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An Analysis of Which Intrinsic and Extrinsic Factors Determine Shade Tree Incorporation Into Cocoa Plantations in Soubré, Côte d'Ivoire

Master Thesis of:
Nathalie Windlin

Student ID:
14-666-820

Email:
nwindlin@student.ethz.ch

Supervisor :
Dr. Pius Krütli, Transdisciplinarity Lab

Co-Supervisor:
Braida Thom, Sustainable Agroecosystems

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Summary

Côte d'Ivoire is the world's largest cocoa producer. Cocoa production is particularly vibrant in the Soubré region in the Western part of the country which accounts for 20 % of the annual national cocoa output. Soubré-based cocoa producers mostly pursue full-sun mono-crop cultivation strategies which promise high short-term yields but undermine cocoa trees' long-term productivity. The academic literature has identified shade trees as one promising remedy to render local cocoa production economically and ecologically more viable. CABOZ AG, which purchases the cocoa harvest from 777 Soubré-based farmers, has undertaken serious endeavours over the past years to promote shade trees on their affiliated cocoa plantations, oftentimes to little avail. The survival rate of distributed shade tree seedlings is low and shade trees barely occur on cocoa fields in contemporary Soubré.

This study aims to flesh out the obstacles to shade tree incorporation on cocoa plantations in the Soubré region. It relies on Fishbein & Ajzen's (2010) Reasoned Action Approach (RAA) to test its main hypothesis that CABOZ-affiliated cocoa producers in Soubré hold strong negative attitudes towards shade trees and are therefore unwilling to plant and maintain them. One key contribution this study makes is the collection of raw data on both local farmers' attitudes towards shade trees and their explanation for why so many shade trees have perished on local cocoa fields. The data collection process in Soubré encompassed four consecutive steps and involved focus group discussions as well as the implementation of a survey that 295 farmers completed. The study uses descriptive analysis and linear regression models to evaluate the data that were compiled during nine weeks in the field.

The analysis of the gathered data reveals that most of the interviewed cocoa producers acknowledge the multiple benefits of shade trees and are willing to plant and maintain the latter in the immediate future. Local cocoa farmers' strong positive attitude towards shade trees runs counter to the above-mentioned hypothesis and raises the question of why shade trees do not persist in Soubré even though local cocoa producers agree on their benefits. The study discusses five potential explanations to account for this puzzle. Two of the rationales offered evolve around farmers' concerns about the disadvantages of incorporating shade trees and unfavourable extrinsic factors such as bad infrastructure, respectively.

Moving ahead, future research should try to better understand how farmers' negative beliefs about shade trees prevent them from incorporating the latter on their fields. A systematic investigation of extrinsic barriers to shade tree incorporation is a second priority for future studies. This particularly concerns the issue of poor infrastructure and farmers' insufficient resources to maintain shade trees. On the other hand, the data suggests that stakeholders which seek to promote shade trees should continue to educate local farmers about the advantages and handling of shade trees, openly discuss farmers' concerns about potential negative consequences of shade tree incorporation and collaborate with farmers to improve the shade tree seedling distribution process.

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1 Introduction

Contemporary cocoa cultivation systems entail considerable negative ecologic, economic, and social repercussions for cocoa producing countries (Gyau et al., 2014). This particularly applies to the full-sun and mono-cropped cocoa production which the majority of cocoa producers in Côte d'Ivoire rely on (Tondoh et al., 2015). Full-sun production systems generate higher yields in the short-term. At the same time, they deplete soils, create an environment conducive to pest infestations, fuel widespread and rapid deforestation, and therefore increase the country's and its cocoa producing communities' vulnerability to climate change in the long run (Andres et al., 2016; Gyau et al., 2014; Ruf, 2001; Tondoh et al., 2015). Furthermore, these negative side-effects have already begun to undermine the productivity of Côte d'Ivoire's old cocoa fields. The output generated by these long-standing plantations has declined steadily over the past years. Other cocoa producing countries and regions are superior to Côte d'Ivoire when it comes to the average cocoa yield per hectare these days (Gyau et al., 2014; Vaast & Somarriba, 2014). Nevertheless, Côte d'Ivoire remains the world's most important contemporary cocoa producer (Gyau et al., 2015; Läderach et al., 2013).

This situation calls for the implementation of "Good Agricultural Practices" (GAPs) to render the country's cocoa sector more sustainable, productive, and efficient without expanding today's cultivation area (Gyau et al., 2014; Vaast & Somarriba, 2014). GAPs, according to Banzon et al. (2013), are techniques that enhance agriculture's sustainability, are committed to produce high-quality food products, and protect farmers and their workers' health, amongst others. Utilising clean and healthy cocoa tree seedlings from nurseries, pruning of young cocoa trees or incorporating shade trees into the cocoa plantations exemplify such GAPs in the context of cocoa cultivation (Niether et al., 2018; Olutegbe & Sanni, 2021; Pannell et al., 2006). Several scholars have intensely studied the trade-offs that are associated with the introduction of shade trees or more sophisticated agroforestry systems, such as Dynamic Agroforestry Systems (DAFs), from an agronomic, environmental, and socioeconomic perspective (Andres et al., 2016; Ayuk, 1997; Fleming et al., 2019; Iiyama et al., 2018; Niether et al., 2018; Phiri et al., 2004). The verdict of the literature is mixed. On the one hand, scholars stress that shade trees or more complex agroforestry systems can enhance carbon sequestration and soil fertility, increase plantations' drought resistance, control weed and biological pest control and contribute to the conservation of biodiversity (Clough et al., 2011; Mwase et al., 2015; Somarriba & Lopez-Sampson, 2018; Tscharntke et al., 2011). Mwase et al. (2015) further point to the long-term economic benefits of shade trees that come in the form of timber, firewood, nuts, or fruits. On the other hand, Blaser et al. (2018) highlight that shade trees compete with cocoa trees for nutrients, water and light. In addition, the authors argue that too much shade hampers cocoa trees productivity. Grass et al. (2020) align with this reasoning and conclude that monocultures guarantee higher yields.

The academic debate outlined above indicates that shade trees are not a panacea. However, there is evidence that cocoa cultivation systems under low to intermediate levels of shade cover promise decent yields while exploiting shade trees' ecological benefits (Blaser et al., 2018).

Although research presents many positive ecologic implications that are associated with shaded cocoa production, farmers remain hesitant to incorporate shade trees on their plantations, let alone adopt more complex agroforestry systems (Gyau et al., 2014; Mwase et al., 2015). There is a vibrant literature strand that is occupied with the question of why farmers do not embrace shade trees and agroforestry practices. Scholars have identified several factors that positively or negatively influence farmers' willingness to rely on shade trees and agroforestry systems. Among many others, farmers' age, tenure state or the exposition of the farm to extreme weather conditions (floods or droughts) are found to determine the adoption of agroforestry practices (Adesina et al., 2000; Mercer, 2004; Pattanayak et al., 2003; Thangata & Alavalapati, 2003). Shifting the focus to the specific case of cocoa plantations, three recent contributions investigate the determinants of shade tree incorporation on Ivorian plantations. Firstly, Kouassi et al. (2021) stress age, gender, access to seedlings of shade trees and financial resources determine cocoa producing households' willingness to adopt cocoa agroforestry.

Secondly, Atangana et al. (2021) find that those Ivorian cocoa producers are more likely to incorporate high-value tree species on their fields who expect the latter to yield multiple benefits and have experience in tree planting. Thirdly, Gyau et al. (2015) further zoom into the determinants of the establishment of agroforestry through the incorporation of shade trees. They find that social network effects, geographic location of farms, and ethnic affiliation of farmers influence farmers' decision to incorporate shade trees on cocoa plantations in Soubré, Western Côte d'Ivoire.

The last three studies presented above enhance our understanding of why shade trees do not persist in Southwestern Côte d'Ivoire. However, Atangana et al. (2021) and Gyau et al. (2014) only offer a superficial investigation and discussion of the intrinsic factors that potentially incentivise or prevent local cocoa farmers to adopt shade trees. Kouassi et al. (2021), on the other hand, neglect intrinsic factors altogether. However, previous studies have shown the importance of intrinsic factors when it comes to the adoption of agroforestry practices, both for cocoa (Wartenberg et al., 2018) and other crops (Douthwaite et al., 2002; Meijer et al., 2015; Mekoya et al., 2008; Sileshi et al., 2008). This study therefore extents the analysis by Gyau et al. (2015) and use the Reasoned Action Approach (RAA) by Fishbein & Ajzen (2010) to investigate how intrinsic factors determine patterns of shade tree incorporation in Soubré. The RAA is a theoretical framework that focuses on three psychological constructs, i.e., attitudes, norms, and perceived behavioural controls, to explain human behaviour (Fishbein & Ajzen, 2010: 22).

Soubré was chosen as the study area for two reasons. Firstly, the region produces 20 % of the annual Ivorian cocoa output (Gyau et al., 2014: 1037). Secondly, different cocoa purchasers that are active in the region have launched unsuccessful initiatives to foster shade tree incorporation in the region in the past. One of these purchasers that seeks to promote shade trees on their farmers' plantations is the Swiss-based CABOZ AG. CABOZ AG has distributed shade tree seedlings among its affiliated farmers and organised instruction sessions during which the latter were introduced to shade tree planting and maintenance techniques. CABOZ AG's endeavours have had a limited impact though and shade tree incorporation rates among their farmers remain low.

The case of CABOZ AG

Like many other stakeholders in the cocoa value chain, the CABOZ AG promotes the incorporation of shade trees into cocoa plantations as an important GAP. Based in Zurich, they have been purchasing cocoa from smallholder cocoa producers in the region of Soubré, since 2009 [1]. CABOZ-affiliated farmers are organised under the umbrella of SCOPACI, a cooperative that is certified by the Rainforest Alliance (RA). The latter certification scheme requires cooperatives to conduct trainings in various areas of life, including health, good agricultural practices, and adaptation to and mitigation of climate change. Moreover, the RA demands a minimum of 18 shade trees per hectare on cocoa plantations (Sanial et al., 2020). CABOZ AG offers the required trainings to comply with the RA certification scheme and render cocoa production both more resilient towards climate change and socially sustainable. In Soubré and Duékoué, CABOZ AG has distributed shade tree seedlings and organised training sessions to educate their farmers about how to plant

[1] Information retrieved from personal discussion with Daniel Stähli, CEO CABOZ AG Switzerland, May 2021

and maintain them.

Between 2018 and 2019, CABOZ AG has implemented a nursery project under which 9250 shade trees were planted in the cocoa fields of 1195 farmers that sell their cocoa harvests to CABOZ AG. CABOZ endeavours to promote shade trees in the region have had limited success though. The survival rate of distributed shade tree seedlings is 3 % which is far below the target rate of 80 % (CABOZ AG, 2019). To increase this sobering number, CABOZ AG has been trying to identify the factors that cause shade trees to perish. This Master's thesis is embedded in the associated evaluation activities. CABOZ AG itself has several assumptions of why shade trees are not thriving in Soubré. On the one hand, they can imagine that harsh climatic conditions such as droughts or heavy rainfalls explain the high mortality rate of shade tree seedlings. On the other hand, they assume that their local cocoa producers seek to maximise the economic potential of their cocoa plantations in the short-run benefits and therefore neglect shade trees and their rather long-term benefits (CABOZ AG, 2019).

Goal and research questions

The low number of shade trees on CABOZ-affiliated farms motivates this study to investigate the obstacles that distort shade tree incorporation in Soubré. In light of the assumed high importance of intrinsic factors for the adoption of agroforestry-like systems such as shade trees this study emphasises farmers' attitudes towards shade trees in the analysis it conducts. The following two research questions guide the analysis:

RQ1: What is the attitude of CABOZ-affiliated cocoa farmers based in the Soubré region towards the incorporation of shade trees into their cocoa plantations?

RQ2: Which intrinsic and extrinsic factors determine the incorporation of shade trees on cocoa plantations in the Soubré region?

The presentation of CABOZ AG and its efforts to promote shade trees in the Soubré region suggest that CABOZ-affiliated farmers have acquired the necessary knowledge about the benefits of shade trees as well as how to plant and maintain them. In spite of farmers' knowledge, however, the shade tree seedlings distributed by CABOZ AG have perished in large numbers. Moreover, unfavourable biophysical conditions cannot exclusively account for the death of distributed shade tree seedlings in the region. This is due to the fact that many CABOZ-affiliated farmers received shade tree and cocoa seedlings, which both thrive under similar biophysical conditions, at the same time. However, the survival rate of cocoa seedlings was much higher as compared to their shade tree counterparts. This indicates that the biophysical conditions would have been suitable for shade tree growth.

Along these lines, this study hypothesises that farmers' attitudes towards shade trees is rather negative and prevents them from incorporating shade trees on their cocoa fields. Hypothesis H1 guides the analysis:

H1: Intrinsic factors hinder the incorporation of shade trees in Soubré.

The study is organised as follows. Section 2 describes the methodological framework of the study. It describes the study area, the composition of the sample, the survey design which encompasses four steps and the strategies employed to analyse the collected raw data. Section 3 presents the results obtained by means of a descriptive and linear regression analysis, respectively. Section 4 discusses the obtained results and identifies limitations of the study design as well as highlights avenues for future research. Section 5 provides a wrap-up of the key insights.

2 Methods

This Section describes the methodological framework of this study. It introduces Soubré as the study area, discusses the composition of the sample of surveyed farmers, presents the study design which consists of four steps, illustrates the data collection process, and explains the strategies used to conduct the analysis.

2.1 Study area

This study focuses on the region of Soubré, in the Southwest of Côte d'Ivoire (see Figure 1)[2]. This region is famous for its huge contribution to the country's cocoa production. Recent estimates as discussed by Gyau et al. (2014) hold that farmers in Soubré are responsible for 20 % of the

[2]Source: https://www.hydroreview.com/world-regions/ivory-coast-seeks-hydropower-site-studies-below-270-mw-soubre-hydro-project/#gref, last accessed: 6/12/2021)

annual national cocoa production. However, cocoa farmers in Soubré grapple with low levels of productivity and produce about 560 kg/hectare/year only (Gyau et al. 2014: 1037). This is far below the output generated by other international cocoa producing regions, but still above Côte d'Ivoire's average yield (Gyau et al., 2014). As already alluded to in Section 1, the CABOZ AG is one of the cocoa purchasers of the region.

Figure 1: Study area in Soubré, Côte d'Ivoire

2.2 Sample

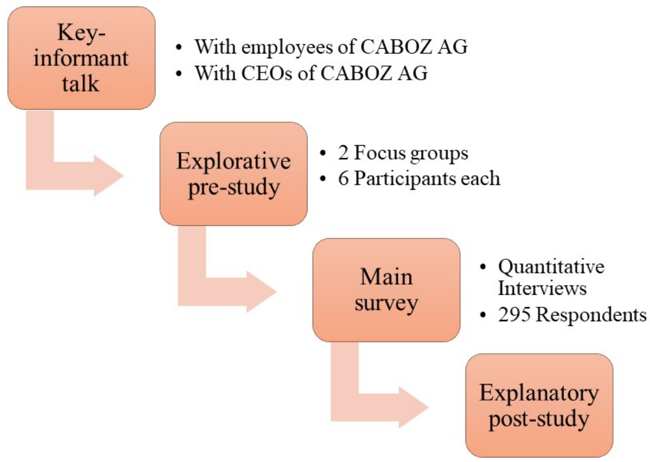
This study conducted a total of 295 interviews with local CABOZ AG-affiliated farmers and members of the cooperative of SCOPACI, respectively, to understand why shade trees have not flourished in the study area yet. The 295 interview partners spread across 78 villages in the region. The sample of 295 farmers was randomly selected from the 777 CABOZ-affiliated farmers based in the region of Soubré (CABOZ AG, 2020). The sample included 263 men and 32 women. Women were slightly overrepresented in the sample as they denote for 11 % of the survey respondents but only 8 % of all CABOZ farmers. Apart from that, the sample was representative of the total population of CABOZ-affiliated farmers. Key socio-demographic indicators such as the average age, gender balance and education did not vary across the sample of interview participants and all CABOZ farmers accordingly. Survey respondents had a mean age of 45 (CABOZ average, in 2020: 47 years), with most of them having at least five years of experience in cocoa farming. The vast majority of the interview partners had either no school education whatsoever (117 farmers, 40 %) or only completed primary school (90 farmers, 31 %). Only 5 % of the sampled farmers attended superior school. The average field size across all farmers interviewed was equal 5.3 hectares. The average age of the sampled cocoa fields was 41 years.

