inputs to gradually increase on-farm productivity and/or use it as a stepping stone to other income generating activities.

For both **Diversified HH** and **Cocoa dependent HH**, training on income diversification and business skills is expected to increase their non-cocoa income, particularly if offered to both spouses. Different income diversification training modules could be offered (e.g. intercropping, food crops, non-farm), which could become part of regular NCP trainings. Follow-up coaching will likely accelerate training effectiveness and is expected to support Diversified HH to optimize their diversified income sources, while enabling Cocoa-dependent HH to make well-informed choices about intercropping and investments in non-cocoa activities outside the cocoa season. For both segments, access to a skilled labor force for more labor-intensive on-farm activities will be an imperative, alleviating their struggle to access affordable labor. It could support Diversified HH in more efficient allocation of their labor to income diversification, while still maintaining their cocoa farm to ensure adequate productivity levels. For Cocoa-dependent HH, affordable, skilled labor can accelerate farm productivity through advanced technology like motorized pruning. Investing in (affordable) child care and HH labor saving devices (including HH amenities like access to running water) will also positively impact both segments. Such support is anticipated to lead to an increase in women's labor-force participation, support HH income and

advance women's decision-making in the HH. The organization of child care and labor saving devices could potentially be developed and piloted with Village Saving and Loan Associations (VSLAs) or together with NGOs and/or suppliers, based on an assessment among potential users of this service and devices.

In particular, Diversified HH, Cocoa-dependent HH and Female entrepreneurs identify the (timely) contribution to a school fund as a welcome intervention to support their children in secondary school as paying the high costs involved in education, including costs of boarding and food, is one of their most pressing concerns. This requires the involvement of the local government – with the support of a financial institution – to efficiently set up procedures and harmonize efforts to increase school attendance.

Female entrepreneurs report that they experience a lack of access to finance to realize their business ambitions. Their participation in a VSLA might be a perfect entry-point, enabling them to save small amounts of their income while also having the opportunity to take out small loans under favorable conditions. Small loans allow Female entrepreneurs to buy the necessary tools and equipment like fridges, cook stoves or sewing machines to kick-start and expand their business. This segment will also benefit from an additional training module that supports them in developing a business plan for professionalizing their business, including attention to financial planning, marketing and soft skills development. This training could be offered via VSLAs, or alternatively via the cooperatives, as their spouses are often members. Depending on the type of business, some Female entrepreneurs might benefit from nearby wholesale opportunities, giving them easier access to small items (e.g. zippers and buttons for sewing) that they use for their trade for which they currently need to travel to the nearest town. While others would benefit from improved access to (peri-urban) markets to receive better prices for (food) products. Several suppliers and NGOs have already started these types of interventions that help to improve market linkages.

Recommendations

This chapter ends with a number of actionable recommendations to accelerate LI among high-potential HH segments. Some of these recommendations are specifically for Nestlé (and it suppliers and implementing partners), while others might be relevant for the wider cocoa sector.

1 Expand the Elite Farmer program

Participation in the Elite Farmer program contributes to increased yields, financial planning and improved HH relations. Although the small scale is inherent to the Elite Farmer program, we see room for (limited) scaling by Nestlé in two ways:

a. Invite the Young, single and ambitious farmers as new cohort

Similar to the Aspirational elite, the Young, single and ambitious segment has a positive and entrepreneurial attitude and exerts willingness to invest in cocoa. Inviting them as new cohort of elite farmers is likely to work as a LI accelerator. Before doing so, we recommend to take stock of learnings of the Aspirational Elite to best assist the Young, single and ambitious farmers.

As the Young, single and ambitious farmers belong to the poorest HH, without access to finance they might not be able to benefit fully from participation in the Elite program. Therefore, we recommend to support this new cohort of elite farmers, with financial incentives (e.g. conditional cash transfers) and with mobilizing savings (e.g. through mobile payments and financial coaching).

b. Give elite farmers the option to invite their spouses (and potentially other adult HH members) to the Elite refresher training.

The current cohort of Aspirational elite aspires to be more successful as a couple and would like to collaborate more with their spouses. Providing the elite the option to invite their spouses to the refresher trainings is likely to help to unleash their potential as a couple, particularly if efforts are made to develop a shared household vision, stimulating joint decision-making and trust in the HH. This would require additional gender training for trainers and coaches to understand and navigate intra-HH dynamics. Nestlé could benefit from existing gender-sensitive HH tools, such as GALS and bringing on board local gender expertise.

2 Expand number of coaches

Follow-up coaching is an important success factor of the Elite Farmer program, and has been reported as essential to ensure that farming HH implement their learnings correctly and are supported in implementing their FDP. Follow-up coaching can also help HH to reallocate their labor or shift focus towards income generating activities that appear to be the most promising, helping them to further increase their HH income.

We recommend to explore with suppliers and cooperatives how best to utilize coaching trajectories and FDP and consider the recruitment of additional coaches to do follow up visits with a wider group of NCP members, in particular the Diversified HH and Cocoa-dependent HH.

3 Support NCP farmers with income-diversification

Income diversification is positively correlated with HH income and is important for all HH segments. However, HH segments have different income diversification needs. Cocoa-dependent HH would benefit from training on inter-cropping and commercialization of food crops, while Diversified HH would benefit from specific

attention to market information and business skills development. We recommend to create different levels with relevant training content for different segments to meet the specific diversification needs of the Cocoa-dependent HH and the Diversified HH in particular.

Without access to markets for non-cocoa crops and other products or services, the training on crop diversification or additional livelihoods in itself will not create additional economic benefits. These markets might be outside the community or even district, as local prices for food crops are usually low due to oversaturation during the peak production season. Market opportunities for processed perishable food crops could be further explored. Nestlé could tap into the experience of suppliers and NGOs who are already actively supporting farmers with establishing market linkages. Additionally the role of cooperative could be explored to play a role in stimulating income diversification and marketing of alternative crops for its members.

