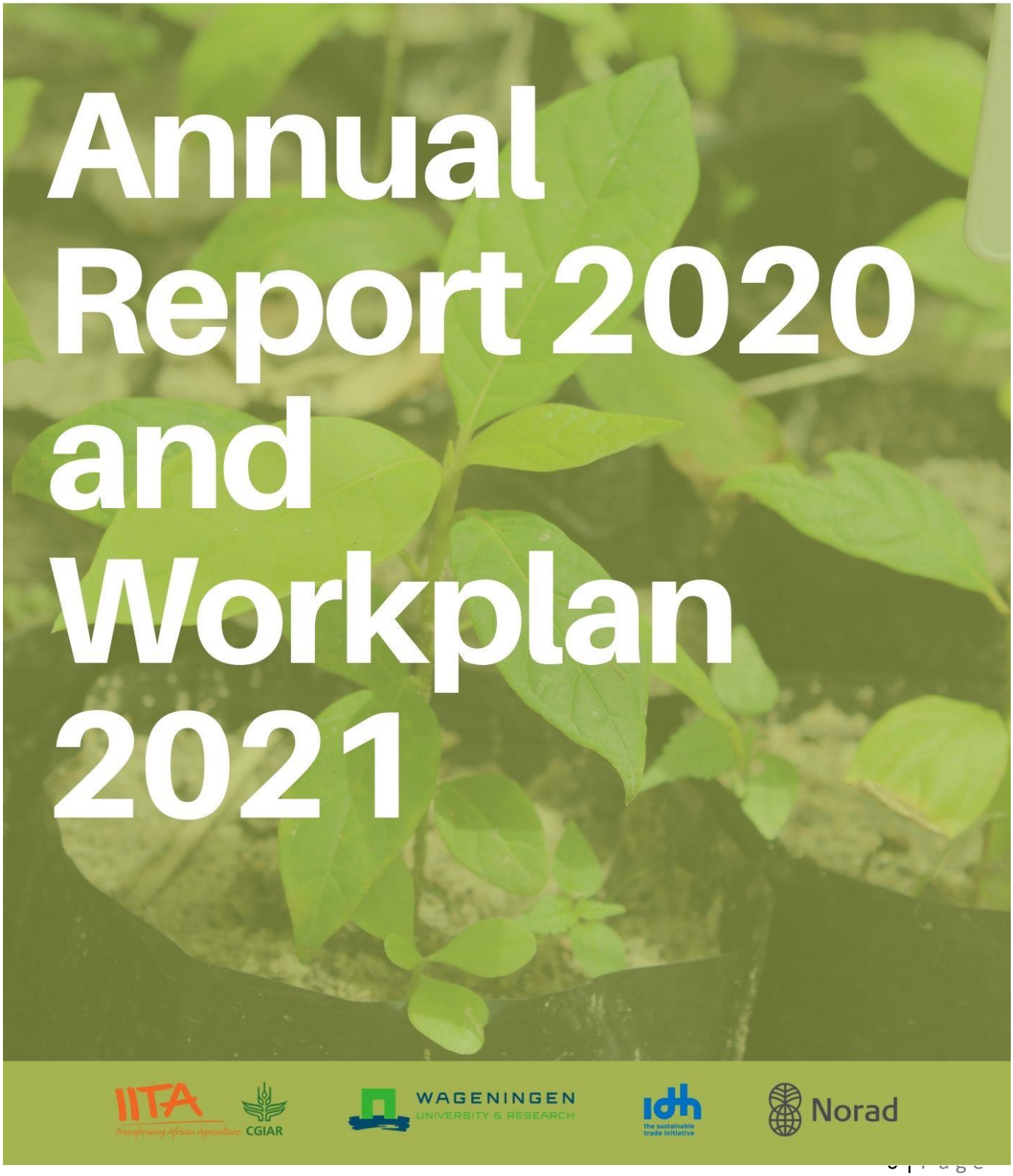
CocoaSoils

JANUARY - DECEMBER 2020

Annual Report 2020 and Workplan 2021



IITA Transforming African Agriculture CGIAR

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Acronyms and Abbreviations

AEZ	Agroecological zones
ARTCI	*Autorité de régulation de télécommunication de Côte d'Ivoire*
AMS	Agroproduce Management Services
BMP	Best Management practices
CASE2	Cocoa Crop Model
CCAFS	Climate Change, Agriculture, and Food Security
CCC	*Conseil Café Cacao*
CFI	Cocoa Forest Initiative
CIAT	International Centre for Tropical Agriculture
CNRA	*Centre National de Recherche Agronomique*
CRIG	Cocoa Research Institute of Ghana
CRIN	Cocoa Research Institute of Nigeria
CSA	Climate-Smart Agriculture
CSC	Climate-Smart Cocoa
CT	Core Trials
EA	Extension Agents
ETG	Export Trading Group
FC	Forestry Commission
FIRCA	*Fonds Interprofessionnels pour la recherche et le Conseil Agricoles*
FST	Farmer Segmentation Tool
ICRAF	World Agroforestry Centre
IDH	The Sustainable Trade Initiative
IITA	International Institute of Tropical Agriculture
IRAD	*Institut de recherche agricole pour le développement*
ISFM	Integrated Soil Fertility Management
IVR	Interactive Voice Response
KABP	Knowledge, Attitude, Behavior, and Practices
MEL	Monitoring, Evaluation, and Learning
NARS	National Agricultural Research systems
NGO	Non-governmental Organization
NORAD	Norwegian Agency for Development Cooperation
ODK	Open Data Kit
PIO	Project Implementation Officer
P4D	Partnership for Delivery
R4D	Research for Development
SC	Steering Committee
SMS	Short Messaging Services
SQM	*Sociedad Quimica y Minera de Chile S. A.*
ST	Satellite Trials
ToR	Terms of Reference
ToT	Training of Trainers
UNEP-WCMC	United Nations Environmental Program – World Conservation Monitoring Centre
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
WCF	World Cocoa Foundation

WENR	Wageningen Environmental Research
WUR	Wageningen University and Research

1 Key messages and challenges