2.3 Study design

The overarching goal of the survey implemented in the context of this thesis was to identify the determinants of shade tree incorporation on cocoa plantations in the Soubré region. To structure the myriad of potentially relevant factors that drive shade tree incorporation, this study relied on the distinction between intrinsic and extrinsic factors while developing the survey questions. Research reveals that attitudes and beliefs of individuals as well as external factors such as climate or infrastructure determine their behaviour (Fishbein & Ajzen, 2010; Sood, K. K. Mitchell C.P., 2006). One contribution that stresses the importance of intrinsic factors is the Reasoned Action Approach (RAA) by Fishbein & Ajzen (2010).

The RAA uses surveys and confronts the respondents with statements that capture constructs like beliefs, norms, and perceived control which all potentially influence human behaviour. The specific items to investigate how these constructs play out in the context of shade tree incorporation in Soubré were developed during the fieldwork on the ground. Below elaborations on the second phase of the data collection process describe the exact approach pursued to identify these items. In the field, the survey team implemented a four-step approach to identify the survey items and collect the data for the analysis (see Figure 2).

Figure 2: The Four Step Study Design



Key informant talks

Firstly, the interviewers sat together with key informants like the employees and the two CEOs of CABOZ AG in the Côte d'Ivoire to discuss both the planned procedure in the field and some general questions concerning shade tree incorporation in the region in an open and informal manner. The discussion incentivised the key informants to present their hunch why shade trees fail to gain traction on cocoa plantations in Soubré. Further discussion topics included the processes involved in seedling production and distribution, and the most common, important, or popular types of shade trees in the region (see Appendix A.1).

Explorative pre-study

The RAA recommends an explorative pre-study to tailor the main survey which is guiding the interviews with the entire sample to the realities on the ground. That said, as part of the study design's second step, a total of twelve farmers were invited to assemble in two focus groups to discuss various potential determinants of shade tree incorporation in the Soubré region. The questions which structured these focus group discussions were extracted from the interview guidelines of the explorative pre-study the RAA suggests conducting (Fishbein & Ajzen, 2010: 451-453) (see Appendix A.1). While the review of the existing thematic literature had helped to identify potential drivers of shade tree incorporation before going into field, the two focus groups brought up additional factors during this explorative pre-survey that impede or foster shade tree incorporation.

The goal of the two focus group sessions was to

- Number of shade trees per hectare
- Farm size
- Implementation of GAPs

More specifically, both focus groups consisted of one individual with at least ten shade trees per hectare, one individual with no more than five shade trees per hectare, one individual with a farm size of at least five hectares, one individual with a farm size of no more than five hectares, one individual implementing GAPs, and one person not implementing GAPs each.

Main survey

Before implementing the final survey (see Appendix A.1) and collecting the data, the survey was tested with ten farmers residing in the environs of Soubré city. Afterwards, 295 farmers were invited to answer the survey in one-to-one conversations. Most of the interviews were conducted in Baoulé which is why two local translators conducted the survey in the field. It took four weeks to complete the third step of the study design and assemble the raw data that was later evaluated to better grasp the patterns of shade tree incorporation in Soubré.

Explanatory post-study

To further enhance our understanding of why shade trees do not persist, some of the insights extracted from the third step of the data collection process were fed back to three focus groups for further discussion. These three focus groups consisted of six to seven farmers each. The survey team selected focus group participants in two consecutive steps. Firstly, the last question of the main survey had asked respondents to elaborate on the reasons which they think explain the high shade tree mortality rate in the Soubré region. Those farmers that alluded to intrinsic factors in their explanations, i.e., those who blamed humans for shade tree death, were considered as potential focus group members. Secondly, the geographic location of the individual farmer determined the final composition of the focus groups. One focus group consisted of farmers whose cocoa plantations were situated close to the nursery and had direct access to the road network. Members of the second focus group were based in Pokouagui, which is far away from the nursery, but connected to the road system. The final focus group encompassed farmers with limited access to roads. This selection process allowed to make a sound assessment regarding the severity of the transportation issue concerning shade tree seedling distribution. It further triggered an in-depth discussion about human failures in cultivating shade trees. Specific discussion topics covered during the focus group sessions included (see Appendix A.1):

- The distribution and transportation of shade tree seedlings
- Optimal moment of distribution
- The implementation of other measures beyond seedling distribution to encourage shade tree incorporation
- Maintenance of shade trees

2.4 Questionnaire

The following sections provide a detailed overview of the items that were included in the main survey (third step of study-design). The discussion begins with a presentation of the two measurements for shade tree incorporation that this study employs. It then continues with the different elements the main survey comprises to capture intrinsic and extrinsic factors that in expectation determine shade tree incorporation. All information that are contained in the final dataset are measured on the individual level, i.e., for each farmer surveyed. The final dataset is cross-sectional, i.e., there is no variation in the variables measured across time but only across individual farmers.

2.4.1 Shade tree incorporation

This thesis seeks to explain the incorporation of shade trees into cocoa plantations in the Soubré region. To this end it uses two measures to proxy for the outcome of interest, namely

- Number of shade trees per hectare
- Survival rate of distributed shade tree seedlings

The first measurement was extracted by asking the interviewees to report the number of shade trees per hectare that were older than two years and cultivated on their field at the time of the interview. This implies that shade trees growing widely on their fields were not considered. This exclusive focus on planted shade trees has three advantages: Firstly, as it excludes wild shade trees, the investigated shade tree number is uniquely dependent on the farmer's behaviour in the past. Secondly, a behaviour which was recently performed is more easy to remember than a behaviour which lays back several years (Fishbein & Ajzen, 2010). Thirdly, the experience of the survey team showed that the estimation of wildly grown shade trees was challenging for farmers as they are mostly more numerously than deliberately planted shade trees.

A total of 272 farmers reported the number of shade trees on their fields. An alternative source of information on the number of shade trees for each individual CABOZ-affiliated farmer is a dataset maintained by CABOZ AG. Back in 2020, CABOZ AG used a uniform procedure implemented by their technicians ("Paysan relais") to estimate the number of shade trees for all CABOZ-affiliated farmers. However, the information compiled back then are available for 186 (63 %) of the survey respondents only. Along these lines, to boost the statistical power of the computations performed in Section 3, this study used farmers' self-reported number of shade trees to capture shade tree incorporation. As a general word of warning, the results obtained should be interpreted with caution as they are predicated upon self-reporting.

The second proxy for the incorporation of shade trees is the survival rate of shade tree seedlings approximately one year after they had been distributed to farmers. Farmer f was asked whether and how many shade tree seedlings r he or she had received in 2020 and how many of those are still alive a today. To render the information comparable across respondents and to ensure that external factors are not driving the variation in survival rates, the question was only asked for the distribution last year, in 2020. Equation (1) expresses the shade tree survival rate in mathematical terms:

$$(1) \qquad \textit{Survival rate}_i = \frac{100_f}{r_f} \times a_f$$

If farmers received shade trees, the majority of them obtained between one and ten seedlings. Survey respondents found it easier to report the number of shade tree seedlings they had received as compared to the number of shade trees on their field. Another advantage of using the survival rate of seedlings after the first year evolved around the fact that the long-term incorporation of shade trees hinges upon the survival of the distributed seedlings during the first twelve months.

The strict criteria employed to measure the second proxy for shade tree incorporation required sacrificing a considerable number of observations given that 53 % of the interviewees (155 farmers) had received shade trees in 2020. Many of the respondents never received the shade tree seedlings they had ordered, and a smaller number of respondents had either failed to show up when the seedlings were distributed or had no interest in obtaining shade tree seedlings.

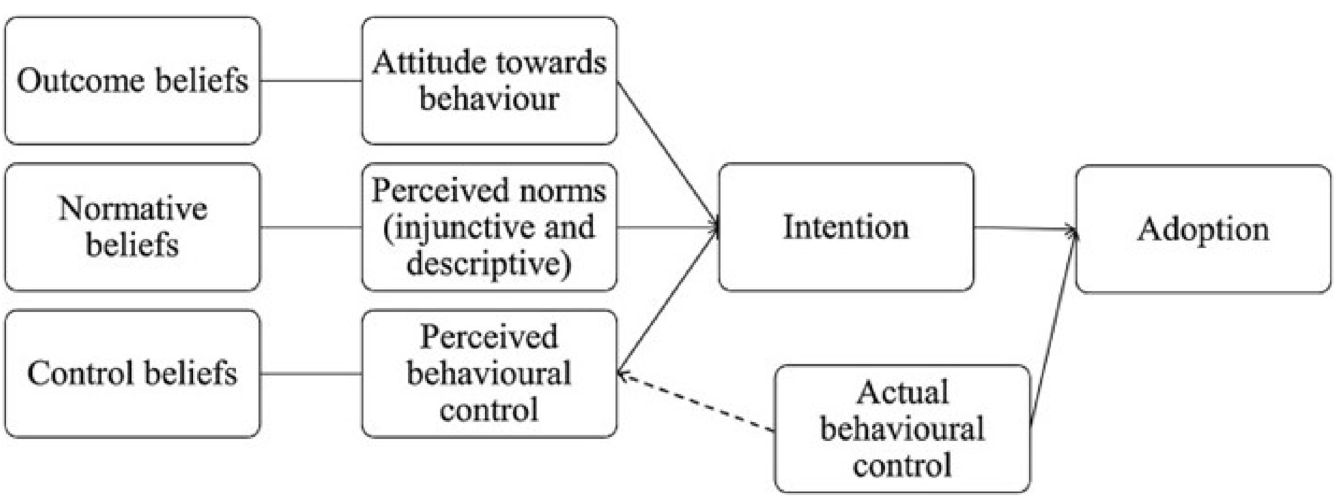
2.4.2 Determinants of shade tree incorporation

This study assigns potential determinants of shade tree incorporation in Soubré to three categories, namely intrinsic, extrinsic, and sociodemographic. The subsections below will zoom into each of these categories and discuss the variables that this study has created for the analysis.

2.4.3 Intrinsic factors

There is a myriad of theoretical approaches researchers have developed and tested to predict and explain human behaviour (e.g., Theory of Reasoned Action or Theory of Planned Behaviour). A particularly famous framework suggested by Fishbein & Ajzen (2010) is the Reasoned Action Approach (RAA) which is based on the "Theory of Planned Behaviour" by Ajzen (1991). The preceding theory emphasises the importance of attitudes towards a specific behaviour, subjective norms, and the perception of behavioural control to predict human's behaviour. Since 2010, the RAA has been tweaked and further elaborated to now include the level of "beliefs" and the construct of "actual behavioural control" which indeed hinder or facilitate an individual from performing a particular behaviour. The RAA is well-established within the literature and hence the ideal theoretical framework to explain why cocoa farmers in the Soubré regions do or do not incorporate shade trees on their plantations. Figure 3 graphically depicts all components that, according to the RAA, explain human behaviour.

Figure 3: Model of the Reasoned Action Approach (RAA) by Fishbein & Ajzen (2010)



The following sections discuss both the seven psychological constructs which the RAA identifies as determinants of human behaviour and the items included in this study's survey to operationalise them.

Outcome beliefs

The RAA defines "Beliefs" as the association of an object with several characteristics and qualities. In the context of explaining or predicting behaviour, individuals form beliefs about an outcome, i.e., about an expected result or consequence of the behaviour (e.g., planting shade trees will attract rain). A belief about the outcome of a behaviour can be positive or negative. Hence, one can name the positive or negative outcome beliefs as advantages ("shade trees attract rain") or disadvantages ("shade trees attract parasites"). Moreover, any belief an individual holds can be strong or weak. Those two components together, i.e., the valence of the behaviour and its strength, build the attitude (Fishbein & Ajzen, 2010). To find out and test the outcome beliefs that CABOZ-affiliated farmers hold about shade tree incorporation in their cocoa plantations, they were asked to name advantages and disadvantages of growing shade trees. Table 1 provides an overview of the disadvantages and advantages that the twelve farmers who participated in the two focus group discussions under survey development step 1 (see Section 2.3) mentioned. It also reports the number of focus group participants who referred to the respective (dis-)advantage. The overview further indicates that some (dis-)advantages were mentioned by several farmers. The final survey included those (dis-)advantages that were cited most often. The selection process ensured that an equal number of advantages and disadvantages were included as items in the final survey. It is therefore that the two advantages "Give money" and "Give strength to humans" were excluded from the final survey while the disadvantage "Some trees occupy space without any use", even though the latter was only mentioned by one farmer. Note that three advantages were brought up by two participants each. In this case, "attract rain" was selected for the final survey as this aspect alluded to biological factors. On the other hand, "Give money" and "Give strength to humans" refer to the same idea as "Give strength to cocoa trees" and "Shadow and protection for humans" which were both mentioned by five participants each. Table 1 marks those items which were not incorporated in the final survey in italics.

Table 1: Disadvantages and advanages of the planting of shade trees into cocoa plantations stated by farmers participating in focus groups

Advantages	Frequency of naming	Disadvantages	Frequency of naming
Provide food	6	Hinder production if too dense	5
Give strength to cocoa trees	5	Favour development of parasites	4
Protection against the sun	5	Favour the black pod disease	3
Provide shadow for humans	5	Some trees make the soil hard	3
Provide wood for construction and furniture	4	Branches of the tree can fall and destroy cocoa trees	3
Provide medicaments	4	Tree can fall and destroy cocoa trees	3
Attract rain	2	Some trees occupy space without any purpose, use, or value	1
Give money	*2*		
Give strength to humans	*2*		

Attitude

As already alluded to in the previous section, attitudes base on the outcome beliefs which a person holds about a specific behaviour. The RAA refers to the concept of attitude as the "latent disposition or tendency to respond with some degree of favourableness or unfavourableness to a psychological object" whereas the object can be a behaviour (Fishbein & Ajzen, 2010: 76). There are several options to measure attitudes. One of them is the "semantic differential" by Charles Osgood and his associates (1957) which stands out for its popularity and simplicity and was therefore chosen for this survey. The approach Osgood et al. (1957) pursue relies on several adjectives that refer to the showing of a behaviour and are presented to interview partners within a bipolar scale to let the latter rate them. The attributes used to test the surveyed cocoa farmers' attitude towards the incorporation of shade trees are the following:

- Good / bad
- Desirable / undesirable

The inclusion of the survey item that asked respondents to rate the "ecological importance" of shade trees deviates from Osgood et al.'s approach. The two local translators indicated that the concept of "ecological importance" was difficult to translate into Baoulé. The survey team therefore adjusted the wording of the item that covered the potential ecologic value of shade trees.

More specifically, the survey asked respondents whether they believe that the incorporation of shade trees on their cocoa plantations is "precious for nature" rather than "ecologically important". The interviewees' responses were captured by means of a Likert [3] scale from 1 (= totally disagree) to 5 (= totally agree) (Preedy & Watson, 2010).

Norms

The construct of norms investigates the perceived social pressure individuals feel to show or refrain from a particular behaviour. This construct hence rests upon the assumption that someone's behaviour is strongly influenced by their social environment.

Similar to the formation of attitudes, only salient normative referents do influence an individual's behaviour (Fishbein & Ajzen, 2010). Common examples of salient normative referents are family members, friends or the organisation an individual is working for. To identify the most relevant normative referents for cocoa farmers in the Soubré region, the facilitators of the two focus group discussions conducted under the second step of the study design (see Section 2.3) encouraged the participants to discuss which actors they think would command or reprimand them for planting shade trees on their cocoa fields. The discussions yielded the following five players as crucial normative referents for CABOZ-affiliated farmers in the Soubré region:

- CABOZ
- ANADER [4]
- Predecessors, i.e., farmers that had cultivated a respondent's cocoa plantation in the past
- Elder relatives
- Farmer colleagues

Adapting this insight in the main survey, the latter asked respondents to complete the following statement for each of the above-mentioned normative referents: "CABOZ thinks I should / I should not plant and maintain shade trees to incorporate them in the long term in my cocoa

[3]The Likert scale is a common and widely used scale to measure somebody's attitude towards an object or a behaviour. In this study, a five-point scale is used from 1 = "totally disagree" to 5 = "totally agree" to capture respondents' reactions to the respective survey item.