4 Integrate soft-skill development in wider set of trainings

We found that internal locus of control is positively correlated with input use, cocoa income, and total HH income – and this finding could encourage greater focus on developing soft skills as part of agricultural support programs for cocoa producing HH. Adding soft skills training to more conventional technical programs aimed at increasing technology adoption and productivity could yield great potential to substantially increase cocoa net income. In addition, VSLA participants could benefit from training modules that include soft skills development, particularly around leadership and building self-esteem. Finally, training in soft skills can strengthen Aspirational elite (and their spouses) to operate as role models, supporting them to channel knowledge effectively to other likeminded farmers and to stimulate and support them in reaching out to their younger, like-minded peers.

5 Increase financial incentives and support mobilizing savings

Access to financial resources is one of the main pressing concerns of cocoa producing HH and different financial packages can be developed for different purposes (e.g. GAP implementation, plantation rejuvenation, income diversification) and different HH segments.

Rather than focusing on loans, most HH segments would benefit from other financial incentives and savings. In many cases loans are taken out to pay for education and healthcare, which suggests that household income is not sufficient to cover basic needs and loans are considered a fallback option for emergency purposes rather than an investment in additional livelihood options.

Particularly, Young, single and ambitious farmers and Cocoa-dependent HH, being among the poorest high-potential HH, they would benefit from financial incentives, such as conditional cash transfers, to make the required investment both on-farm and off farm and increase their HH income. The learning from Nestlé's Household Accelerator Program could be used to further tailor cash transfers to HH segments, supporting HH in achieving their aspirations.

6 Develop a gender-sensitive household approach

We recommend to all stakeholders who are committed to achieving an LI for cocoa households to take a gender-sensitive HH approach towards LI.

For reaching an LI, better results can be reached by taking a gender-sensitive household approach, as the income a HH earns usually comes from multiple sources to which different HH members contribute – and intra-HH dynamics are known to influence HH decision-making and investments. It has been well documented that women tend to prioritize their families' health, nutrition, and education when spending income.

A gender-sensitive HH approach towards LI includes the engagement of different productive HH members in training and service provision, while paying attention to HH dynamics, labor division, spousal decision-making and trust. There are existing tools, such as GALS that can help create a shared HH vision. What is also anticipated to help unleash the potential of couples are interventions that reduce time needed for care and HH activities, creating time for income generating activities, particularly for the spouse. We recommend to take stock of existing initiatives that promote labor saving devices.

To take a gender-sensitive HH approach implies that field staff and coaches will need to be trained to ensure they have the capacity to understand gender issues and address gender inequalities that hinder spouses of elite and NCP farmers and Female entrepreneurs to unleash their potential and contribute to the HH income.

7 Leave no one behind

More vulnerable groups, such as Female farmers, unorganized farmers, laborers (including sharecroppers), and farmers who live more remotely are currently underrepresented in NCP, and therefore automatically fell out of the scope of this study. However, we would like to emphasize that there is an urgent need for the sector to look at such vulnerable groups in more detail in future research and sustainability programs.

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Appendix 1 – Regressions

Table 31 Regressions on cocoa yield and fertilizer use / application rate

	Cocoa yield (kg/ha)	Cocoa yield (kg/ha)	Fertilizer use (no/yes)	Fertilizer application (% of cocoa land under fertilizer)
	(1)	(2)	(3)	(4)
Cocoa productive land (ha)	-47.744** (22.901)	-74.554** (30.904)	0.176 (0.125)	4.624 (3.610)
Cocoa productive land (ha) * Cocoa productive land (ha)	2.366** (1.184)	4.004** (1.662)	-0.008 (0.008)	-0.319 (0.214)
HH head age		-31.923 (22.170)	-0.088 (0.088)	1.481 (2.590)
HH head age * HH head age		0.354 (0.234)	0.001 (0.001)	-0.022 (0.027)
no education HH head (ref)		ref (.)	ref (.)	ref (.)
primary education HH head		48.427 (87.783)	-0.212 (0.351)	-12.654 (12.501)
secondary education or higher HH head		-110.562 (92.892)	0.165 (0.363)	-1.136 (12.179)
HH head is single/widowed/divorced (ref)		ref (.)	ref (.)	ref (.)
HH head is married		224.024*** (84.408)	-0.619 (0.434)	-27.180** (13.202)
HH head living in cohabitation		64.550 (93.637)	-0.501 (0.456)	-20.328 (12.713)
Internal locus of control of HH head		43.142 (40.868)	0.308* (0.161)	6.050 (5.418)
External locus of control of HH head		98.452* (56.743)	-0.359** (0.159)	-8.661 (5.866)
Household size adults		10.148 (18.298)	0.076 (0.070)	4.279* (2.369)
Household size children		1.043 (11.559)	-0.075 (0.046)	-3.359** (1.467)
Born in the region		53.631 (63.727)	-0.699*** (0.262)	-16.004* (8.333)
Spouse involved in HH decision making on sale, income and credit		42.896 (110.108)	0.076 (0.372)	5.336 (11.155)
Comoé district (ref)		ref (.)	ref (.)	ref (.)
Gôh-Djiboua district		136.247 (104.533)	0.193 (0.422)	2.858 (14.971)
Other district		63.921 (91.006)	-0.738 (0.464)	-33.370* (17.222)
HH has a bank account		51.045 (66.054)	0.654* (0.344)	20.979** (9.605)
Mobile money		151.321* (86.269)	-0.641 (0.403)	-18.130 (11.966)
Granular fertilizer (% of land cultivated)		3.746*** (1.126)		
Pesticide (% of land cultivated)		-0.234 (1.475)	0.010 (0.006)	0.318 (0.193)
Fungicide (% of land cultivated)		-0.205 (0.850)	0.000 (0.003)	-0.076 (0.105)
Pruning (% of land cultivated)		1.483* (0.835)	0.001 (0.003)	0.012 (0.127)
Weeding (% of land cultivated)		2.081** (1.051)	0.005 (0.005)	0.087 (0.157)
Planting of new seedlings (% of land cultivated)		2.602 (4.608)	0.022 (0.017)	0.179 (0.581)
Percentage of land with cocoa trees 5 yrs or older		0.705 (2.316)	-0.011 (0.010)	-0.148 (0.334)
Adoption of shade trees (yes/no)		198.673*** (64.887)	0.631* (0.366)	14.428 (12.649)
Sharecroppers on cocoa land		61.870 (82.267)	0.648** (0.320)	12.497 (9.919)
Number of trainings (GAP & GSP) received		-21.873*** (7.765)	0.074* (0.044)	1.738 (1.490)
Importance of cocoa sales to total HH income (as %)		4.718** (1.858)	-0.002 (0.009)	0.093 (0.302)
Number of income sources		75.113** (30.561)	-0.140 (0.112)	-6.408* (3.462)
Farm business school skills		60.629 (83.574)	-0.455 (0.318)	-16.493* (9.675)
Amount of money borrowed (in CFA)		0.000 (0.000)	0.000 (0.000)	0.000** (0.000)
HH saved money		29.815 (52.773)	0.299 (0.246)	5.949 (8.033)
Followed training on soil fertility			-0.597 (0.415)	-6.732 (14.961)
Constant	748.605*** (79.014)	65.988 (653.180)	2.764 (2.933)	-4.400 (85.298)
R-squared adjusted	0.010	0.228		
Pseudo R-squared			0.291	0.058
Log likelihood			-81.704	-505.670
Estimation technique	OLS	OLS	Probit	Tobit
Observations	152	151	167	167