In the context of its R4D component, the CocoaSoils program made significant progress in establishing Satellite Trials (ST) across different agroecological zones (AEZ) and soil types in Cameroon, *Côte d'Ivoire*, Ghana, and Nigeria. In conjunction with the approach to open-data sharing, this will deliver quality data, generated through a broad public-private partnership that the CocoaSoils project seeks to achieve. The draft extension manuals and farmer handbooks developed under the P4D component of the project were validated with public and private partners in the four countries. With a current database of over 180 000 farmers available through our partner dissemination networks and the engagement with digital dissemination partners, the project is on course to deliver recommended options on Integrated Soil Fertility Management (ISFM) to smallholder farmers in West and Central Africa. In this summary, highlights of the progress on the Research for Development (R4D), Partnership for Delivery (P4D), and project management for 2020 are described and further detailed in the main body of the report.

Progress with R4D Outputs

With regard to generating ISFM options, a total of eight Core Trials (CT) in West and Central Africa and additional trials in Ecuador and Indonesia are being managed based on agreed protocols. A new CT is being established by Mondelez in the south-western part of Ghana, which will be managed by the Cocoa Research Institute of Ghana (CRIG). Cocoa planting has been completed in all CT sites. Barcodes have been printed and distributed to seven CT sites. A protocol for early cocoa tree evaluation was developed for evaluation in the first two years after planting. Two additional protocols have been developed for maize subplot evaluation and plantain evaluation. A tutorial video for chupon removal and weedicide application has also been created to help CT managers.

A total of 292 ST sites have been installed in accordance with the approved protocols. These sites are being managed by 117 trained technicians across the four countries. Data collection related to management and fertilizer application started in July 2020 and is available on the data portal. A reward system has been created to incentivize Extension Agents in conducting data collection.