[4]ANADER (Agence nationale d'appui au développement rural, agricultural extension group in Côte d'Ivoire. http://www.anader.ci/)

plantation." This phrase aligns with the RAA (Fishbein & Ajzen, 2010: 454) and captures the so-called "injunctive norm" i of the respondent regarding normative referent r, in this case CABOZ.

As not every normative referent may be of identical importance to a survey respondent, the survey also tested individuals' motivation m to comply with each normative referent's preference. This test was performed by exposing all respondents to the following sentence: "When it comes to cocoa production and the maintenance of my field, I want to do what CABOZ thinks I should do." (Fishbein & Ajzen, 2010: 454). Respondents reacted to this statement by giving their approval or disapproval on the Likert scale from 1 (totally disagree) to 5 (totally agree). As indicated by Equation (2), the product of the injunctive norm i and the motivation m_r to comply with a specific normative referent r results in the norm n_r:

$$(2) \qquad \mathrm{n}_r = \mathrm{i}_r \times \mathrm{m}_r$$

Next to an individual's perception of what other people expect them to do or which behaviour to avoid, respectively, there is the construct of descriptive norms which is a second cornerstone of social pressure (Fishbein & Ajzen, 2010: 143). Descriptive norms refer to the actions taken by the social environment. That said, the survey asked all respondents to react to the following statement: "The majority of my farmer colleagues have planted and maintained shade trees last year." (Fishbein & Ajzen, 2010: 454). Once again, interviewees expressed their agreement or disagreement by using the Likert scale from 1 (totally disagree) to 5 (totally agree).

Control beliefs

Besides attitude and norms, perceived behavioural control is the third construct which influences a person's intention to perform a behaviour. The RAA defines perceived behavioural control as "the extent to which people believe that they are capable of performing a behaviour, that they have control over its performance" (Fishbein & Ajzen, 2010: 154-155). Hence, it incorporates several resources and circumstances which encourage or hinder an individual from performing a certain behaviour. The RAA refers to those resources and circumstances as control beliefs which shape the perceived control belief (Fishbein & Ajzen, 2010: 156). Furthermore, Fishbein & Ajzen (2010) distinguish between internal and external control. Internal control beliefs encompass "skills, abilities, and motivation". On the other hand, the RAA refers to "luck, other people or circumstances" as examples for external control beliefs (Fishbein & Ajzen, 2010: 154).

All twelve focus group participants involved in the first phase were asked to enumerate factors or circumstances which encourage or hinder to incorporate shade trees on their cocoa plantations. Table 2 presents those factors or circumstances mentioned most frequently. The final survey included those factors mentioned most often to test for those control beliefs. Elements in italics indicate those factors which were excluded from the final survey. Note that "strong presence of sun" and "need of rain" were dropped although they had been mentioned by four and three participants, respectively. The rationale for this decision evolved around the fact that the final survey already covered the benefits of shade tree incorporation regarding the attraction of rain and the protection of cocoa trees from the sun, respectively.

Table 2: Factors and circumstances facilitating or impeding the planting and long-term incorporation of shade trees into cocoa plantations, stated by farmers participating in focus groups

Facilitating Factors	Frequency of naming	Hindering Factors	Frequency of naming
Good experience	5	Fear of being dispossessed from their shade trees by CABOZ or loggers	4
Strong presence of sun	*4*	Fear of destruction of the field by loggers	3
Encouragement	4	Bad state of the field (tattered, infested by parasites or CSSV)	2
Need of rain	*3*	*If there are already enough or too many shade trees in the field*	*1*
Receiving a formation	2	*Fear of being dispossessed of its land*	*1*
		Fear of favouring the development of parasites	*1*
		If a tree is "against" the cocoa tree/ if it hinders the production of cocoa	*1*

The literature discusses insecure land tenure as an additional obstacle to the adoption of innovative agricultural practices (Kassie et al., 2013; Mwase et al., 2015). Focus group participants did not allude to insecure land rights when discussing factors that impede the planting of shade trees. However, since land rights are highly contested in sub-Saharan Africa (Bros et al., 2019) and particularly in Côte d'Ivoire (Pritchard, 2016), this aspect was nevertheless included in the main survey. Note that the survey only asked those respondents about the issue of insecure land tenure who had either reported to lack a legal document which confirms their ownership of the plantation they cultivate or were renting their cocoa field.

Following Fishbein & Ajzen (2010), the most convenient approach to investigate an interviewee's perceived behavioral control, which is the sum of all control beliefs, is to directly ask if they feel capable to perform a certain behaviour. Therefore, the survey included the following statement "I feel capable to plant and maintain shade trees now or next year if CABOZ AG is going to distribute shade trees again." (Fishbein & Ajzen, 2010: 462).

Intention

Fishbein & Ajzen (2010) define intention as a "person's estimate of the likelihood or perceived probability of performing a given behaviour". An individual's intention is determined by his or her attitude towards the behaviour of interest, the perceived norm, and the perceived behavioural control. The more positive the first two constructs are for an individual, the higher the probability that he or she shows the intention to perform the behaviour.

Perceived behavioural control tends to mitigate the effect of the other two constructs on an individual's actual behaviour observed in reality. The importance of each of these constructs for explaining observed behaviour varies across individuals though. Some individuals bend to the social pressure their referents exert on them, whereas the intention of others is determined much more strongly by their attitudes. That said, the survey asked respondents to report their intention with the following statement: "I have the intention to plant and maintain shade trees next year in order to incorporate them in the long run in my cocoa fields." Here again, farmers used the Likert scale from 1 (totally disagree) to 5 (totally agree) to give their response.

Past behaviour

Past behaviour is an important and strong predictor for future behaviour (Fishbein & Ajzen, 2010). Several scholars, according to Fishbein & Ajzen (2010: 286), have suggested to add past behaviour to the RAA accordingly. The survey conducted in the context of this study accounts for path dependency in human behaviour. More specifically, respondents were asked to either agree or disagree with the following statement: "Last year, I planted shade trees in my cocoa plantation".

Those respondents who disagreed with this statement were encouraged to elaborate on the reasons why they had not planted shade trees. This follow-up question enhanced the understanding of major obstacles to shade tree incorporation on cocoa plantations in Soubré.

Miscellaneous

Intrinsic factors that concern beliefs, norms and attitudes are obvious suspects when it comes to the question of why shade trees fail to gain traction on cocoa plantations in Soubré. The exchange with stakeholders in the field brought up the following two additional elements that might impede shade tree incorporation:

- General unwillingness on the part of farmers to diversify their plantations and crops
- Many of the local cocoa producers have their roots elsewhere and plan to return to their home soil in the future which is why they do not care about the long-term productivity of the cocoa fields they currently cultivate

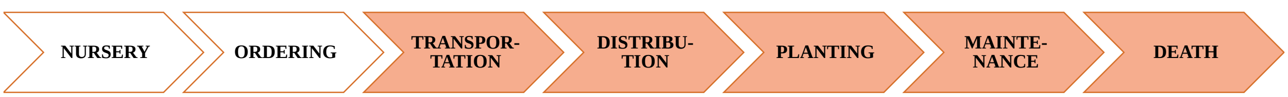
If farmers could derive economic benefits from shade trees, this might facilitate the promotion of shade trees in the Soubré region. Along these lines, CABOZ AG currently considers buying other products than cocoa from their farmers in order to foster more diverse plantations on their cooperative's ground. To assess whether a diversification of their income source incentivises farmers to incorporate shade trees, the survey asked the latter whether they were generally interested to grow other trees than cocoa.

The second element concerns the ethnic affiliation of the majority of CABOZ-affiliated farmers in the Soubré region. Most of the latter belong to the ethnic group of the Baoulé which are historically alien to Soubré and only settled in large numbers in the region around 60 years ago. The decent conditions to farm and earn a living acted as the main pull factor for the Baoulé back then (Ruf, 2001: 297). If Baoulé farmers long for returning to the home soil of their ethnic group at some point in the future, they might want to maximise their short-term economic income. Given that shade trees promise long-term economic and ecologic benefits, this myopic thinking might impede shade tree incorporation in the presence.

2.4.4 Extrinsic factors

The above-presented sub-sections indicate that psychological factors are strong determinants of human behaviour. Other important factors that help us predict and explain how humans behave can be summarised under the umbrella term "extrinsic factors". Common examples for extrinsic factors discussed in the literature include politics, climate and geography or culture (Meijer et al., 2015). However, in the context of this study, external factors play a minor role only. More specifically, this study limits its scope to four extrinsic factors which might affect the outcome of interest, i.e., the incorporation of shade trees on cocoa plantations in the Soubré region. To flesh out extrinsic factors which potentially promote the death of shade tree seedlings, it is helpful to illustrate the journey which shade tree seedlings complete before being planted in the cocoa fields. Figure 4 depicts the seven stages of that journey, which begins in the nursery and ends with shade trees dying. This study investigates the last five steps, i.e., transportation, distribution, planting and maintenance of shade trees, as well as the reason for death cited by farmers.

Figure 4: The Journey of Shade Tree Seedlings from Nursery to the Field



Receiving instruction

The process of distribution shade tree seedlings among farmers on the ground also included a short instruction about the benefits of these trees and how to plant and maintain them, respectively. As the instruction on the optimal planting and on the effect of the trees can have both an effect on the survival rate and the long-term incorporation of shade trees (Meijer et al., 2015), it might act as an important extrinsic factor to incorporate in this study. Furthermore, a workshop on shade trees should ideally increase the knowledge a person has about shade trees. For example, Gyau et al. (2015) find that past extension programs had a significant effect on the current incorporation of shade trees in the Soubré region. CABOZ AG organised instruction sessions on the day of seedling distribution. These sessions took place at the tree nursery or the collective distribution centres and discussed techniques to plant shade tree seedlings. That said, the survey asked respondents whether they had received an instruction on shade trees. Those respondents who reported to have participated in such an introductory lesson were further invited through an open-ended question to elaborate on the knowledge they had built up on this occasion and whether they found the instruction session helpful (”Did you learn something new from the instruction? If yes, what exactly?”).

Planting moment of shade trees

There is no contribution that has investigated whether the timing of planting shade trees affects the odds of the latter surviving. It is common sense though that the timing of plantation is crucial for each plant’s prospect to flourish. During the explorative first phase of survey development, it became evident that many of those respondents that had received shade tree seedlings had also received cocoa seedlings at the same time. When considering the CABOZ evaluation study conducted on the success of the seedling distribution, it is striking that the number of surviving cocoa seedlings was considerably higher as compared to their shade tree counterparts (CABOZ AG, 2019). This observation led to the ideas that the cocoa and shade tree seedlings had either been planted at different points in time or had not been maintained the same way. The survey took heed of the importance of the planting moment and asked the respondents whether they had planted their shade tree and cocoa seedlings simultaneously. If a respondent’s answer was in the negative, he or she was invited to elaborate on the reasons for the non-simultaneous planting behaviour.

Maintenance of shade trees

Once a shade tree seedling has been planted, the probability of survival depends on its ability to grow roots and the level of care that the individual farmer dedicates to it in the subsequent months (Conseil du Caflé-Cacao, 2015). One working hypothesis that evolved while implementing the second phase of the survey stated that farmers do not invest sufficient time or labour force to maintain the shade trees they had planted before. This hypothesis came up too late to be tested for all survey participants. Nevertheless, a total of 120 respondents were asked if they invested work to maintain their shade trees. Everybody, except from one person, answered this question in the affirmative. An open-ended question was then posed to those respondents to learn more about their specific maintenance activities. To facilitate note taking, the questionnaire had already prepared with a compilation of the most important maintenance activities including:

- Weeding
- Fertilising
- Irrigating
- Phytosanitary treatment, and
- Other

Reasons mentioned for death of shade trees

This study approached all 295 interviewed farmers to find out whether they had received a shade tree seedling in 2020. If so, the consecutive question concerned the number of shade trees that were still alive one year after the respective farmer had planted them on their cocoa field. For those farmers who reported that some of their seedlings had perished, the survey relied on an open-ended question to allow the individual farmer to expand on the reasons for the seedlings' death. Note that the explanatory power of this information is limited as it is both based on self-reporting and only available for 108 farmers. Potential factors that undermine the validity of the self-reported reasons seedling death encompass:

- Social desirability – People might be inclined to conceal personal failures when it comes to shade tree planting or maintenance (Fishbein & Ajzen, 2010; Sjöström & Holst, 2002) and might use the weather or other external factors as scapegoats instead
- Lack of knowledge – Farmers might allocate the reason for the seedling's death to the wrong element because they do not have enough information or lack appropriate knowledge (see also Smith Dumont et al., 2014)
- Death of seedlings may be the result of external factors which were both unconducive to shade tree seedlings' development but beyond the control of individual farmer

In light of these issues with self-reported reasons for the death of their own shade tree seedlings, the survey asked farmers to explain the general pattern of high shade tree mortality rate in Soubré. Shifting farmers attention away from their own cocoa field when discussing the issue of shade tree death mitigates the issue of farmers feeling accused of the death of their own shade trees.

2.4.5 Sociodemographic factors

The conceptual framework developed by Meijer et al. (2015) refers to sociodemographic factors as an important group of variables which influence an individual's adoption behaviour. Furthermore, several behavioural studies reveal that the following sociodemographic factors affect human behaviour or adoption behaviour in the context of sustainable agriculture (Fishbein & Ajzen, 2010; Kaba et al., 2020; Meijer et al., 2015; Mwase et al., 2015; Thangata & Alavalapati, 2003):

- Gender
- Age
- Experience
- Education
- Income and assets (proxied by yield, number of workers, number of animals, additional sources of income apart from cocoa)
- Farm characteristics (farm size, age, yield, tenure state of farm)

Along these lines, this survey asked all respondents for their gender, age, education level, experience in cocoa production, as well as the size, age, tenure state and yield of their cocoa plantations. Additionally, the survey ascertained the number of workers and additional income sources apart from cocoa. Table 3 presents this study's most important intrinsic, extrinsic, and sociodemographic factors that potentially determine the incorporation of shade trees.

Table 3: Part II: Descriptive Statistics

Variable	Observations	Mean	Stand. Dev.	Minimum	Maximum
Number of shade trees	186	8.234	3.421	2	16
Survival Rate of Shade Tree Seedlings (in Percent)	145	68.558	29.224	0	100
Sex (0 = male, 1 = female)	295	0.108	0.312	0	1
Age	294	45.218	13.019	17	81
Experience of Farmer (in Years)	290	25.807	13.155	2	64
Education Level	295	0.969	0.960	0	4
Farm Age (in Years)	264	40.542	9.175	10	70
Farm Size (in Hectares)	287	5.296	5.601	0.005	55
Additional Income Sources	294	0.639	0.502	0	2
Shade Trees Attract Rain (Outcome Belief)	294	4.806	0.640	1	5
Shade Trees Attract Parasites (Outcome Belief)	291	3.412	1.570	1	5
Shade Trees are Desirable (Attitude)	295	4.715	0.650	1	5
Perceived Social Pressure Exerted By Predecessor (Norms)	290	11.307	7.937	1	25
Past Behaviour of Farmer Colleagues (Perceived Norm)	293	4.218	1.303	1	5
Having Received Encouragement after Planting (Control Belief)	293	4.044	1.515	1	5
Fear of Being Dispossessed by CABOZ (Control Belief)	293	2.075	1.628	1	5
Feeling Capable to Plant Shade Trees Next Year (Perceived Behavioural Control)	294	4.667	0.833	1	5
Instruction	294	0.554	0.505	0	2

Note: Observations = number of observations, Mean = arithmetic mean, Stand.Dev. = standard deviation, Minimum = minimum value, Maximum = maximum value.