Notes: * p<0.10, ** p<0.05, *** p<.01. Robust standard errors in parentheses.

Table 32 Regressions on cocoa input costs per ha

	Input cost per ha (USD)	Input cost per ha (USD)	Input cost per ha (USD)	Input cost per ha (USD)
	(1)	(2)	(3)	(4)
Cocoa productive land (ha)	-4.018 (3.089)	-4.536 (2.909)	-3.905 (3.038)	-3.020 (3.124)
Cocoa productive land (ha) * Cocoa productive land (ha)	0.264 (0.181)	0.275 (0.168)	0.246 (0.178)	0.212 (0.180)
HH head age	-3.089* (1.853)	-2.384 (1.815)	-3.345* (1.784)	-2.944* (1.734)
HH head age * HH head age	0.030 (0.019)	0.023 (0.019)	0.033* (0.018)	0.028 (0.018)
no education HH head (ref)	ref (.)	ref (.)	ref (.)	ref (.)
primary education HH head	-4.353 (10.459)	-4.624 (10.490)	-5.942 (10.420)	-5.064 (10.399)
secondary education or higher HH head	-10.695 (9.862)	-11.153 (9.861)	-11.148 (9.751)	-10.002 (9.902)
HH head is single/widowed/divorced (ref)	ref (.)	ref (.)	ref (.)	ref (.)
HH head is married	-0.385 (7.565)	2.474 (7.125)	-2.015 (7.436)	-5.625 (7.543)
HH head living in cohabitation	1.118 (8.417)	3.434 (8.225)	-1.826 (8.296)	-3.198 (8.498)
Internal locus of control of HH head	2.121 (4.404)	0.812 (4.177)	1.684 (4.373)	2.117 (4.169)
External locus of control of HH head	1.949 (4.430)	3.393 (4.257)	1.945 (4.388)	2.399 (4.233)
Household size adults	0.332 (1.559)	0.390 (1.494)	0.326 (1.543)	0.547 (1.511)
Household size children	-0.227 (1.026)	0.109 (0.947)	-0.226 (0.999)	-0.588 (1.010)
Born in the region	-5.161 (6.929)	-2.944 (6.977)	-4.023 (6.984)	-6.639 (6.874)
Spouse involved in HH decision making on sale, income and credit	-8.742 (7.804)	-9.686 (7.444)	-7.713 (8.006)	-7.662 (7.844)
Comoé district (ref)	ref (.)	ref (.)	ref (.)	ref (.)
Gôh-Djiboua district	-1.201 (10.570)	-2.891 (10.732)	-1.967 (10.586)	-2.832 (10.192)
Other district	-4.074 (10.062)	-5.830 (10.554)	-3.970 (9.860)	-2.995 (9.980)
HH has a bank account	10.116 (7.763)	6.407 (7.846)	9.780 (7.663)	10.972 (7.547)
Mobile money	20.638 (13.562)	19.991 (13.534)	18.993 (13.470)	21.406 (13.426)
Granular fertilizer (% of land cultivated)	1.204*** (0.126)	1.933*** (0.359)	1.207*** (0.124)	1.177*** (0.124)
Pesticide (% of land cultivated)	0.039 (0.118)	0.020 (0.114)	0.047 (0.119)	0.043 (0.118)
Fungicide (% of land cultivated)	0.185* (0.109)	0.193* (0.109)	0.182 (0.111)	0.169 (0.107)
Pruning (% of land cultivated)	0.218** (0.101)	0.213** (0.096)	0.755*** (0.279)	0.218** (0.101)
Weeding (% of land cultivated)	0.191* (0.102)	0.196* (0.100)	0.202* (0.102)	0.189* (0.101)
Planting of new seedlings (% of land cultivated)	-0.009 (0.452)	-0.197 (0.448)	-0.022 (0.444)	-2.116** (0.932)
Percentage of land with cocoa trees 5 yrs or older	0.225 (0.193)	0.284 (0.197)	0.270 (0.189)	0.144 (0.202)
Sharecroppers on cocoa land	6.794 (7.668)	5.396 (7.755)	5.587 (7.583)	5.110 (7.695)
Number of trainings received	-0.925 (0.712)	-1.265* (0.678)	-1.074 (0.714)	-0.916 (0.707)
Importance of cocoa sales to total HH income (as %)	0.110 (0.179)	0.126 (0.179)	0.074 (0.174)	0.139 (0.178)
Number of income sources	1.828 (3.183)	2.149 (3.045)	1.437 (3.116)	1.426 (3.100)
Adoption of shade trees (yes/no)	8.178 (5.878)	5.808 (5.579)	8.478 (5.820)	8.745 (5.887)
Farm business school skills	0.849 (8.136)	1.493 (7.950)	0.221 (8.154)	1.053 (8.086)
Amount of money borrowed (in CFA)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
HH saved money	-2.847 (5.652)	-4.008 (5.520)	-3.763 (5.748)	-0.205 (5.683)
Granular fertilizer (% of land cultivated) * Granular fertilizer (% of land cultivated)		-0.008* (0.004)		
Pruning (% of land cultivated) * Pruning (% of land cultivated)			-0.005* (0.003)	
Planting of new seedlings (% of land cultivated) *Planting of new seedlings (% of land cultivated)				0.090*** (0.033)
Constant	37.025 (59.680)	13.311 (60.061)	40.326 (58.366)	43.755 (56.502)
R-squared adjusted	0.569	0.584	0.574	0.581
Estimation technique	OLS	OLS	OLS	OLS
Observations	167	167	167	167