An online geographic information system, accessible to all project partners, has been set up to monitor deforestation near the STs in Ghana. A manual for using this online map has been developed. The online system will provide initial information on deforestation activities with which partners can verify whether deforestation has taken or is taking place and whether it is related to CocoaSoils activities.

Knowledge products have been developed at the national scale. These consist of maps and spatial planning steps to help understand risks and plan for opportunities arising from the interaction between cocoa production, its intensification, climate change, forests, biodiversity, and ecosystem services.

The prototype for the decision-support application (Climate-Smart cocoa (CSC) implementer) has been reviewed to combine both structural and functional farmers' characteristics and tactical agronomic decision-making with the use of additional data from the project baseline.

A draft cocoa-specific ontology essential for the proper collection, management, and storage of data has been developed and presented in a webinar. The data team has developed data collection forms in Open Data Kit (ODK) for all data from STs and CTs and an interactive ODK Data collection manual for all CT forms.

In addition to the four PhD students on the project, 10 MSc students have been recruited across the four countries and are working on various topics.

Challenges with the R4D Outputs

Finding a new location for the new CT site in Cameroon was challenging as this delayed the relocation and installation of the irrigation system. Also, the process of getting contractors on site for the installation of the irrigation systems and weather stations was delayed by travel restrictions in the country.

In addition, there was a further delay in the implementation of the STs due to the COVID-19 pandemic. To address this challenge, multiple physical trainings were held with partner technicians based on the safety protocols on social distancing. This prolonged the training periods and also increased cost. When the travel restrictions were relaxed in the various countries, key activities were merged and carried out concurrently.

Progress with P4D Outputs

Two new partners, Olatunde International and Sucden, both in Nigeria, signed the Participation Statement which was developed for new partners for STs and scaling. In all, eight scaling partners are engaged and have signed dissemination agreements with workplans.

The draft versions of the first extension manual and farmers' handbook have been validated virtually in all four countries by the members of the P4D committees. Both documents have been translated into French. A physical formal validation with the P4D committees in *Côte d'Ivoire,* Cameroon, and Ghana has been carried out, while a virtual meeting was organized for Nigeria. The manual is currently being pre-tested with farmers in all four countries.

Currently, 619 EAs have been submitted by partners from all four countries, out of which 153 have been trained to train farmers through their traditional dissemination channels, namely Farmer Field Schools, Coaching, etc.

To make up for the project's scope for dissemination, a target of reaching 25,000 farmers has been set via the engagement with Viamo, through the Grameen Foundation. In *Côte d'Ivoire*, an agreement has been signed with Radio Gagnoa with an objective of reaching 10 000 farmers and discussions are ongoing with ANADER for the use of their e-extension platform to reach 50,000 farmers.

Consultations have begun in *Côte d'Ivoire* and Ghana on policy dialogue on the use of recommendations from the project. In *Côte d'Ivoire*, a meeting was held with *Fonds Interprofessionnels pour la recherche et le Conseil Agricoles* (FIRCA), *Centre National de Recherche Agronomique* (CNRA), *Conseil Café Cacao* (CCC), and private sector partners to clarify the roles and commitments of all stakeholders involved in the project in *Côte d'Ivoire*. In Ghana, a meeting was held with the Forestry Commission (FC), on how to integrate the CocoaSoils work on avoiding deforestation in the overall framework of the Ghana cocoa and forest project, Emission reduction project, and the REDD+ project. These consultations will be extended to Nigeria and Cameroon in 2022.

P4D component - challenges

Due to the COVID-19 pandemic and civil unrests, especially in Cameroon and Nigeria, there have been delays in the training of EAs and formal validation and pre-testing of the manual and farmers' handbook.

Also, convening activities were put on hold as strict measures about movement were imposed by the authorities. This has delayed the process of organizing physical Partnership Committee meetings, which will lead to policy dialogue in Cameroon and Nigeria.

Progress with project coordination

In addition to the existing staff, 12 new project staff have been recruited with specific terms of reference and contracts across the four countries.