2.5 Data collection

The four-step study design presented in Section 2.3 generated the data used in this study. Two research assistants who speak the local language Baoulé implemented the main survey and facilitated the focus group discussions on the ground. The informal key-informant talks (Step 1) were held in Soubré between July 19 to 22, 2021. The discussion language was French. The two focus group discussions within the explanatory pre-study took place on 25 and 26 July 2021. One research assistant facilitated the focus group discussions while the second research assistant took notes. Additionally, both focus group discussions were recorded. The main survey was tested in field on 30 July 2021. The main survey was implemented by means of one-to-one conversations between one of the two research assistants and all 295 farmers who spread across 78 villages in the Soubré region. These conversations were organised between August 2 and August 29, 2021 and were mostly held in Baoulé. As part of the explanatory post-study, three focus group discussions took place on the 5 and 6 September 2021. These final discussions were facilitated by one research assistant who led the conversation and took notes at the same time. Once again, the three focus group discussions were recorded.

2.6 Data analysis

To get an overview of the data compiled in the main survey, the statistical software program R, as well as Excel, were used to create descriptive statistics for all survey items used to capture potential intrinsic and extrinsic drivers of shade tree incorporation. Section 2.3.2 discussed the various variable choices made for every psychological construct influencing a behaviour, i.e., beliefs, norms, perceived behavioural control, attitudes, intention, and past behaviour. The descriptive analysis provided first robust answers to the research questions and helped to assess the validity of the hypothesis H1 that underpins this study. To better understand the impact of intrinsic, extrinsic, and socio-demographic factors on patterns of shade tree incorporation in the Soubré region, this study additionally used Ordinary Least Squares (OLS). Note that this study does not seek to establish causality. It rather uses OLS to obtain a first rough impression of which intrinsic, extrinsic, and socio-demographic factors help determine patterns of shade tree incorporation on Soubré cocoa plantations.

The final regression model presented below exploits the cross-sectional variation that arises from differences in shade tree incorporation levels across individual survey respondents. To reiterate, there is no time variation since this study collected the raw data at one point in time, i.e., July-September 2021. Equation (3) is the regression model and reads as follows:

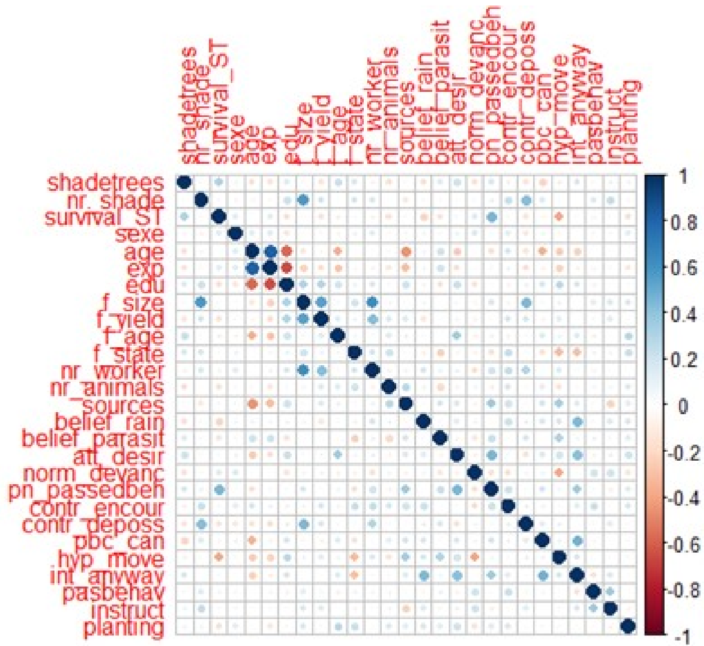
$$(3) \qquad \gamma_i = X_i + I_i + H_i + \epsilon_i$$

The outcome of interest, i.e., γ_i is shade tree incorporation on cocoa plantations. This study uses two continuously measured indicators to capture this outcome, namely the number of shade trees on an individual farmer's cocoa plantation, standardised by the individual farmer's field size, and the survival rate of shade trees on that farmer's cocoa field, respectively. i denotes the unit of observation which is the individual cocoa farmer that participated in the survey. X_i, I_i, and H_i are vectors that represent the three broad classes under which this study sorts the potential factors that help explain shade tree incorporation, namely intrinsic factors, extrinsic factors, and socio-demographic factors, respectively. The different independent variables plugged into the two final models (one per proxy for the outcome of interest) flow directly from the survey questions discussed in the previous sections. To safe space, the regression equation presented above does not list them individually. The specific components of the two final regression models are discussed below. Finally, ϵ_i is the error term whose expected average value is 0. In line with Hypothesis H1, the coefficients for at least some of the intrinsic variables should in expectation be statistically significant and positive. This would imply that a more positive attitude towards shade trees boosts the number and survival rate of shade trees, respectively.

To arrive at the two final regression models that use one of the two proxies for shade tree incorporation as dependent variable, this study follows a stepwise approach of cutting down the number of independent variables included in the respective model. The elaborations below describe the procedure for the first proxy for shade tree incorporation, i.e., "the number of shade trees". The same approach was pursued for the second proxy for shade tree incorporation, i.e., the survival rate of shade trees.

The preliminary regression model incorporated 24 independent variables which covered all constructs the RAA discusses (see Section 2.3.2 and Tables in Appendix A.2). Two criteria guided the compilation of this preliminary model. Firstly, each construct that the RAA refers to must be represented by at least one independent variable. Secondly, an inter-correlation matrix was used to identify those independent variables that had the highest correlation with the respective dependent variable of interest. Moreover, the inter-correlation matrix helped to ensure that the independent variables chosen for the preliminary model did not correlate with each other. Figure 5 depicts the inter-correlation matrix.

Figure 5: Inter-correlation matrix of dependent and independent variables



The preliminary model had very little explanatory power and contained far too many independent variables that do not help explain the number of shade trees on a farmer's cocoa field. The number of independent variables was hence reduced within nine consecutive steps. As part of each step, those two independent variables with the highest p-value were dropped. The final model that resulted from this exercise contained eight independent variables with p-values not higher than 0.159. Replicating this procedure for the second proxy for shade tree incorporation yielded a final regression model with eight independent variables, too. The highest p-value observed for this second regression model was 0.217. The final regression model that uses the number of shade trees as dependent variable is referred to as "Model 1". Its counterpart that proxies shade tree incorporation with the survival rate of shade trees is referred to as "Model 2".

The below Table 4 compiles all independent variables that the final two regression models, i.e., Model 1 and Model 2, encompass.

Table 4: Compilation of independent variables of the final two regression models

	Model 1	Model 2
Dependent Variable	Number of Shade Trees	Survival Rate of Shade Trees
Independent Variables – Intrinsic factors (X_i)	Positive Control Belief: Receiving Encouragement, Negative Control Belief: Fear of Dispossession, Norm: Past Behaviour of Colleagues, Norm: Normative Influence of Predecessor	Positive Outcome Belief: Attracting Rain, Negative Outcome Belief: Favouring Parasites, Attitude: Shade Trees Are Desirable, Perceived Behavioural Control: Self-confidence to Plant
Independent Variables – Extrinsic factors (I_i)	---	Instruction
Independent Variables – Socio-demographic factors (H_i)	Age, Farm Size, Farm State, Additional Sources of Income	Experience, Farm Age
Number of Observations	253	124

Another noteworthy pattern concerns the plummeting in the number of observations when using the survival rate of shade trees as the dependent variable (Model 2). This drop is mainly due to the fact that the survival rate was only computed for those 155 farmers who had received shade tree seedlings in 2020.

3 Results

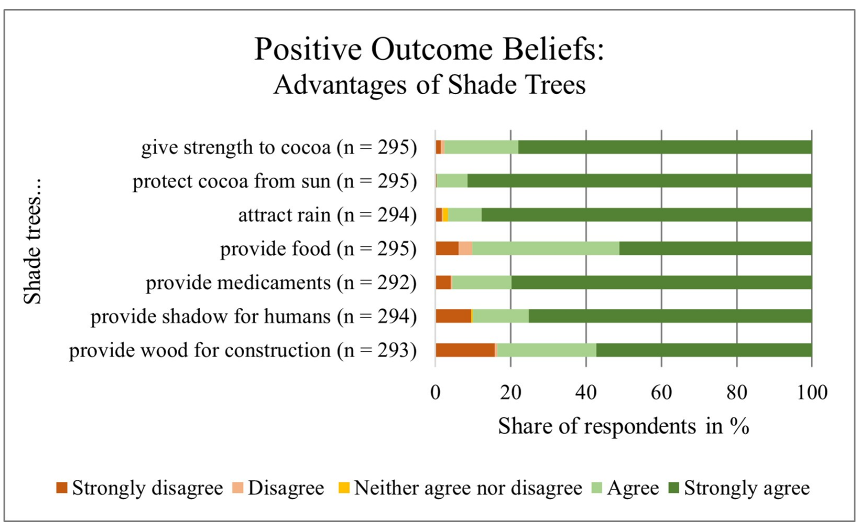
This section presents the gathered information on intrinsic and extrinsic factors which determine shade tree incorporation on cocoa plantations of CABOZ-affiliated farmers in the Soubré region. It begins with a descriptive analysis of the factors. After a summarising section of the descriptive part, the two proxies for shade tree incorporation used in this study are regressed on the independent variables that survived the nine-step model-building process.

3.1 Intrinsic factors

Beliefs

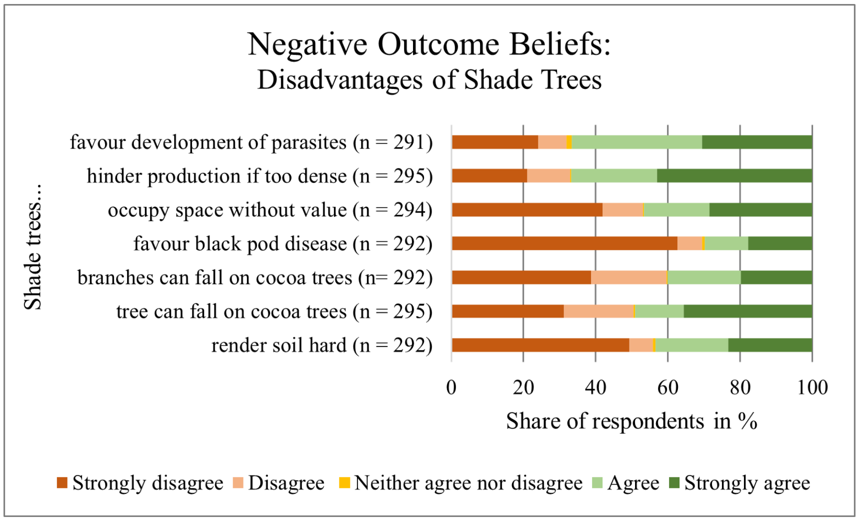
Results show that cocoa farmers in Soubré strongly believe in the manifold advantages of shade trees for the cultivation of cocoa (see Figure 6). Section 2 has presented the seven advantages and seven disadvantages associated with shade trees that this study investigates. Across all statements, the average approval rate of interview partners, i.e., answer value four or higher, equalled 84 %. Interestingly, statements about biological advantages of shade trees were more strongly approved than statements about material advantages (which products farmers can obtain from shade trees). Except from one person, all respondents, i.e., 294 farmers, were convinced that shade trees protect their cocoa trees from the sun. Furthermore, the vast majority of survey participants are of the conviction that shade trees give strength to their cocoa trees (288 people or 98 % of the entire sample) and attract rain (284 or 97 % of the sample), respectively. The belief that respondents approved the least concerned the importance of shade trees as potential sources of wood for construction and furniture. 84 % of the respondents did at least approve this statement.

Figure 6: Results of main survey on advantages of shade trees



The level of agreement among sampled farmers notably drops when interviewers exposed them to statements about the potential disadvantages of shade trees. Figure 7 shows that the majority of sampled farmers only agrees on two disadvantages that shade trees might have on cocoa plantations: 67 % of the survey participants noted that dense shade trees impede the productivity of cocoa trees if they are growing too dense. The same number of respondents further stipulated that shade trees promote the growth of parasite populations. Other disadvantages of shade trees did not seem to bother the majority of cocoa farmers. 47 % of the sample argued that some shade trees occupy space on their fields without any use, value, or purpose. These respondents differentiated between different categories of shade trees. While they regarded some of the shade trees on their field as benefitting their cocoa trees, they assessed that other shade trees as useless. Fewer farmers, i.e., 30 % of those interviewed, believed that shade trees allow the black pod disease to spread.

Figure 7: Results of main survey on disadvantages of shade trees

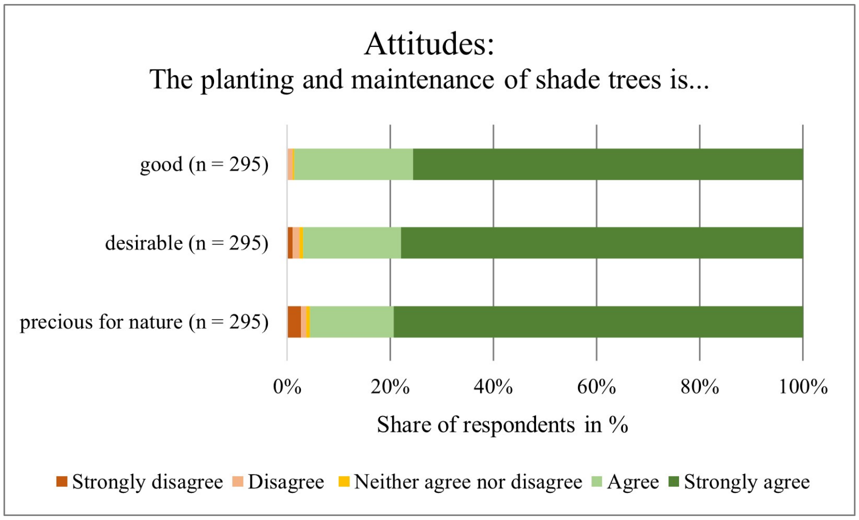


To summarise the insights gained above, farmers agreed on various advantages of shade trees for their cocoa plantations. The approval rate for statements about the benefits of shade trees was always above 90 %, with only one exception. Opinions on the disadvantages of shade trees diverged much stronger, with fewer farmers believing that shade trees entail negative repercussions for their cocoa plants.

Attitude

Farmers' response to statements that measure their attitude towards shade trees further support the impression that they are positively inclined towards shade trees. More specifically, Figure 8 reveals that 99 % of the respondents thought that planting and maintaining shade trees in their cocoa plantation is "good". A comparably high 97 % stated that the planting and maintenance of shade trees is "desirable". Finally, 96 % of the interview partners agreed that shade trees are precious for nature. The remaining 4 % of the respondents did not agree on shade trees being ecologically important.

Figure 8: Results of main survey on attitudes towards planting shade trees

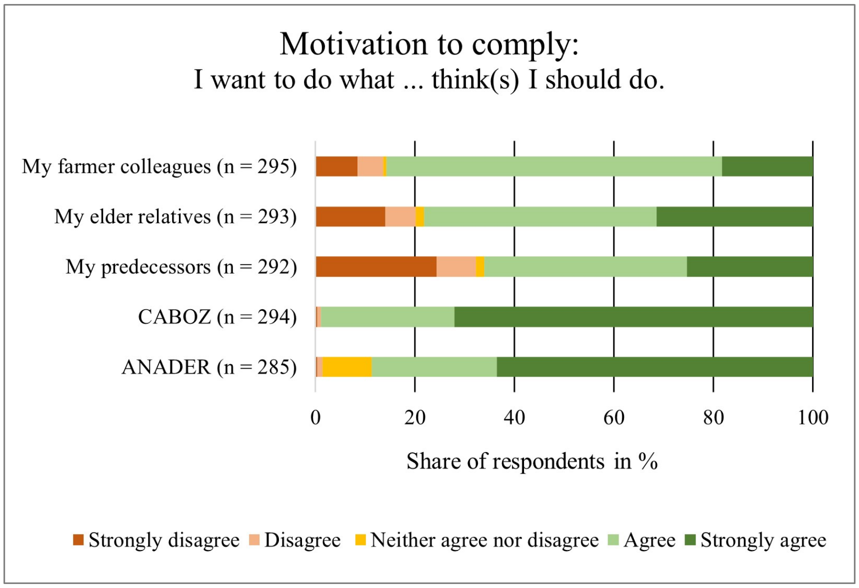


Overall, the surveyed cocoa farmers were aware of the benefits of shade trees for their cocoa plantations and exhibited a strong, positive attitude towards their plantation and maintenance.