Notes: * p<0.10, ** p<0.05, *** p<.01. Robust standard errors in parentheses.

Table 33 Regressions on cocoa labor costs per ha and total cocoa farm costs per ha

	Total labor cost per ha (USD)	Total farm cost per ha (USD)
	(1)	(2)
Cocoa productive land (ha)	3.357 (5.654)	-2.814 (6.436)
Cocoa productive land (ha) * Cocoa productive land (ha)	-0.147 (0.344)	0.236 (0.390)
HH head age	4.173 (3.894)	-0.061 (4.087)
HH head age * HH head age	-0.038 (0.038)	0.004 (0.040)
no education HH head (ref)	ref (.)	ref (.)
primary education HH head	14.267 (24.582)	-16.795 (22.330)
secondary education or higher HH head	-20.103 (24.749)	-45.365* (25.482)
HH head is single/widowed/divorced (ref)	ref (.)	ref (.)
HH head is married	-38.941* (21.736)	-34.637 (23.110)
HH head living in cohabitation	-33.764 (23.891)	-16.540 (23.970)
Internal locus of control of HH head	-0.509 (12.367)	3.288 (13.910)
External locus of control of HH head	-11.895 (9.856)	-10.994 (9.875)
Household size adults	5.158 (3.213)	3.726 (3.446)
Household size children	-0.321 (2.928)	-1.766 (3.007)
Born in the region	45.498*** (16.687)	48.903*** (17.531)
Spouse involved in HH decision making on sale, income and credit	5.282 (19.930)	-5.184 (20.383)
Comoé district (ref)	ref (.)	ref (.)
Gôh-Djiboua district	-4.832 (19.342)	-14.220 (22.986)
Other district	-14.265 (19.812)	-24.734 (23.301)
HH has a bank account	26.766 (20.980)	28.626 (22.251)
Mobile money	7.067 (29.777)	58.422** (24.751)
Granular fertilizer (% of land cultivated)	0.589** (0.243)	1.565*** (0.271)
Pesticide (% of land cultivated)	-0.343 (0.344)	-0.298 (0.348)
Fungicide (% of land cultivated)	0.262 (0.247)	0.126 (0.216)
Pruning (% of land cultivated)	0.241* (0.140)	0.411** (0.161)
Weeding (% of land cultivated)	0.264 (0.247)	0.373 (0.246)
Planting of new seedlings (% of land cultivated)	1.679 (1.293)	2.243* (1.316)
Percentage of land with cocoa trees 5 yrs or older	0.442 (0.499)	0.779 (0.533)
Sharecroppers on cocoa land	-39.084** (17.224)	-35.768* (19.126)
Number of trainings received	0.744 (1.312)	0.044 (1.536)
Importance of cocoa sales to total HH income (as %)	0.179 (0.465)	0.183 (0.478)
Number of income sources	-1.055 (4.698)	-3.816 (4.755)
Adoption of shade trees (yes/no)	5.076 (16.724)	16.442 (17.627)
Farm business school skills	16.020 (18.256)	21.871 (19.098)
Amount of money borrowed (in CFA)	0.000 (0.000)	0.000 (0.000)
HH saved money	10.727 (11.210)	6.218 (12.380)
Constant	-170.776 (138.478)	-76.596 (146.051)
R-squared adjusted	0.190	0.353
Estimation technique	OLS	OLS
Observations	164	163

Notes: * p<0.10, ** p<0.05, *** p<.01. Robust standard errors in parentheses.

Table 34 Regressions on HH cocoa net income, cocoa dependence and number of income sources