The project shared insights and learnings with the wider public including the Research Committee members, other participants from the larger research community, private sector companies, and the general public

through its second forum held in January 2020 in Yaoundé, Cameroon. The forum was attended by more than 140 participants from different backgrounds, including private sector companies, research institutes, farmer organizations, public institutions and many more. Topics discussed under R4D included, adapting cocoa production to climate change, reducing pressure on forests, increasing cocoa yields through ISFM, and increasing cocoa smallholder incomes. On P4D, participants from the four committees in the corresponding countries presented context of activities implemented and obtained feedback from the audience as inputs for work plans for 2021.

Under Monitoring, Evaluation, and Learning (MEL), data collection tools developed in 2019 have been reviewed, based on feedback and initial data analysis. Tools have been developed to document the baseline information and panel data of the partner EAs in terms of their Knowledge, Attitude, Behavior, and Practices (KABP) to enable the measurement of learning among the trained EAs.

Eighty-two EAs from different partners have been trained on the use of the MEL tools to capture all relevant data from the dissemination events. Furthermore, the KAPB baseline and the learning data of these EAs have also been documented using the extension tools. All trainings for EAs in P4D and technicians in R4D have also been captured using the MEL tools developed and data was uploaded on the ODK Aggregate server.

The MEL plan has been updated and shared on the project website and the full draft of the baseline report is currently available. Results from the analysis indicate that cocoa farms produced, on average, as follows: Cameroon 429 kg/ha, *Côte d'Ivoire* 391 kg/ha, Ghana 23 k/ha, and Nigeria 369 kg/ha. These results are about 65% less than the potential yield of 1200 kg/ha. In addition, living income analysis of the baseline data has been conducted and presented to stakeholders in the cocoa industry. In addition, living income analysis of the baseline data was conducted and presented to stakeholders in the cocoa industry during the 2020 CocoaSoils forum.

With regard to communication, the project website was regularly updated; social media platforms were used in reaching project partners; and two newsletters were published. With the use of MailChimp email services, monthly updates were sent to all partners. A Webinar was organized on the ontology of cocoa with a wider audience

Project coordination - challenges

The timelines for MEL trainings delayed due to a delay of the partner extension network training as a result of the COVID-19 Pandemic. The extension of the timelines has been shifted to Q4 2021 to cover the refresher trainings based on the MEL framework gaps that will be identified.

2 Progress narrative

2.1 Introduction

The CocoaSoils Annual Report 2020 presents the workplan for 2021, as well as the project's progress on the 2020 workplan. Results and progress were evaluated against the 2020 targets for outcomes and outputs, as well as the set milestones for coordination-related activities, the R4D and P4D components. Delays experienced were explained and mitigation plans were presented with timelines. Progress against specific outcomes and outputs is presented in **APPENDIX 1 – Status of Project Results with Mitigation plans**. The milestones are evaluated under the respective outputs in the report itself.

2.2 Project coordination

2.2.1 Project coordination team established

Achievement of the following milestones is expected at the time of reporting: (1) interviews based on specific ToR organized; (2) negotiations and signing of contracts completed; (3) list of required capital items

assembled; and (4) capital items procured and delivered. The table below and the following information provide details on progress in the milestones for 2020.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 1: Status of milestones under project coordination team established

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Coordination-related																				
Project coordination team established																				
Recruitment of project staff																				
Milestone: Interviews based on specific terms of reference organized									X	X										
Milestone: Negotiations and signing of contracts completed									X	X										
Procurement of capital equipment																				
Milestone: List of required capital items assembled																				
Milestone: Capital items procured and delivered																				