Norms

99 % of interviewed CABOZ-affiliated cocoa producers regarded CABOZ AG as an important source of information and reference when it comes to cocoa production and maintaining cocoa plants. Figure 9 on the motivation to comply with a specific normative referent reveal that ANADER and the fellow cocoa producers are additional contact points for 89 % and 86 % of surveyed farmers, respectively. Elder relatives also seem to have a strong influence on the cocoa-related decision-making processes for 76 % of the respondents. The predecessors of farmers, on the other hand, do not act as an equally important source of inspiration. Roughly two-third of the respondents reported that they want to comply with what their predecessors expect from them.

Figure 9: Results of main survey on motivation to comply with different normative referents



Interestingly, the above-described pattern of the most important normative referents matches farmers' elaborations on which of their normative referents is most satisfied when farmers plant shade trees. Interviewees ranked CABOZ AG, their farmer colleagues and ANADER as those actors that expect them most to make shade trees thriving on their cocoa plantations (see Figure 10). Another 36 % of the farmers expressed their belief that their predecessors reject shade trees. A smaller minority of 23 % felt that the same was true for their elder relatives.

Figure 10: Results of main survey on normative beliefs of important normative referents

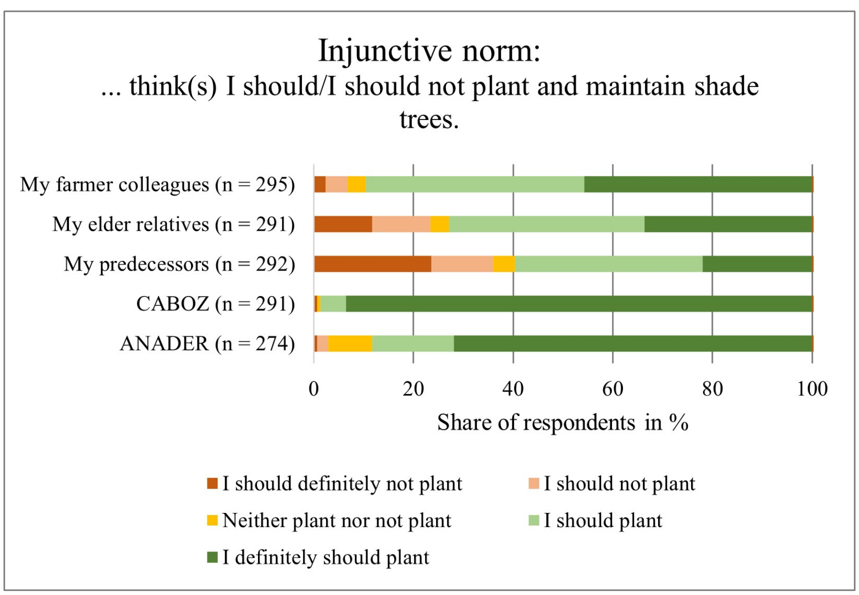
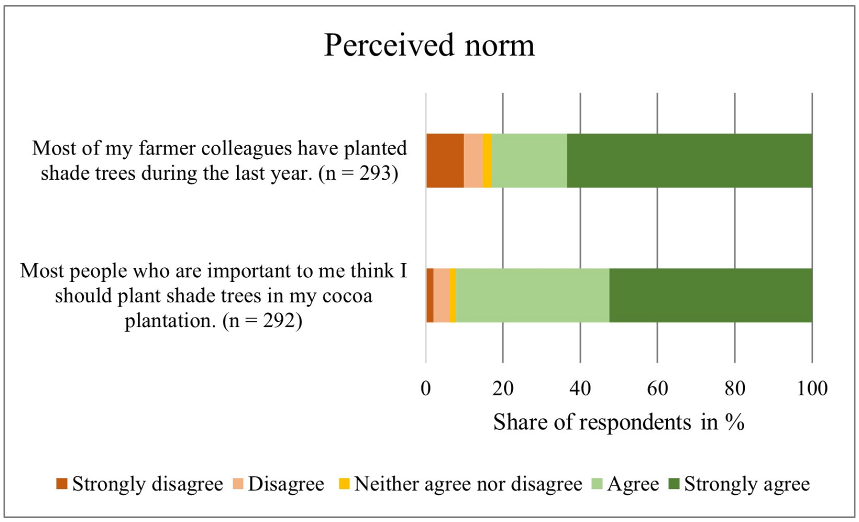


Figure 11 below reveals that 92 % of the surveyed farmers believe that their social environment expects them to plant and maintain shade trees. This expectation is also true for their peer farmers. 90 % of the survey respondents believe that the latter would appreciate them for planting shade trees (see Figure 10 above). However, when asking about the planting behaviour of their farmer colleagues, "only" 83 % of the respondents reported that they had planted shade trees in the previous year themselves.

Figure 11: Results of main survey on perceived norms



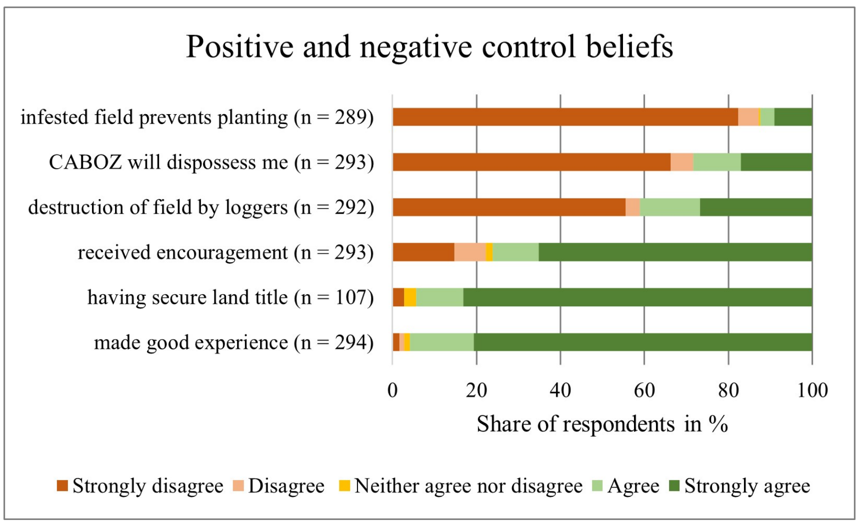
Overall, the figures above reveal that the majority of the interviewed cocoa farmers believes that several actors in their immediate social environment approve the planting and maintenance of shade trees. CABOZ AG, ANADER and colleagues are particularly important referents for the farmers surveyed.

Control beliefs

The following questions investigate factors and beliefs which might hinder or facilitate farmers to plant and maintain shade trees. Figure 12 illustrates that 96 % of the sampled farmers noted that they have made good experiences with planting the distributed shade tree seedlings or maintaining the wild seedlings in the past. 76 % of the farmers further asserted that other actors including their farmer colleagues, CABOZ AG and ANADER, commended them for having planted shade trees in the past. On the other hand, this study finds that farmers' willingness to grow shade trees on their fields also depends on the legal state of the cocoa field they cultivate. Legal uncertainties concerning the ownership of land emerged as a major obstacle to shade tree plantation. 94 %

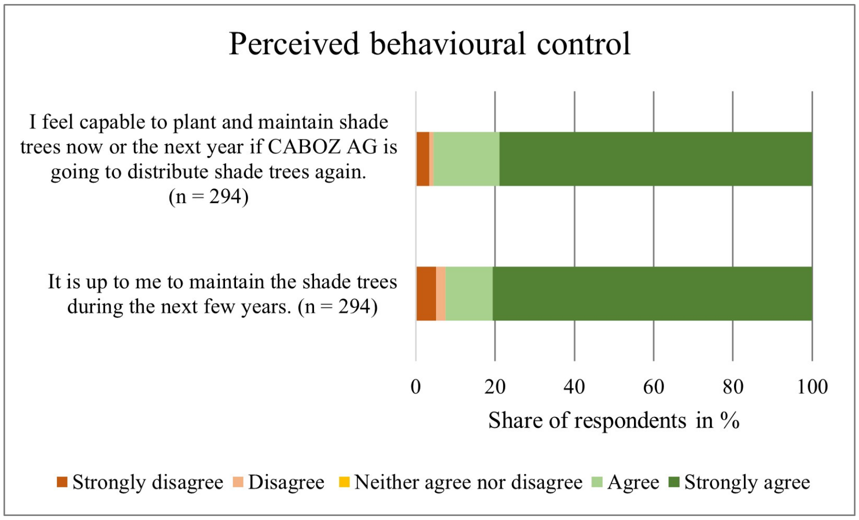
of the surveyed farmers operate on a field with unclear tenure state mentioned that they would dare to plant and maintain more shade trees if they were sure that the land, they farm is their legal possession. Another 56 % of the surveyed farmers feared that planting shade trees might attract and incentivise loggers to loot the field. 28 % of the respondents worried that CABOZ could approach them in several years from now to take away the distributed shade trees once they are big enough for profit-making. Poor conditions of their plantations due to the black pod disease or an infestation by the swollen shoot virus, amongst others, do not act as burden to shade tree incorporation though. On the contrary, the lion's share of interviewees, i.e., 82 %, stated that a tattered field would even encourage them to plant shade trees.

Figure 12: Results of main survey on control beliefs hindering/facilitating the planting of shade trees



Another important insight retrieved from the collected data concerns the self-confidence of farmers regarding their capacity to maintain shade trees over several consecutive years. 96 % of the interviews reported their conviction that they have the knowledge and skills to take care of shade trees after having received the seedlings (see Figure 13). The small remaining minority of 4 % mentioned time and knowledge constraints as major obstacles which, to their mind, render the cultivation and maintenance of shade trees impossible for them. Interestingly, over 7 % of the respondents felt that maintaining the shade trees that they had received from CABOZ does not fall within their remit.

Figure 13: Results of main survey on perceived behavioural control



Intention

A person's intention is a key predictor of its behaviour. This study acknowledges this well-established pattern and asked farmers if they intended to plant shade trees next year and maintain them in the long run. 87 % of the respondents affirmed that statement. 13 % of the respondents, on the other hand, did not report any such intention. However, it is theoretically conceivable that individuals who have a strong intention to execute a certain activity might not step into action unless they receive external support. The survey therefore asked farmers if they had the intention to plant shade trees themselves even if CABOZ AG would not allocate the seedlings to them. The approval rate dropped as compared to the above-mentioned statement by 16 %. Still 71 % of the respondents said that they would intend to plant shade trees, even if they had to organise the seedlings from somewhere else than CABOZ or even produce them themselves. This finding clearly indicates that CABOZ activity to facilitate the farmers' access to shade tree seedlings to the maximum possible extent does a valuable contribution to the endeavour to establish shade trees on local cocoa plantations.

To develop a better grasp of the factors that discourage those 13 and 16 % of the respondents, respectively, who reported no intention whatsoever to plant shade trees unless they receive the seedlings from CABOZ AG, the survey confronted these respondents with an additional question. The extra statement sheds light on the drivers of those farmers' unwillingness to incorporate shade trees on their fields without external support.

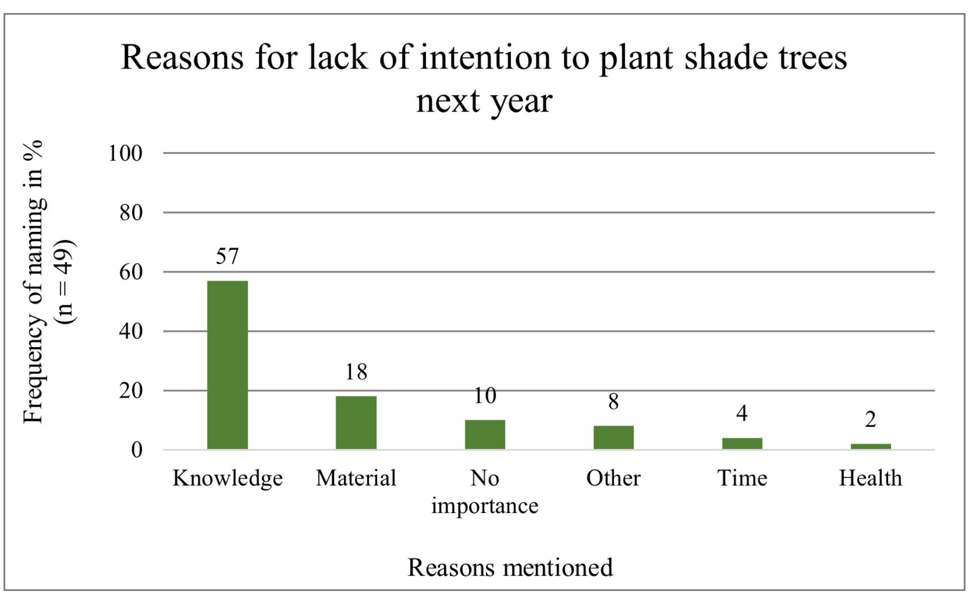
Unfortunately, the additional statement was only included into the survey after 157 interviews had already been conducted. Therefore, further explanations on why holding no intention to plant shade trees is only available for 41 farmers. A “lack of knowhow” accounted for 57 % of all 49 reasons that those 41 farmers mentioned. More specifically, farmers reported that they have insufficient information about the production and the planting of shade trees, and which shade tree varieties generate the highest benefit for cocoa trees. The second most frequently cited factor was “material”. Farmers who brought up this issue bemoaned that they are not aware of any source to retrieve shade tree seedlings other than CABOZ AG. On the other hand, time and health constraints do not drive farmers’ rejection to cultivate shade trees on their own.

Finally, farmers attaching no importance to shade trees emerged as another critical barrier to shade tree incorporation. Those farmers who reported that shade trees did not matter to them said that their adverse attitude rests upon a blend of reasons (see Figure 14). These reasons included the little economic benefits shade trees generate in the short run or the infestation of their cocoa trees with the swollen shoot virus which ties up their resources and gives them no time to plant shade trees, amongst others.

“Other” reasons that farmers cited to explain their reluctance to plant shade trees on their cocoa plantations next year added up to 8 % of all 49 reasons mentioned and included:

- Farmers’ conviction that they already have enough shade trees on their fields
- Insufficient space on farmers’ cocoa plantations to incorporate additional trees.