	Cocoa net income (USD - log)	Cocoa dependence for income (%)	Number of income sources
	(1)	(2)	(3)
Cocoa productive land (ha)	0.245*** (0.045)	1.665 (1.465)	0.006 (0.016)
Cocoa productive land (ha) * Cocoa productive land (ha)	-0.005* (0.003)	-0.070 (0.083)	0.000 (0.001)
HH head age	-0.035 (0.037)	-0.366 (0.791)	-0.014 (0.012)
HH head age * HH head age	0.000 (0.000)	0.001 (0.008)	0.000 (0.000)
no education HH head (ref)	ref (.)	ref (.)	ref (.)
primary education HH head	-0.097 (0.125)	-5.704 (3.538)	-0.006 (0.056)
secondary education or higher HH head	-0.201 (0.141)	5.136 (3.834)	-0.010 (0.063)
HH head is single/widowed/divorced (ref)	ref (.)	ref (.)	ref (.)
HH head is married	0.624*** (0.140)	-2.996 (3.941)	0.100* (0.060)
HH head living in cohabitation	0.213 (0.153)	-0.626 (3.602)	0.088* (0.050)
Internal locus of control of HH head	0.215*** (0.058)	1.915 (1.844)	-0.001 (0.025)
External locus of control of HH head	0.089 (0.072)	-0.465 (1.514)	0.006 (0.026)
Household size adults	0.055* (0.029)	0.171 (0.718)	0.025** (0.010)
Household size children	-0.013 (0.019)	-0.337 (0.451)	-0.009* (0.005)
Born in the region	-0.129 (0.097)	-5.183* (2.991)	-0.040 (0.030)
Spouse involved in HH decision making on sale, income and credit	0.081 (0.151)	-3.667 (3.993)	0.026 (0.063)
Comoé district (ref)	ref (.)	ref (.)	ref (.)
Gôh-Djiboua district	0.142 (0.136)	9.556** (4.175)	0.146** (0.062)
Other district	0.184 (0.128)	17.528*** (4.345)	0.052 (0.075)
HH has a bank account	0.164 (0.105)	-9.787*** (3.186)	-0.084* (0.045)
Mobile money	0.080 (0.139)	-5.524 (3.557)	0.003 (0.052)
Granular fertilizer (% of land cultivated)	0.001 (0.001)	0.013 (0.042)	-0.001* (0.001)
Pesticide (% of land cultivated)	0.004* (0.002)	-0.003 (0.063)	-0.001* (0.001)
Fungicide (% of land cultivated)	-0.003** (0.001)	-0.018 (0.032)	0.000 (0.001)
Pruning (% of land cultivated)	0.000 (0.001)	0.006 (0.035)	0.000 (0.001)
Weeding (% of land cultivated)	0.005*** (0.002)	0.064 (0.059)	0.000 (0.001)
Planting of new seedlings (% of land cultivated)	0.004 (0.008)	-0.162 (0.180)	0.000 (0.003)
Percentage of land with cocoa trees 5 yrs or older	0.002 (0.003)	0.026 (0.121)	0.000 (0.001)
Adoption of shade trees (yes/no)	0.320*** (0.102)	0.319 (4.100)	0.039 (0.041)
Sharecroppers on cocoa land	0.287** (0.127)	1.428 (2.896)	0.061 (0.042)
Number of trainings received	-0.021* (0.011)	0.436 (0.426)	0.012*** (0.005)
Importance of cocoa sales to total HH income (as %)	0.006** (0.003)		-0.004*** (0.001)
Number of income sources	0.075* (0.043)	-4.026*** (1.342)	
Farm business school skills	-0.013 (0.126)	0.209 (3.120)	-0.104** (0.049)
Amount of money borrowed (in CFA)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
HH saved money	0.067 (0.095)	1.765 (2.813)	0.087** (0.038)
Constant	5.501*** (1.054)	89.502*** (26.066)	2.064*** (0.358)
R-squared adjusted		0.315	
Pseudo R-squared			0.029
Log likelihood	-98.601	-669.999	-302.691
Estimation technique	GSEM	OLS	Poisson
Observations	145	167	167

Notes: * p<0.10, ** p<0.05, *** p<.01. Robust standard errors in parentheses.

Table 35 Regressions on total HH net income and probability of earning an LI

	Total HH net income (USD - log)	Earning an LI (no/yes)
	(1)	(2)
Cocoa productive land (ha)	0.235*** (0.045)	0.056 (0.034)
Cocoa productive land (ha) * Cocoa productive land (ha)	-0.004 (0.003)	0.001 (0.002)
HH head age	-0.036 (0.038)	-0.033* (0.018)
HH head age * HH head age	0.000 (0.000)	0.000 (0.000)
no education HH head (ref)	ref (.)	ref (.)
primary education HH head	-0.102 (0.126)	-0.088 (0.091)
secondary education or higher HH head	-0.201 (0.142)	-0.109 (0.085)
HH head is single/widowed/divorced (ref)	ref (.)	ref (.)
HH head is married	0.641*** (0.140)	0.299*** (0.105)
HH head living in cohabitation	0.245 (0.153)	0.219** (0.094)
Internal locus of control of HH head	0.226*** (0.060)	0.056 (0.043)
External locus of control of HH head	0.080 (0.071)	0.057 (0.045)
Household size adults	0.065** (0.029)	-0.049*** (0.018)
Household size children	-0.015 (0.020)	-0.021* (0.012)
Born in the region	-0.155 (0.102)	-0.087 (0.062)
Spouse involved in HH decision making on sale, income and credit	0.055 (0.149)	-0.034 (0.102)
Comoé district (ref)	ref (.)	ref (.)
Gôh-Djiboua district	0.150 (0.138)	0.143 (0.097)
Other district	0.230* (0.133)	0.171* (0.098)
HH has a bank account	0.150 (0.107)	0.062 (0.080)
Mobile money	0.059 (0.139)	0.029 (0.089)
Granular fertilizer (% of land cultivated)	0.001 (0.001)	0.001 (0.001)
Pesticide (% of land cultivated)	0.003 (0.002)	0.001 (0.001)
Fungicide (% of land cultivated)	-0.003** (0.001)	-0.002** (0.001)
Pruning (% of land cultivated)	0.000 (0.001)	0.001 (0.001)
Weeding (% of land cultivated)	0.004*** (0.002)	0.002 (0.001)
Planting of new seedlings (% of land cultivated)	0.002 (0.008)	0.007* (0.004)
Percentage of land with cocoa trees 5 yrs or older	0.002 (0.003)	-0.001 (0.002)
Adoption of shade trees (yes/no)	0.280*** (0.106)	-0.077 (0.066)
Sharecroppers on cocoa land	0.281** (0.128)	0.188** (0.077)
Number of trainings received	-0.017 (0.011)	-0.007 (0.008)
Importance of cocoa sales to total HH income (as %)	-0.012*** (0.003)	-0.008*** (0.002)
Number of income sources	0.071* (0.041)	0.026 (0.032)
Farm business school skills	-0.012 (0.126)	0.165** (0.073)
Amount of money borrowed (in CFA)	-0.000* (0.000)	0.000 (0.000)
HH saved money	0.075 (0.097)	0.019 (0.060)
Constant	7.305*** (1.082)	1.053* (0.593)
R-squared adjusted		0.473
Estimation technique	GSEM	OLS
Observations	145	145

Notes: * p<0.10, ** p<0.05, *** p<.01. Robust standard errors in parentheses.

Appendix 2 – Alternative income generating activities

Table 36 Assessing potential on-farm income generating activities

	Poultry	Beekeeping	Livestock	Fish ponds
What does it involve/ what problem does it aim to solve?	Provides a source of income or food that is not seasonal and requires little to no land (depending on the scale).	Provides an income source that is not seasonal and requires little land.	Provides a source of income or food that is not seasonal and requires little to no land (depending on the scale)	Provides a source of income or food that is not seasonal. Requires land for the fishponds.
Who is targeted?	Farmers and/or their spouses.	Farmers and/or their spouses.	Farmers and/or their spouses.	Farmers and/or their spouses.
Who made the suggestion?	Cooperatives, NCP, and elite farmers.	-	Elite farmers, cooperatives.	NCP farmers.
Is there any evidence that it works?	Implemented by several cocoa/chocolate companies. No clear evidence of the results.	Inconclusive evidence in current literature. Works in certain contexts[125]. It is too early to draw conclusions from our data.	Little evidence from qualitative data or literature. Opportunity to sell livestock in case of emergency can increase resilience.	Unclear from literature. Data suggests that certain scaling of the fish ponds is necessary to become profitable.
Is there a market?	There is likely to be a local market. Chickens are most popular food.	Still unclear. International Cocoa Initiative (ICI) mentions honey is uncommon in local markets which provides potential.	Unclear from qualitative data.	Fish is always in demand, particularly fresh fish. Current supply does not meet demand[126].
What are conditions?	Requires investment (access to finance for construction and working capital for feed/water) and training (technical assistance).	Literature suggests training and protective equipment and beehives are the key factors to successful implementation.	Requires investment (access to finance) and training.	Construction costs for fish ponds are high and training. Access to finance is key. The fish ponds need to be located close to water.
Positive spin-off?	Food security and nutrition/ lowering cost of living. Poultry droppings can be used as manure on cocoa farms.	Nutritional products for intake and for sale in community. Increased pollination by bees (potentially improving crop yields).[127]	Food security and nutrition/ lowering cost of living.	Food security and nutrition/ lowering cost of living,
Possible trade-offs/ risks?	Diseases (e.g., avian flu) and oversaturation of local markets.	Requires proper maintenance and technical assistance. It also requires sufficient protective clothes and transportation.	Diseases among animals. Animal feed is also expensive.	Requires proper maintenance (regular cleaning) and technical assistance. Fish feed is expensive.

[125]Amulen, D.R., D'Haese, M., Ahikiriza, E., Agea, J.G., Jacobs, F.J., de Graaf, D.C., Smagghe, G. & Cross, P. (2017). The Buzz about Bees and Poverty Alleviation. Identifying Drivers and Barriers of Beekeeping in sub-Saharan Africa. PLoS ONE, 12(2), e0172820

[126]CORAF (2018). Turning Fish Farming into Profitable Business in Côte d'Ivoire. Available at: http://www.coraf.org/2018/11/07/turning-fish-farming-into-profitable-business-in-cote-divoire/

[127]Amulen et al (2017)

Box 3 Alternative income generating activities: cocoa pulp and cocoa juice

Cocoa beans only constitute 10% of the gross weight of a cocoa pod, meaning that 90% of is discarded. Efforts can be made to convert this waste into profitable by-products. The cocoa beans inside the pod are surrounded by mucilage, a sticky pulp. This pulp is discarded as a waste product during post-harvest, but still has a few uses that could allow farmers to gain an additional income alongside selling dried cocoa beans. For example, the flavor from the pulp can be used as a substitute for sugar in chocolate production, while it can also be used to is to produce juice from the pulp.

Nestlé is currently using pulp as a natural sweetener in chocolate bars called Incoa. Currently, this pulp is sourced exclusively from Brazil, with trials being conducted in West Africa. Nestlé has also laid the foundation for Kumasi juice, which is a fast-growing start-up sourcing pulp from Ghana and trailing local juice production in Côte d'Ivoire. The Swiss-Ghanaian start-up KOA is an important technical partner to process pulp.

As most initiatives relating to cocoa pulp are relatively young, the impact on HH income remains largely unclear. The ultimate income level will largely depend on creating market demand for this new product. Nestlé argues that, by creating opportunities for pulp sale, farmers can potentially boost their income from cocoa by 20-40%. This is similar to the income boost of approximately 30% per kg of beans, as noted by KOA and Kumasi juice.

Box 4 Alternative income generating activities: biochar

Biochar is a type of charcoal that can be produced by burning farm waste products, such as empty cocoa pods, weeds, and leaves, with limited air exposure. Biochar possesses unique chemical attributes which helps rebuild soil by boosting nutrients and improving its physical characteristics, in turn supporting crop growth. Besides its use in agriculture, this type of charcoal can also be used to produce energy and permanently store carbon, which can be beneficial for climate change mitigation (Barry Callebaut, 2020).

Chocolate manufacturer Barry Callebaut is looking into biochar production at farm level, although still in a trial phase. A previous biochar trial in Indonesia found significantly increased soil temperature, fertility, and moisture, and growth of cocoa seedlings (Bahrun et al., 2017). In addition, trials using biochar in Cameroon provided positive results on soil fertility, crop growth, and the reduction of black pod rot (Nkengafac, 2016). Ultimately, it can be used by farmers as a fertilizer enhancer. The primary goal of the program is to increase cocoa yields while reducing the need for and expenditures on chemical fertilizers, subsequently increasing farmer revenue (ibid). The effects on yields and HH income are currently unclear.