Figure 14: Results of main survey on why farmers lack intention to plant shade trees



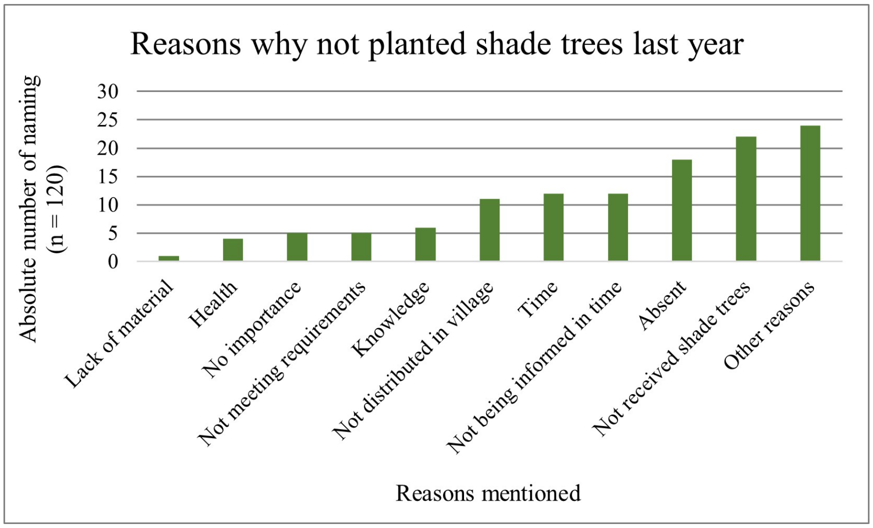
Past behaviour

The survey reveals that 60 % of the interviewees planted shade trees in 2020. Those 117 farmers who had not done so were invited to give one or more reasons for their behaviour. Organisational flaws in the seedling distribution process emerged as a key obstacle from the respondents' elaborations (Figure 15). 22 respondents criticised that they never received shade tree seedlings even though they had ordered them. According to them, the non-delivery of seedlings was due to seedlings being in short supply on the day of distribution or other farmers grabbing more seedlings than they had ordered in the first place, respectively. Another twelve respondents, on the other hand, complained that they had not been informed about the time and date of the seedling distribution. The replies by a total of eleven respondents also indicated that the seedling distribution process did not penetrate all villages in the region. According to the respondents, further factors that complicated the distribution process of shade tree seedlings concerned:

- the absence of farmer at the distribution location (mentioned by 18 farmers),
- insufficient time to plant the seedlings (mentioned by twelve farmers), and
- knowledge constraints (mentioned by six farmers).

There was also a high share of farmers who had not requested to receive seedlings in the first place. Some of the farmers falling under the latter category grumbled about a geographically biased distribution process that skipped some villages or poor access to nursery in their environment. Those farmers were clear in saying that the cost of transportation to reach the distribution spots or nursery were simply too high to render the incorporation of shade trees attractive to them.

Figure 15: Results of main survey on reasons for not having planted shade trees last year

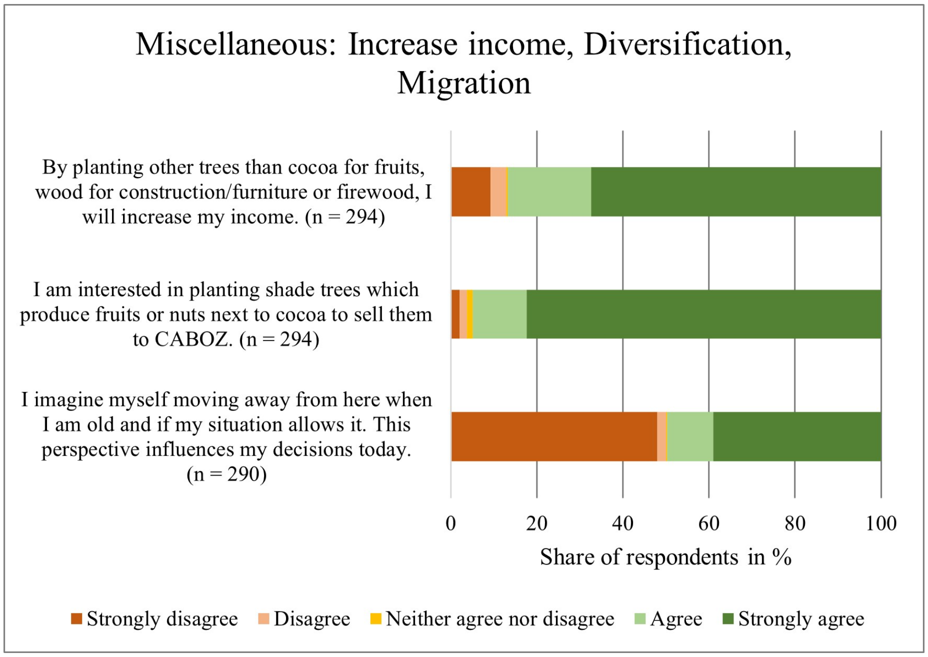


Miscellaneous

95 % of the interviewees reported a general interest in cultivating other crops than cocoa. However, some of the respondents added that they are not interested in replacing cocoa with other trees. Figure 16 further shows that 87 % of the interviewed farmers stated that they can increase their income by planting shade trees which produce additional products like wood or fruits. This figure implies that the remaining 13 % do not believe that they can generate additional income by planting and maintaining shade trees.

Finally, 50 % of the respondents interviewed reported their intention to return to the homeland of the Baoulé upon their retirement or death the latest. Most importantly in the context of this study, many of these farmers added that they have started to invest into different assets on their home soil outside Soubré, e.g., in the creation of cashew fields or buildings.

Figure 16: Results of main survey on statements about income, diversification, and migration



3.2 Extrinsic factors

The following extrinsic factors were investigated within the main questionnaire:

- Receiving instruction
- Moment of planting of the seedlings (cocoa and shade trees)
- Maintenance of shade trees
- Reason for the death of the distributed seedlings, mentioned by interviewees

Receiving instruction

55 % of the sampled farmers received an instruction on shade tree planting techniques organised by CABOZ AG. Respondents' elaborations on the instruction sessions indicated that the latter had enlightened them about shade trees and their correct handling. All of the sampled farmers who had attended an instruction session were able to provide detailed information on either the digging, the optimal size of the hole, or the way of refilling the hole, respectively.

More precisely, farmers reported that they had learnt to refill the dug hole by firstly putting back the upper part of the soil with contains a high share of litter and therefore serves as a fertilizer into the hole. The more stony and poor subsoil is put back at the very end. Furthermore, some farmers highlighted their learning that the hole should not be filled completely. They were also able to reproduce the justification for this procedure: In case of precipitation the water will accumulate on the surface of the refilled hole and trickle down to the roots. This keeps the soil moist and ultimately favours the seedlings' roots' growth.

Moment of planting of the shade tree and cocoa seedling

The survival of shade trees is determined by a variety of factors. One of them is the distribution of shade tree seedlings that was discussed above. Another important determinant of shade tree growth and prosperity concerns the planting of seedlings in the field. That said, the survey asked farmers if they had planted shade tree and cocoa seedlings simultaneously. If yes, this means that cocoa and shade tree seedlings faced almost the same time-dependent growing conditions like e.g., precipitation. Obviously, spot-dependent factors influencing the survival probability are very important as well. However, the inclusion of the exact location of the cocoa and shade tree seedlings went beyond the scope of this study.

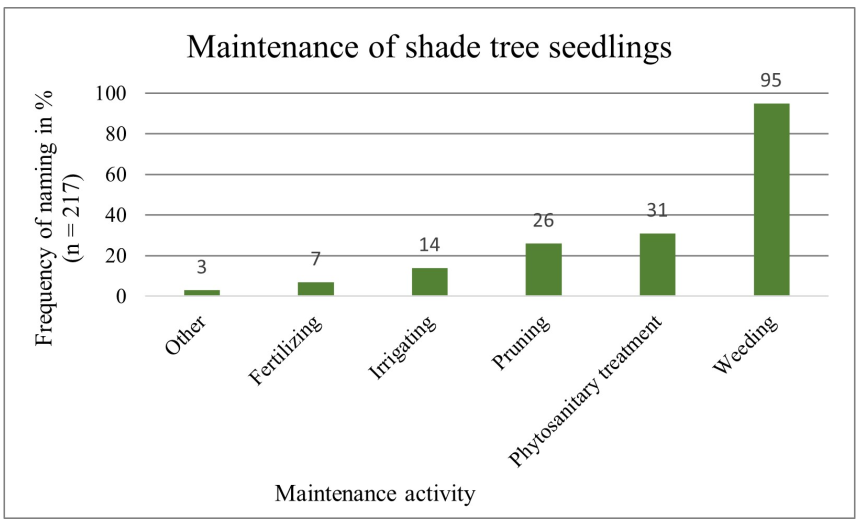
All of the 295 farmers except for 19 who had never received any seedlings so far were invited to elaborate their planting methods. In 2020, 155 producers received shade tree seedlings, as mentioned above. 86 % of these producers received shade tree seedlings alongside with cocoa seedlings. The remaining 14 % received shade tree seedlings but no cocoa seedlings. The survey asked those farmers who had not been allocated shade tree seedlings in 2020 to report their handling of the seedlings they had received in previous years. 66 % of the 276 farmers stated that they had planted shade tree seedlings and cocoa seedlings at different points in time. Survey participants gave several rationales for this behaviour. Firstly, the majority noted that they had received shade tree and cocoa seedlings at the different points in time. Secondly, some farmers declared that they regard cocoa seedlings as being more important than shade tree seedlings. Other respondents even explained that they waited with the planting of the shade trees until they were confident that their cocoa seedlings were thriving.

Seedling maintenance

The question of seedling maintenance only concerned the second half of the interview members as this question came up during the evaluation of the first 157 interviews conducted. 120 farmers were eligible to answer the question on how they maintained the distributed shade trees after they had successfully planted them. Farmers reported an array of maintenance strategies they regularly execute. Weeding around the seedlings emerged as the most popular activity as it was mentioned by 95 % of the 120 farmers interviewed (Figure 17). The second most common maintenance practice concerned the phytosanitary treatment which 31 % of the interviewees contended to do on a regular basis. Finally, a minority of 26 % noted that they prune shade trees.

Irrigating and fertilising shade trees, on the other hand, came out as unpopular maintenance activity. Only 14 % of the farmers reported to irrigate shade trees. An even lower share of 7 % said that they would invest into fertilizer to enhance shade tree growth. A small minority mentioned other maintenance steps as marking the shade trees to mitigate the risk of shade trees being accidentally cut by field workers.

Figure 17: Results of main survey on maintenance activities executed by farmers



Reasons mentioned for death of seedlings

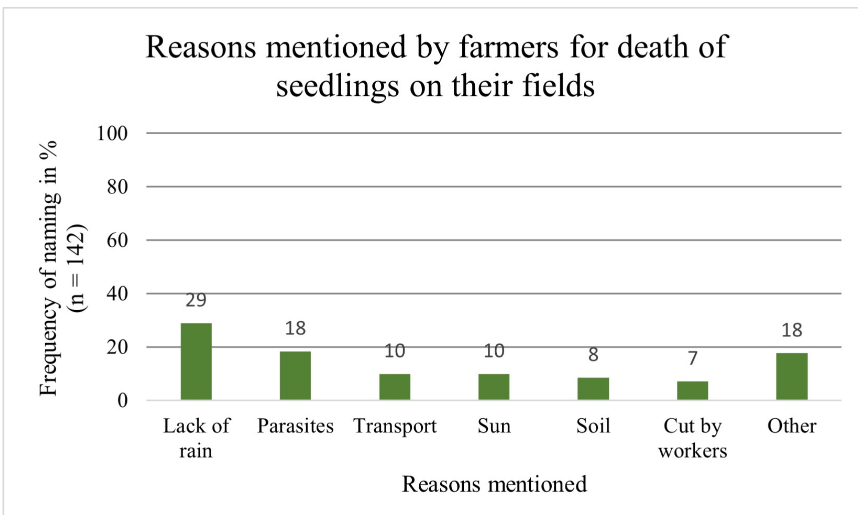
154 survey respondents had received shade tree seedlings in 2020. 46 out of these 154 farmers reported that all seedlings are still alive today. The self-reported average survival rate of seedlings across all 154 farmers was 69 %. This share is way higher than CABOZ AG's own estimate in 2019 (CABOZ AG, 2019). Those 106 farmers who admitted having experienced the perishing of one or more shade trees on their fields mostly identified biological factors as the main culprit. The main reasons mentioned encompassed:

- Lack of rain (29 % of all seven reasons mentioned)
- Parasite infection (18 %)

- Transport (10 %)
- Too much sun (10 %)
- Poor soil conditions (8 %) (see also Figure 18).

Shade tree seedlings in a very bad shape upon their arrival from the nursery in the villages accounted for 10 % of all mentioned reasons. Most farmers negated that their own inadequate treatment of shade tree seedlings caused the latter's perishing. However, farmers sporadically blamed agricultural labourers for having accidentally cut shade trees when weeding in the field (7 % of all reasons mentioned).

Figure 18: Results of main survey on why shade tree seedlings perished on individuals farmers' fields



It is striking to observe survey respondents did not admit any personal failure when explaining why shade trees had died on their fields. Rather they blamed unfavourable climatic and biological conditions, poor infrastructure, or careless agricultural workers for shade tree death.

When confronted with the question of the general drivers for shade tree death, survey respondents stressed the importance of human failure. The two reasons mentioned most frequently for shade tree death were "improper planting of shade tree seedlings" (mentioned by 15 % of survey respondents) and "lack of maintenance" (mentioned by 13 % of survey respondents), respectively. Obviously, when farmers are invited to talk about general shade tree death rather than explaining why their own shade trees had perished, human failure suddenly became a core issue.

3.3 Linear Regressions

The descriptive analysis indicates that farmers acknowledge the multiple benefits shade trees have for their cocoa trees. It therefore appears that intrinsic factors cannot explain the low level of shade tree incorporation in Soubré. The implementation of the two linear regression models that are described in Section 2.6 supplement the analysis presented thus far and shed further light on the role that intrinsic and extrinsic factors play for shade tree incorporation in Soubré.

Neither Model 1 nor Model 2 that are presented in Table 5 support Hypothesis H1 which states that cocoa farmers' intrinsic rejection of shade trees hamper the latter's incorporation on cocoa plantations in Soubré. Note that none of the extrinsic factors survived the process of limiting Model 1 to those independent variables with the highest explanatory power (see Section 2.6). On the other hand, two of the four intrinsic factors that are included in Model 1 reach statistical significance. Both these intrinsic factors belong to the construct of control beliefs. On the one hand, the negative control belief that CABOZ AG might dispossess farmers from their planted shade trees in the future is on average positively associated with the number of shade trees a farmer has on their cocoa fields. More specifically, a one unit increase in the fear of losing shade trees to CABOZ in the future on average increases the number of planted shade trees by 0.623 trees. This effect is statistically significant at the 1 % level (p-value = 0.008). On the other hand, farmers who were encouraged by their social environment after having planted shade trees on average cultivate more shade trees on their plantations. The positive effect of encouragement is even larger as compared to the one for fear of dispossession. A one unit increase in the level of appreciation that farmers had received after they had planted shade trees on average increases the number of planted shade trees on their cocoa fields by 0.89 trees (p-value = 0.001). The two other intrinsic factors that were included in Model 1 fail to reach statistical significance though.

Among the four socio-demographic factors that Model 1 incorporates, two are statistically significant. On the one hand, older farmers on average have fewer shade trees on their cocoa fields. The negative effect is consistent across all models run in the preparation of Model 1 (see Table A1 in Appendix A.2) but is small in size. More specifically, a one-year increase in a farmer's age on average decreases the number of shade trees planted on his or her field by 0.06 trees (p-value = 0.042). On the other hand, Model 1 reveals that farmers who are more confident about the legal status of their field on average tend to cultivate more shade trees. The size of effect is considerable. A one-unit increase in the security of a farmer's ownership of the cocoa plantation they cultivate is on average associated with an increase in the number of planted shade trees by 0.783 (p-value = 0.007).