Appendix 3 – Personas

A persona is developed from a range of sources, pulling together common characteristics of similar people into an "archetype" through which a group can be understood. The characteristics of these archetypes cannot be assigned to a particular person. In this appendix, we share details on different archetypes which reflect our deeper understanding of each segment and what this means for potential solutions that will serve them.

Aspirational elite

Basic demographics
Name: Kwabena
Sex: M
Age: 40
Education: Bachelor's degree
Employment: Self-employed farmer (<3 ha)
Marital status: (Just) Married
Number of children in HH: 4

Values/attitudes/interests
- He is ambitious and confident and has concrete plans to be successful in life as a farmer, investor (in housing), and in business.
- He know how to express himself.
- He is married and wants to form a strong partnership with his wife.
- He wants his children to be successful in life and attend school up to university level.
- He sees himself as responsible for his (extended) family and for poorer members if his community. It gives him satisfaction to help others in need.
- He sees himself as an example for others.
- Honesty and truth are key values.
- He is eager to learn more about agricultural techniques and receive training.
- He wants to be financially well off, but money is not the most important goal in life.
- Getting respect is important for him, but this is not only about money but also about making the effort to dress well and eat well.

Determinants of behavior
He is independent and physically strong, and does most work on his farm together with his wife. Besides his cocoa farm, he also reserves a plot for rubber and other crops. There is no need to hire additional labor and he prefers not to, as doing so is expensive. Although his yields are relatively high, his income is relatively low. Thanks to the Elite training, he improved his financial management skills, which has helped him save money from cocoa sales to modernize his farm and invest in additional income-generating activities. He has many ideas, but would benefit from more knowledge; for example, on income diversification and the financial aspects of setting up a business. He wants to avoid being in debt.

Behavior
He applies GAP on his farm and conducts proper weeding and pruning. He invests in inputs, particularly fertilizer. He also planted some new cocoa trees last cocoa season. He makes the decisions on the household and finances with his wife. They have a shared vision for the future.

Barriers
There is not a lot that can keep him from being successful, except for his health. What constrains him from realizing some business activities is a lack of money to make the required investments. There are a few additional potential barriers that could hinder him in achieving his goals. He feels he lacks knowledge on income diversification and the marketing of non-cocoa goods, and could benefit from more training on financial planning. There are also some external factors that potentially affect his farm, such as CSSVD and bushfires.

Information sources and channels
- He likes to hang out with his friends, but since he is married he also likes to be with his wife and make plans with her.
- He watches television and listens to the radio to be informed.
- The cooperative is the main provider of the information and services he receives.

Young, single, and ambitious farmers

Basic demographics
Name: Jesse
Sex: M
Age: 33
Education: Secondary school
Employment: Self-employed cocoa farmer (<2 ha) and different jobs
Marital status: Single
Number of children in HH: 3

Values/attitudes/interests
- He is ambitious and smart. He has lot of ideas on how to make money.
- He wants to be rich and values clothing (he likes brands!).
- He is single and still lives with his mother and siblings.
- He feels responsible for his mother and siblings. His father has passed away.
- He is eager to have a house of his own and settle down, but will only do so when he has sufficient financial resources to take care of his (future) wife and (future) children.
- Although still young, he is already thinking about his retirement and what he will need to do to live comfortably when he gets older.
- He finds elite farmers an inspiration and wants to become like them and have access to Elite training.
- He is confident and a role model in the community.

Determinants of behavior
When his father died, he was bequeathed a small piece of cocoa land. He manages the farm by himself. The farm does not provide enough money, so he combines cocoa farming with cocoa trade. He also has a motorbike that he rents out as a taxi. Although he is keen to invest in other activities, he sees cocoa as his financial basis and legacy for his (future) children.

Behavior
He mainly invests in labor on his farm. Pruning in particular helps him a lot, and he enjoys the motorized pruner he borrows from his uncle. He does not always have the money to invest in inputs and equipment, and manages to apply fertilizer on only part of his farm. He tries to save some money from cocoa sales to invest in a freezer so he can start a trade in frozen Ghanaian chicken, for which there is a lot of demand.

Barriers
One challenging factor is that his farm is quite remote and the road conditions are poor. Transporting the cocoa is challenging and, last year, some of his cocoa rot. In addition, some financial constraints prevent him from accessing more fertilizer and other crop protection products. Having access to processing equipment would be of great assistance and also help his mother process cassava.

Information sources and channels
- He likes to hang out with his friends and play on his mobile phone. He watches television, but not at his own house (as he doesn't have a television).
- He thinks the cooperative can help with providing access to inputs and loans.

Diversified HH

Basic demographics
Name: Samuel
Sex: M
Age: 42
Education: Primary school
Employment: Self-employed farmer (<4 ha)
Marital status: Married
Number of children in HH: 4

Values/attitudes/interests
- He is a family man. His family is at his core.
- He considers himself to be an entrepreneur, and is always looking for opportunities on his farm.
- He is hard worker and dynamic.
- He is active in the community and respected.
- He wants to share his knowledge with others.
- He thinks about the longer-term.

Determinants of behavior
He had to stop school at young age to care for his mother. He has married twice, and lives with his wives, children and his mother. His mother is getting old and is often sick. He takes care of her and pays the health care bills. He relies on inputs on credit from the cooperative, which help him access fertilizer. It is becoming more difficult to access labor, as youth prefer the quick money available from the gold mines. His children are in school and have little time to help on the farm.

Behavior
He grows different crops on his farm, and is currently investing in crops that are more drought-resistant. He tries to encourage his wives to set up a small business, and invested some money in a hairdressing shop. However, they have not been very open to the opportunity and he has not seen any progress. He is investing in a fish pond, for which he obtained a loan from the cooperative. It will take some years before he will see the benefits, but he is patient. He know there is demand for fish.

Barriers
There is a water problem in the community and many of the crops he grows do not survive. The droughts that result from climate change are forcing him to diversify his income even further. The relationship with his wives is not optimal; they don't share any information with each other. This frustrates him, as he wants to help them. The health situation of his mother is worrisome, but he still manages to pay health-related bills from his income-generating activities.

Information sources and channels
- He watches television for the news, so he can debate with his friends.
- He prefers to spend time with intelligent and educated men.
- The cooperative is an important provider of inputs and loans.

Cocoa-dependent HH

Basic demographics
Name: Tom
Sex: M
Age: 57
Education: No education
Employment: Self-employed cocoa farmer (<6 ha)
Marital status: Married
Number of children in HH: 4

Values/attitudes/interests
- He is the head of the family.
- He values education for his children, particularly because he did not have the opportunity to attend school.
- His wife is his compass.
- Respect is important for him.
- He wants to share his wisdom with people who are poor, like him.

Determinants of behavior
His parents come from Burkina Faso. Although he was initially interested in carpentry, he decided to follow in the footsteps of his father, and began working on his cocoa farm. He learned everything from his father. He has been a farmer for many years and now owns quite a large cocoa farm. Some of his trees are old, but still bear some fruit. He is currently building a house, little by little, with a small shop for his wife. He also recently invested in some pigs and sheep to provide the household with additional income.

Behavior
He applies everything he learned from his father on the farm. When he sells his cocoa, he is able to pay for his children's education. He saves part of the cocoa money for inputs, and applies fertilizer on part of his farm. His yields are quite high. During harvest, he hires some seasonal laborers to help him with pod breaking. He also tries to save some money to cover emergencies, such as funerals. It is important to make a significant financial contribution to a funeral so people respect him.

Barriers
Although he believes he is successful in life, he still considers himself poor and cannot make any big investments. The laborers he normally hires are now asking for higher wages, which worries him. He also relies on his wife to guide him in making responsible decisions. Sometimes, he regrets that he did not receive any education as this would have benefited him. He currently depends on his children to read letters or register at a bank.

Information sources and channels
- He spends most time with his wife and children.
- He watches television and listens to the radio to be informed about the news.

Female entrepreneurs

Basic demographics
Name: Edith
Sex: F
Age: 35
Education: No education
Employment: Hairdresser
Marital status: Divorced
Number of children in HH: 2

Values/attitudes/interests
- She is proud.
- Financial independence is important to her.
- She would do anything for her children.
- She wants to be respected.
- Her mother and children are her motivators and encourage her to be successful.
- Her mother is her moral compass.
- She sees independent, hard-working women as her role model.

Determinants of behavior
Her parents divorced when she was young, and her mother did not have the money to attend school. Fortunately, she could do an apprenticeship at a hairdresser. She learned the trade. She took a cleaning job to save some money to open up her own hairdresser salon. Her father refused to help her, but her mother helps with advice. She has two daughters, is a single mother and still lives with her mother. She is determined for her daughters to avoid are suffering as she did, which is why she is determined to build a house as inheritance for them.

Behavior
She works hard in her salon and is saving money to build her own house. This is important to her, as it will make her respected. She now has two girls who do apprenticeships with her.

Barriers
As a single mother, she has to take care of herself. She lacks financial skills to increase her profits. Sometimes, she needs to travel to Abidjan to buy materials for the salon, but this takes a lot of time and is expensive as there is no good transport service. Income from the salon is also irregular, which proves challenging. During the holidays there are many clients, but outside this time it can be quiet and income can be low.

Information sources and channels
- She watches television when she is working in the salon and there are no customers present.

Appendix 4 – List of pain relievers

Table 37 Summary of pain relievers identified by HH segments

Challenge/Pain	Pain reliever	Suggested by:
Access to financial resources & services	Partnership between cooperative and banks to provide favorable loans to members	Young, single, and ambitious farmers
	Promote savings at the right time, particularly directly after cocoa sales	Young, single, and ambitious farmers
	Promote saving groups via women's associations/VSLAs	Female entrepreneurs
	Provide inputs on credits, which can be refunded to the cooperative at a later stage after the cocoa sales	Young, single, and ambitious farmers
	Set up microfinance institutions specifically for farmers	Diversified HH
	Organize women and give them access to funds so they can start a business together and/or individual loans to women to set up a business	Cocoa-dependent HH
	Provide women with information on financial services	Female entrepreneurs
Access to training	FBS training for non-elite farmers and training in income-diversification	Young, single, and ambitious farmers
	Training on financial planning and marketing of alternative crops/products as part of the elite training	Aspirational elite
	Additional coaching on the farm and at household level to understand farmers' challenges and give advice	Aspirational elite
Access to inputs /equipment	Supply of necessary cocoa inputs though the cooperative	Diversified HH
	Access to processing equipment for cassava via NGO or women's association	Female entrepreneurs
Access to markets/ poor infrastructure	The government should construct roads, which would increase farmers' mobility, reduce transport costs and facilitate trade	All HH segments
	Community members can support the construction/repairment of roads	Young, single, and ambitious farmers
	Local businesses would benefit from nearby wholesale opportunities to purchase materials at lower price	Female entrepreneurs
	A water tower to provide community members with easy access to clean water, avoiding the need to fetch water from the river	Diversified HH and Female entrepreneurs
Pests, droughts and diseases	Farmers would benefit from accessing a motorbike pump for irrigation, for example via the cooperative	Aspirational elite
	Extension agents should give right and timely advice on Swollen Shoot	Young, single, and ambitious farmers
	Better information about which products to use to maintain the farm, avoiding contradictory advice	Cocoa dependent HH
Expenditures	Banks could start providing loans/school funds at the beginning of every academic year	Aspirational elite/ Diversified HH
	Build schools for secondary school children in villages	Diversified HH/Female entrepreneurs
	Promote changing funeral traditions, as these pose big costs for farmers	Young, single, and ambitious farmers