Table 5: Regression Analysis: The Effect of Intrinsic, Extrinsic and Sociodemographic Factors on the Incorporation of Shade Trees on CABOZ-affiliated Cocoa Plantations in Soubré

	Number of Shade Trees	**Survival Rate of Shade Trees**
Age	-0.060**	
	(0.042)	
Farm Size	0.127*	
	(0.051)	
Land Tenure State	0.783***	
	(0.007)	
Additional Sources of Income	-1.090	
	(0.159)	
Perceived Social Pressure Exerted by Predecessor	0.075	
	(0.110)	
Having Received Encouragement after Planting	0.890***	
	(0.001)	
Fear of Being Dispossessed by CABOZ	0.623***	
	(0.008)	
Past Behaviour of Farmer Colleagues	0.539*	8.612***
	(0.073)	(0.007)
Farmer Experience		0.283
		(0.122)
Farmer Age		0.373
		(0.148)
Shade Trees Attract Rain		-4.394
		(0.217)
Shade Trees Attract Parasites		-2.970*
		(0.053)
Shade Trees Are Desirable		-7.206
		(0.152)
Feeling Capable to Plant Shade Trees Next Year		8.819*
		(0.060)
Instruction		14.451***
		(0.010)
Observations	253	124
Adjusted R^2	0.146	0.146

Note: p-value in parentheses

Other than in Model 1, the intrinsic variable that captures the incorporation of shade trees by farmers' colleagues in Model 2 helps explain the variation in the survival rate of shade trees. A one unit increase in the strength of farmers' belief that that their colleagues have planted and maintained shade trees on their fields during the last year is on average associated with an increase in the survival rate of their shade trees by 8.612 % (p-value = 0.007). The regression models presented in Appendix A.2, Table A2 indicate that this effect is robust across the nine steps during which Model 2 was developed. Model 2 also includes the extrinsic factor "instruction" which captures whether survey respondents were instructed about how to plant and maintain shade tree seedlings. The associated coefficient reveals that instructing farmers pays off. The survival rate of shade trees for those farmers who received an introduction into the art of planting and maintaining shade trees is on average 14.45 % higher as compared to their counterparts who did not receive such an instruction (p-value = 0.01). All other independent variables included in Model 2 fail to pass conventional thresholds of statistical significance.

3.4 Explanatory post-study

A preliminary evaluation of the main survey in the field informed the design and content of the explanatory post-study of Phase III. To reiterate, three focus groups assembled with six to seven participants each. The aggregated number of participants across all three focus groups was 19. Main issues discussed concerned the optimum moment of shade tree and cocoa seedling distribution, the transportation of shade tree seedlings, and shade tree maintenance.

With regard to the former, 84 % of the focus group participants referred to May and June as the ideal months for shade tree seedling distribution. A total of six focus group participants indicated that they would prefer to receive shade tree seedlings in May. Another ten cocoa farmers, on the other hand, wish that the future dissemination of shade tree seedlings occurs in June. Nine of 19 focus group participants justified their preference for May or June with the approaching rainy season which guarantees decent water supply for shade tree seedlings.

Concerning the distribution of cocoa seedlings, 13 out of 19 focus group participants reported that they wish to receive shade tree and cocoa seedlings concurrently to cut down transportation costs and increase their working efficiency. The former rationale rests on the assumption that farmers need to organise the delivery of shade tree seedlings themselves. A slight majority of nine focus group participants assessed the current distribution procedure as satisfactory. Five participants particularly commended the CABOZ AG for having unloaded shade tree seedlings for several farmers and villages at a central crossroad which was easy to reach for all local farmers. Focus group participants nevertheless agreed that there is still room for improving the distribution procedure. This particularly concerns the bad state of the local road network which they identified as the major obstacle for shade tree delivery. One focus group participant even bemoaned that the distribution of shade tree seedlings favours those villages that are connected to the road network. The difficulty to reach more remote villages that are isolated from the road network, he continued, torpedoes the delivery of shade tree seedlings, and oftentimes neglects farmers working in these places. Six farmers suggested to use motorcycles for shade tree seedling delivery as a potential remedy.

Shifting the focus to shade tree maintenance, three core activities that farmers employ emerged from the discussions. All focus group participants reported to weed around their shade trees. Phytosanitary treatment of shade trees (mentioned by 15 farmers) and pruning (mentioned by eight farmers) were the second and third most popular maintenance activity focus group members listed.

On the other hand, the focus group discussions revealed a persisting knowledge gap concerning best practices for shade tree maintenance. Five focus group participants admitted having insufficient expertise to adequately maintain shade trees. Focus group participants referred to the insufficient instruction that farmers had received when trying to explain why the latter employ rudimentary maintenance activities only. More specifically, farmers reported that the CABOZ technicians had suggested weeding as the only maintenance activity.

Finally, focus group participants examined potential strategies to alter the attitude of those farmers who neglected their shade trees in the past. Nine focus group participants encouraged the technicians working for CABOZ AG to organise sensibilisation workshop for farmers who neglect their shade trees. Another seven participants offered to invite those neglecting farmers on their own fields to show them the benign impact shade trees can have on cocoa trees. Other forms of sensibilisation that focus group participants proposed included the following:

- Control visits to give farmers feedback on the shade tree-related maintenance activities they employ (mentioned by four participants)
- Promote exchange about best shade tree maintenance practices among producers (mentioned by three participants)

Participants of one focus group also elaborated on measures that would boost their own motivation to plant and maintain shade trees. Access to better working tools such as machetes, saws, boots, or wheelbarrows was cited by four of the seven farmers participating in that focus group. Another three farmers mentioned that they would need pesticides to protect shade trees from the high disease pressure on their plantations.

4 Discussion

The key insight that flows from the evaluation of the survey data that this study has assembled concerns the strong positive attitude that the surveyed CABOZ-affiliated cocoa farmers in the Soubré region hold towards shade trees. Local farmers embrace the latter as an asset for their cocoa trees and believe that planting and maintaining shade trees has a positive effect on the productivity and prosperity of their fields. Farmers were also familiar with various benefits of shade trees and by-products which they can harvest from shade trees. Arguably, the strong awareness of shade tree benefits among farmers fuels the widespread intention among the latter to plant shade trees next year. The commitment to plant shade trees appears to be strong as a majority of survey respondents is willing to incorporate shade trees even without support by CABOZ AG. Two remarks regarding these insights are noteworthy: On the one hand, they align with earlier findings by Smith Dumont et al. (2014) who concluded that cocoa farmers in Southwestern Côte d'Ivoire are aware of benefits associated with shade trees and hence want to include more of them on their fields. On the other hand, they run counter to Hypothesis H1 which had postulated that an intrinsic rejection of shade trees among local farmers impedes shade tree incorporation in the Soubré region.

Furthermore, the majority of surveyed farmers feel social pressure exerted by three of their normative referents, i.e., colleagues and technicians of CABOZ and ANADER, to incorporate shade trees. Besides social pressure, farmers also receive encouragement to plant shade trees. Model 1 in Table 5 even shows that survey respondents who were encouraged by their social environment after planting shade trees have more shade trees on their fields. On the other hand, survey respondents also imitate the behaviour of their farmer colleagues. If CABOZ-affiliated cocoa farmers believe that their peers have planted shade trees last year, this positively influences the survival rate of shade trees on their own plantation (see Model 2 in Table 5). In combination, these findings indicate that the social environment survey respondents are operating in is generally conducive to shade tree incorporation. The finding that encouraging normative referents are a key driver of shade tree incorporation corroborates the conclusions drawn by previous contributions. Several studies find that farmers all over the world attach high importance to and are willing to comply with the opinion of normative referents (Borges et al., 2014; Martinez-Garcia et al., 2013; Senger et al., 2017). However, it is not all normative referents that shape farmers' behaviour. Many studies find that family members, friends, and peer farmers are by far the most important normative referents when it comes to the adoption of new agricultural practices (Elahi et al., 2021; Martinez-Garcia et al., 2013; Zubair & Garforth, 2006). On the other hand, Borges et al. (2014) and Senger et al. (2017) conclude that additional actors such as extension agents or the government drive farmers' behaviour, too. This study's insight that CABOZ AG, ANADER and colleagues are important normative referents speaks to both groups of studies. Moving ahead, the influence CABOZ AG has on their affiliated farmers' decision-making gives them the opportunity to directly approach the latter to promote shade trees.

The strong positive beliefs that farmers hold towards shade trees and their expressed commitment to integrate them into their cocoa fields beg the question why shade tree incorporation levels in Soubré remain at a low level. Based on the above-presented analysis, there are five explanations that potentially account for the mismatch between farmers' words and deeds concerning the incorporation of shade trees on their cocoa plantations.

First explanation: Negative beliefs

Firstly, while the survey respondents exhibit a high awareness of the benefits of shade trees, they are concerned about possible negative repercussions that the planting of shade trees might entail for their cocoa fields. Main fears on the part of farmers evolve around the potential adverse impact shade trees might have on the growth of cocoa trees as well as the issue of ownership regarding the planted shade trees. The latter pattern aligns with Kouassi et al. (2021) who equally list the issue of insecure land tenure and uncertain ownership of shade trees as a major barrier to shade tree incorporation in South-West Côte d'Ivoire. Against the background that a considerable minority of interviewed farmers brought up these shade tree-related concerns, it is conceivable that some of the local farmers attach more weigh to the negative ramifications of shade tree incorporation as compared to shade trees' benefits and are therefore reluctant to include shade trees on their fields. This phenomenon of weighing benefits and downsides that are associated with a new agricultural practice has been reported elsewhere (Arbuckle & Roesch-McNally, 2015). For example, Martinez-Garcia et al. (2013) finds that farmers attaching more importance to the economic and environmental benefits of farm forestry as compared to the potential negative benefits was a prerequisite for the individual decision to plant trees on farmland in Pakistan's North-West Frontier Province. The regression analysis conducted in this study provides only limited support to this explanation in the context of shade tree incorporation in Soubré though. Neither of the two concerns about shade trees attracting loggers or promoting pests that also harm cocoa trees is statistically associated with the incorporation of shade trees (Model 1 and 2, Table 5). For the time being, there is therefore good ground to conclude that while a considerable share of interviewed cocoa farmers is aware of some potential downsides of shade tree incorporation, these downsides do not determine the number of shade trees or the shade tree survival rate on an individual farmer's plantation.

Second explanation: Social desirability bias

Secondly, it is possible that some farmers exaggerated when expressing their approval for shade trees and are actually unwilling to plant them. This explanation speaks to the common issue of social desirability bias. Against the background of this study, survey respondents were most likely aware of the endeavours CABOZ has undertaken to promote shade trees in the Soubré region. Farmers might therefore have reported high levels of appreciation for shade trees to please their main purchaser of cocoa.

Third explanation: Resource constraints

Thirdly, focus group discussions showed that farmers encounter severe time, labour force, working equipment, and agricultural input factors constraints in their daily work. These constraints might help explain why the farmers' high awareness of shade tree benefits does not translate into higher shade tree numbers or shade tree survival rates on their fields, respectively. Other studies have shown that capital constraints (Autio et al., 2021; Simtowe et al., 2009), labour constraints (Grabowski & Kerr, 2014) as well as poor access to agricultural input factors (Nakawuka et al., 2018; Rohila et al., 2021) prevent smallholder farmers from embracing new agricultural technologies all over the world. Participants of the focus group discussions that were organised as part of the explanatory post-study (Step IV) stated that they grapple with poor equipment and working conditions. Neither irrigation systems nor machinery are available on the ground. All work steps on the cocoa plantations have to be carried out manually[5] which seriously impedes local farmers' efficiency. This is particularly true given that agricultural labour force is in scarce supply as focus group discussants reported. The low level of efficiency and the resulting insufficient time farmers have to maintain their cocoa fields force them to think twice about the activities they want to spend time, money, and labour force on. That said, the high importance that cocoa farmers attach to the well-being of their cocoa trees might reduce their willingness to redistribute resources previously used to produce cocoa to shade tree maintenance. Ensuring that cocoa farmers have access to more resources and tools to farm in a more sophisticated manner would probably boost their confidence to maintain shade trees and in turn enhance incorporation levels.

The negative impact of meagre resources on shade tree incorporation decisions is arguably ex-

[5]Information retrieved from oral statement of CABOZ AG employees

acerbated by the intention of numerous local Baoulé farmers to relocate to their ethnic home soil in the future. Those survey respondents who regard Soubré as their contemporary home further indicated that their resettlement plans affect their decision making in the presence. It is therefore conceivable that the farmers with resettlement plans prioritize short-term financial benefits over the sustainability and long-term output of their cocoa fields in Soubré. For example, a farmer who plans to leave Soubré might be more inclined to invest all resources that he or she does not require to maintain the cocoa field into future home at the expense of shade trees. This myopic behaviour arguably is a major obstacle to the integration of shade trees in the region.

Fourth explanation: Time lag

Fourthly, there is a time lag between a farmer's acknowledgement of shade trees as an asset on their cocoa fields and the actual planting and maintenance of that shade tree. The contemporary number of shade trees on a farmer's cocoa field hinges upon his or her decision to incorporate shade trees two or more years ago. Farmers that belong to this study's sample of interview respondents might have lacked the expertise and awareness of shade trees and their benefits two years ago which is why there are few shade trees on their cocoa plantations today, if that. If it was only within the past year that many farmers attended one of CABOZ instruction sessions on shade trees, this would explain why a large share of the interview respondents reported a low number of shade trees on their fields, even though they exhibited high awareness on the benefits of shade trees and expressed their willingness to plant and maintain them. This explanation would imply that the potentially positive repercussions of CABOZ endeavours to establish shade trees in the Soubré region should be re-assessed at a later stage, i.e., in two years' time.

Fifth explanation: Extrinsic factors

The fifth and final explanation for why shade trees remain an exception rather than a key characteristic of cocoa plantations in Soubré shifts the focus to extrinsic factors. After all, even those farmers most committed to shade tree plantation and maintenance will fail to grow shade trees when they lack the knowledge on how to plant and maintain shade trees, face difficulties when trying to access shade tree seedlings or experience unfavourable climatic conditions (Dhar et al., 2018; Rohila et al., 2021). Regarding the first aspect, Model 2 in Table 5 shows that such an instruction had a positive effect on the survival rate of shade trees. This finding is in line with

Matata et al. (2010) who report that workshops enhance farmers' willingness to embrace new agricultural practices in rural Tanzania. The positive effect of the instruction sessions on shade tree survival rate is good news for CABOZ AG as their endeavours to educate the recipient of shade tree seedlings seem to pay off.

Still, CABOZ has only instructed 55 % of all survey respondents regarding the handling of shade tree seedlings as of September 2021. This figure suggests that the number of farmers who have acquired in-depth knowledge on shade tree planting and maintenance is still to loo low. Indeed, the majority of survey respondents indicated that human failure evolving around improper planting and maintenance was the most important driver for the perishing of shade tree seedlings. Concerning the specific planting and maintenance activities, most of the participants of the final focus groups limit themselves to pruning, weeding, and treating the shade tree seedlings with phytosanitary products. Some of them added that they lack the knowledge about how to maintain shade trees, given that instructors referred to weeding as the only maintenance activity. There exists no detailed manual for optimum shade tree maintenance, however, the general rules for maintaining trees also apply in this context. For example, to tweak their maintenance of shade trees, local farmers might want to consider fertilizing, irrigating, or marking shade trees as well (Conseil du Café-Cacao, 2010: 76). The latter activity mitigates the risk of shade trees being accidentally cut by field workers.

Section 3.2 reveals that those survey respondents who had received shade tree seedlings in the previous year, repeatedly cited lack of rain, parasites, and transportation issues as reasons for shade tree death. Matching spatially-disaggregated data on precipitation with shade tree incorporation goes beyond the scope of this study. However, the mere fact that the survival rate for cocoa seedlings was much higher as compared to shade tree seedlings casts doubt on the role of unfavourable climatic conditions as a main driver of shade tree death. This is because cocoa seedlings thrive under similar biophysical conditions as the distributed shade tree varieties (CABOZ AG, 2019; Conseil du Café-Cacao, 2015). A severe lack of rain would have not only harmed shade tree seedling, but also cocoa seedling accordingly. The same conclusion applies to the alleged importance of parasites as a main culprit for shade tree death.

Concerning the issue of shade tree seedling distribution, farmers that participated in the final focus groups stipulated that the shade tree seedlings they had ordered either did not reach them or arrived later than anticipated, respectively. Focus group discussants repeatedly attributed blame for the distribution issues to the poor local infrastructure. Roads in the Soubré region, they noted, were either in bad shape or not available close to their plantation whatsoever. The literature confirms the general verdict that the Ivorian road network is underdeveloped and operated in an inefficient manner (Mujica Mota et al., 2019). It should be noted again though that this study lacks the required data to verify whether the country's poor road network systematically accounts for low shade tree incorporation rates in the Soubré region.

4.1 Limitations and avenues for future research

There are three major limitations of this study which should be kept in mind but also might inspire future research on shade tree incorporation. Firstly, an inherent weakness of every survey concerns the discrepancy between words and deed. This phenomenon of the respondent answering questions in a way that he or she thinks the interviewer will appreciate is known as social desirability bias (Fishbein & Ajzen, 2010). Obviously, the survey conducted in the context of this Master's thesis is vulnerable to social desirability bias, too. This is particularly true given that the two outcomes of interest, i.e., the number of shade trees per hectare and the survival rate of shade trees on a farmer's plantation, were extracted through self-reporting of the farmers. Most of the farmers are supposedly aware of the fact that CABOZ AG aims at establishing the plantation and maintenance of shade trees on cocoa plantations as a common practice in the region. Along these lines, some farmers might have exaggerated when reporting the number of shade trees on their fields. Using the self-reported data on shade tree incorporation in this study was still superior to relying on the data generated by CABOZ AG which was available for roughly 50 % of survey respondents only.

A second limitation of this study concerns its superficial treatment of extrinsic factors that determine shade tree incorporation in the Soubré region. This study concentrates on intrinsic factors and reveals that they do not help explain why many local cocoa plantations are mostly free from shade trees. Having shown that local cocoa farmers embrace the advantages of shade trees, the search of obstacles that hamper shade tree incorporation must necessarily involve extrinsic factors to a stronger degree. Collecting robust data on extrinsic factors was beyond the scope of this study though.

Thirdly, this study has gathered only meagre information on shade tree maintenance and extrinsic reasons for shade trees perishing in the fields. This is due to the fact that only 155 farmers received shade trees in 2020. Of those 155 farmers, another 46 indicated that all seedlings survived the first twelve months after planting them. Survey items asking respondents about their maintenance activities with regard to shade trees were only integrated for the last 120 respondents. This drastically reduced the number of observations and the validity of regression models in Appendix A.2 which incorporate the extrinsic factors, accordingly.

Several avenues of future research evolve from these limitations. Firstly, future studies should invest more time to compile sophisticated data on extrinsic factors such as the proximity to the local road network, precipitation figures or the distribution moment, as well as shade tree maintenance strategies pursued by local farmers to explain shade tree incorporation patterns in the Soubré region and beyond. For example, with regard to the latter, it would be of high interest to know more exactly how much of their work, time, and financial resources local farmers dedicate to shade tree maintenance over a specific period. The issue of the timing of shade tree seedling distribution and planting equally deserves more attention. The World Bank Group has published a spatially-disaggregated dataset on the road network in Côte d'Ivoire in 2021 (World Bank, 2021). Matching this dataset with information on local shade tree survival rates will allow to verify whether patterns of low shade tree survival rates do indeed spatially overlap with patterns of bad infrastructure. Incorporating weather and climate data in any such investigation would be a major asset as well. The National Oceanic and Atmospheric Administration (NOAA) is a precious source of information in this regard (NOAA, 2021). Secondly, future studies might want to contemplate more robust models that rely on an even larger sample of respondents and address the issue of reversed causality. With regard to the former, there is a need to collect information on extrinsic factors for a larger number of observations to reject them as drivers of shade tree incorporation patterns in Soubré. Furthermore, an instrumental variables approach would help to mitigate the issue of reversed causality in the regression models. In theory, it is well conceivable that farmers who worried about parasites had already lost shade trees due to parasites in the past. The same is true for the statistical relationship between fear of dispossession by CABOZ AG and the incorporation of shade trees. More specifically, cultivating more shade trees on their plantation might exacerbate farmers' fear of being dispossessed in the future as they have much more to lose.

This study acknowledges the room for improvement concerning the regression analysis performed above. It therefore by no means claims to arrive at a final verdict on the question of whether intrinsic factors do better in explaining the variation in the number of shade trees or the survival rate of shade trees, respectively, across cocoa plantations as compared to their extrinsic counterparts. Finally, Section 2.4.2.2 shows that two-thirds of all survey respondents have not planted shade tree and cocoa seedlings concomitantly in the past. There has been no research on the optimum planting moment for shade trees yet. It is thus not possible to make a sound judgement on whether shade trees and cocoa trees should be planted at the same time in order to increase the former's prospects to survive. Future contributions should hence embark on research on this matter to optimise the distribution process of shade tree seedlings.

5 Conclusion

The analysis of the data gathered in the field reveals that the overwhelming majority of interviewed cocoa producers hold a strong positive attitude towards shade trees and are willing to grow them on their cocoa plantations in the short-term future. The evaluation of the data further points to several potential both obstacles and conducive circumstances to shade tree incorporation in contemporary Soubré. Three of them are particularly noteworthy. Firstly, social pressure, encouragement and capacity building interventions organised by technicians boost shade tree incorporation levels on the ground. Opening field schools, conducting workshops on shade trees, and carrying out control visits on farmers' plantations would contribute to a vivid exchange between shade tree experts and farmers and help the latter gain hands-on experience in the adequate handling of shade trees (see also Atangana et al. 2021; Smith Dumont et al. 2014). Such encouragement and education activities on shade trees and more sophisticated agroforestry practices should ideally target "early adopters", i.e., those farmers who are genuinely interested and motivated to plant shade trees, as proposed by Orr (2003). Secondly, negative beliefs about shade trees fostering parasite development, attracting loggers, or CABOZ AG dispossessing them of their shade trees in the future persist among farmers and potentially impede shade tree incorporation. Scientific research should therefore produce more robust evidence about potential negative biological, economic, and social consequences of shade trees to alleviate these negative beliefs or inform strategies to mitigate them. Practical-oriented actors such as CABOZ AG, on the other hand, should emphasise that all shade tree seedlings they distribute among their farmers are the latter's possession. The issuing of an ownership certificate for every shade tree distributed is one promising approach to ensure farmers that all shade trees they cultivate on their fields are theirs (see also Kouassi et al., 2021). In addition, all stakeholders should work towards farmers obtaining secure land titles more generally. Thirdly, focus group discussions revealed that unfavourable extrinsic factors such as the country's poor road networks torpedo the distribution of shade tree seedlings among cocoa producers. Future academic contributions should compile or exploit high-quality datasets on the shape of the Ivorian road network, cocoa farmers' access to agricultural input factors, and time, labour and financial resource constraints farmers encounter on a frequent basis to verify whether these extrinsic factors impede shade tree incorporation on the ground. Research activities should also try to identify the optimum planting moment for shade tree seedlings. Focus group participants demanded to receive shade tree and cocoa seedlings at the same time and ahead of the rainy season, i.e., in May or June. Yet, there is no literature about whether delivering shade tree seedlings during these months maximises the prospects of the latter to survive.

Overall, fostering shade tree incorporation on cocoa fields in the Soubré region remains a challenge. Local farmers are aware of the benefits associated with shade tree cultivation and exhibit a strong positive attitude towards their incorporation. Making shade trees thrive in the Soubré region is therefore possible, but will require more research, capacity building, and a stronger commitment of stakeholders involved in the cocoa value chain to improve the shade tree seedling distribution process.

6 References

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A Appendix

A.1 Survey material

For the survey, please reach out to the author: nwindlin@student.ethz.ch

A.2 Extensive Regression Models

Table A1: The Determinants of the Number of Shade Trees per hectare in the Soubré Region

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**
sexe	-1.039	-1.161	-1.130	-1.376	-1.517	-1.676	-1.656	
	(0.614)	(0.527)	(0.531)	(0.442)	(0.318)	(0.261)	(0.237)	
age	-0.124*	-0.129*	-0.128*	-0.133**	-0.103*	-0.089**	-0.085**	-0.088**
	(0.073)	(0.055)	(0.054)	(0.044)	(0.052)	(0.012)	(0.016)	(0.012)
exp	0.050	0.046	0.043	0.053	0.019			
	(0.458)	(0.483)	(0.499)	(0.408)	(0.727)			
edu	-0.394	-0.482	-0.491	-0.488	-0.569	-0.643	-0.554	-0.489
	(0.550)	(0.451)	(0.438)	(0.437)	(0.254)	(0.170)	(0.230)	(0.288)
f_size	0.221	0.225	0.225*	0.210	0.172*	0.163	0.109	0.111
	(0.153)	(0.105)	(0.098)	(0.121)	(0.093)	(0.107)	(0.111)	(0.104)
f_yield	0.014							
	(0.963)							
f_age	-0.049	-0.059	-0.060	-0.064	-0.065	-0.061	-0.064	-0.058
	(0.437)	(0.334)	(0.319)	(0.283)	(0.169)	(0.172)	(0.146)	(0.188)
f_state	1.102***	1.077***	1.073***	1.090***	1.089***	1.041***	1.060***	1.005***
	(0.007)	(0.007)	(0.006)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
nr_worker	-0.290	-0.303	-0.300	-0.258	-0.232	-0.210		
	(0.563)	(0.500)	(0.495)	(0.557)	(0.487)	(0.523)		
nr_animals	-0.003	-0.003	-0.003	-0.003				
	(0.605)	(0.608)	(0.602)	(0.593)				
sources	-2.362**	-2.355**	-2.381**	-2.179**	-2.216**	-1.921**	-1.790**	-1.929**
	(0.040)	(0.033)	(0.029)	(0.039)	(0.011)	(0.022)	(0.032)	(0.019)
belief_rain	-0.072	-0.100						
	(0.915)	(0.878)						
belief_parasit	0.244	0.246	0.252	0.170	-0.009			
	(0.476)	(0.460)	(0.443)	(0.589)	(0.973)			
att_desir	1.003	0.989	1.008	0.806	0.634	0.322		
	(0.286)	(0.277)	(0.262)	(0.360)	(0.359)	(0.621)		
norm_devanc	0.108	0.103	0.103	0.101*	0.080	0.080	0.088*	0.081*
	(0.113)	(0.109)	(0.103)	(0.091)	(0.114)	(0.104)	(0.071)	(0.094)
pn_passedbeh	0.332	0.343	0.331	0.354	0.495	0.460	0.496	0.620**
	(0.486)	(0.441)	(0.445)	(0.407)	(0.133)	(0.155)	(0.120)	(0.045)
contr_encour	0.893**	0.924**	0.919**	0.979***	0.955***	0.985***	1.032***	1.076***
	(0.022)	(0.014)	(0.013)	(0.005)	(0.001)	(0.000)	(0.000)	(0.000)

Table A2: The Determinants of the Number of Shade Trees per hectare in the Soubré Region (ctd.)

	(1) **M1**	(2) **M2**	(3) **M3**	(4) **M4**	(5) **M5**	(6) **M6**	(7) **M7**	(8) **M8**
contr_deposs	0.812**	0.790**	0.792***	0.747**	0.593**	0.562**	0.605**	0.648***
	(0.011)	(0.011)	(0.010)	(0.014)	(0.021)	(0.024)	(0.013)	(0.007)
pbc_can	0.525	0.367	0.353					
	(0.560)	(0.655)	(0.663)					
hyp_move	-0.063	-0.055	-0.051					
	(0.834)	(0.854)	(0.859)					
int_anyway	0.173	0.198	0.210	0.236	0.272	0.241	0.276	
	(0.671)	(0.621)	(0.589)	(0.508)	(0.364)	(0.396)	(0.301)	
pasbehav	0.094							
	(0.936)							
instruct	0.104	0.055						
	(0.921)	(0.956)						
planting	-0.655	-0.500	-0.483	-0.255				
	(0.550)	(0.637)	(0.644)	(0.805)				
Observations	172	176	177	180	217	223	229	230
Adjusted R^2	0.122	0.141	0.154	0.153	0.173	0.171	0.187	0.184

Table A3: The Determinants of the Survival Rate of Shade Tree Seedlings in the Soubré Region

	(1) **M1**	(2) **M2**	(3) **M3**	(4) **M4**	(5) **M5**	(6) **M6**	(7) **M7**	(8) **M8**
sexe	-11.126	-5.723	-5.606	-5.245	-5.213	-7.331	-7.484	-6.546
	(0.264)	(0.561)	(0.564)	(0.534(	(0.531)	(0.391)	(0.375)	(0.428)
age	-0.330	-0.340	-0.507	-0.180	-0.183	-0.156	-0.177	
	(0.404)	(0.358)	(0.128)	(0.575)	(0.563)	(0.620)	(0.567)	
exp	0.351	0.562	0.741**	0.484	0.486	0.465	0.446	0.303*
	(0.346)	(0.115)	(0.021)	(0.117)	(0.102)	(0.122)	(0.126)	(0.097)
edu	1.548	3.060	4.075	2.936	2.899	1.074		
	(0.678)	(0.371)	(0.216)	(0.374)	(0.371)	(0.737)		
f_size	0.549	-0.432	-0.538	-0.162	-0.159			
	(0.547)	(0.643)	(0.542)	(0.770)	(0.769)			
f_yield	-2.565	-0.525	-0.484					
	(0.197)	(0.780)	(0.793)					
f_age	-0.086	0.252	0.253	0.176	0.175	0.221	0.233	0.274
	(0.791)	(0.376)	(0.364)	(0.528)	(0.526)	(0.426)	(0.387)	(0.289)
f_state	0.006							
	(0.998)							
nr_worker	0.341	0.451	0.343					
	(0.891)	(0.857)	(0.888)					
nr_animals	0.003							
	(0.916)							
sources	-3.403	-5.678	-6.785	-3.523	-3.346	2.114	2.130	
	(0.602)	(0.359)	(0.259)	(0.556)	(0.565)	(0.710)	(0.705)	
belief_rain	-.936	-2.013	-2.299	-1.896	-1.910	-4.274	-4.412	-4.187
	(0.402)	(0.582)	(0.520)	(0.603)	(0.596)	(0.243)	(0.215)	(0.234)
belief_parasit	-1.942	-3.092*	-2.822*	-2.825*	-2.849*	-2.514	-2.553	-2.573
	(0.256)	(0.067)	(0.083)	(0.086)	(0.078)	(0.126)	(0.117)	(0.111)
att_desir	-11.376*	-11.281**	-11.468**	-9.811*	-9.725*	-6.304	-6.614	-6.209
	(0.062)	(0.039)	(0.032)	(0.068)	(0.064)	(0.236)	(0.201)	(0.224)
norm_devanc	-0.180	0.046	0.099	-0.059	-0.058			
	(0.642)	(0.899)	(0.777)	(0.866)	(0.867)			
pn_passedbeh	20.526***	21.760***	22.120***	17.402***	17.387***	8.947***	8.828***	9.308***
	(0.0001)	(0.00001)	(0.00000)	(0.00002)	(0.00002)	(0.007)	(0.007)	(0.004)
contr_encour	3.580	-0.055						
	(0.118)	(0.981)						
contr_deposs	-2.586	-1.084	-0.901	-0.157				
	(0.145)	(0.536)	(0.601)	(0.928)				
pbc_can	3.060	3.691	2.995	8.350	8.508*	8.364*	8.213*	8.588*
	(0.607)	(0.554)	(0.621)	(0.115)	(0.087)	(0.100)	(0.084)	(0.067)
hyp_move	-2.255	-1.299	-1.100	-1.651	-1.683	-1.490	-1.565	-1.329
	(0.158)	(0.397)	(0.464)	(0.286)	(0.262)	(0.303)	(0.267)	(0.326)

Table A4: The Determinants of the Survival Rate of Shade Tree Seedlings in the Soubré Region (ctd.)

	(1) **M1**	(2) **M2**	(3) **M3**	(4) **M4**	(5) **M5**	(6) **M6**	(7) **M7**	(8) **M8**
int_anyway	-1.703	-1.224	-1.496	-1.298	-1.323	-0.373		
	(0.415)	(0.555)	(0.463)	(0.534)	(0.520)	(0.857)		
pasbehav	-25.201*	-6.364	-6.214	1.841				
	(0.091)	(0.631)	(0.634)	(0.886)				
instruct	12.546**	8.875	10.095*	8.751	8.762	11.547**	11.497**	11.812**
	(0.049)	(0.132)	(0.080)	(0.134)	(0.127)	(0.044)	(0.042)	(0.035)
planting	-1.102	-0.016						
	(0.836)	(0.998)						
Observations	96	110	111	117	117	122	122	122
Adjusted R^2	0.216	0.182	0.215	0.185	0.201	0.116	0.131	0.142