Progress on milestones: The PIO houses the Project Coordinator, Project Officer, Communications Officer, Research Assistant, a driver, the Systems Agronomist, and the MEL Specialist. A Research Assistant associated with the CCAFS cocoa project has been assigned on a 50% basis to assist the MEL team. A CT Manager for the IITA site in Cameroon, Research Assistants, and Research Technicians have been recruited to support activities under the STs across the four countries. In total twelve project staff have been recruited with specific ToR and contracts. After the exit of the post-doctoral candidate (Dr Kam-Rigne Laossi) on the project, the project coordination team deliberated on whether to bring on board a scientist or to recruit more hands on the field to improve upon efficient and timely data collection. Due to challenges with lack of sufficient technical staff on the part of the partners to support with project field activities, the decision was taken to recruit field research technicians in the four countries to directly supervise and support the work of partner technicians. This led to the hiring of 12 individuals for the job in the four countries. Table 2 shows the details of new staff recruitment under CocoaSoils, with their positions.

Table 2: New project recruits

INSTITUTION	NAME	POSITION/ EXPERTISE	LOCATION
IITA	Mekonnen Hailemariam	Manager - CT	Cameroon
IITA	Eric Yao	Research Assistant – STs	*Côte d'Ivoire*
IITA	Adalbert Onana	Research Assistant – STs	Cameroon
IITA	Augustina Amaechi	Research Assistant – STs	Nigeria

INSTITUTION	NAME	POSITION/ EXPERTISE	LOCATION
IITA	Fred Ankuyi	Research Technician – STs	Ghana
IITA	Alvine Tchouga	Research Technician – STs	Cameroon
IITA	Onyiro Queen	Research Technician – STs	Nigeria
IITA	Ezeoti Joy Nneka	Research Technician – STs	Nigeria
IITA	Obaseki Blessing	Research Technician – STs	Nigeria
IITA	Nwanga Michael	Research Technician – STs	Nigeria
IITA	Suleiman Fatimah	Research Technician – STs	Nigeria
IITA	Oyelude Oluwaseyi	Research Technician – STs	Nigeria

NB: See here for rest of project staff

The PIO procured all the needed items in 2020, including a motorcycle for the Research Technician in Ghana, as agreed on the procurement list of required capital items.

2.2.2 Project management and administration functional

Achievement of the following milestones is expected at the time of reporting: (1) timely reports by the application and its partners submitted; (2) annual planning and evaluation meetings organized; (3) effective communication using various tools facilitated; and (4) three Quarterly Newsletters produced. The table below and the subsequent information provide details on the progress of the milestones for 2020.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 3: Status of milestones under project management and administration functional

Activities and milestones	**2018**				**2019**				**2020**				**2021**				**2022**			
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Coordination-related																				
Project management and administration functional																				
Agreement on a reporting framework																				
Milestone: A reporting framework established																				
Milestone: Timely reports by the application and its partners submitted																				
Agreement on a meeting and communication strategy																				
Milestone: Annual planning and evaluation meetings organized																				
Milestone: Effective communication using various tools facilitated																				
Milestone: 3-monthly newsletter produced																				

Progress on milestones: All contractual reports (progress on financial and technical reports for 2019 and workplan for 2020) were submitted on the agreed dates. See here for final approved Annual Report by NORAD for 2019. All contractual reports have been submitted by partners for the current annual report. The reporting framework established in 2019 was reviewed and used for this report. See here for sample.

The project shared annual insights, learnings, and updates with the wider public including the Research Committee members, other participants from the larger research community, private sector companies (mainly active in Cameroon) and the general public through its second annual forum held in January 2020 in Yaoundé, Cameroon (Report). The Research Committee meeting (Technical report) was held in the same week as the forum. This offered partners and other stakeholders the platform for discussing project implementation processes including protocols for trial establishment, procedure for dissemination through partners' channels, and general roles and responsibilities. Planning activities for the Forum in 2021 have begun with the creation of a Coordinating Committee between the Consortium members, including WUR, IITA, and IDH. The objective of the forum for 2021 is to provide a framework to highlight the benefits of CocoaSoils for private sector partners and the need for them to play a key role in scaling the project's recommendations.

With regard to communication, IDH collaborated closely with the coordination team for alignment on marketing the program, especially through the development of pitch presentations for potential new partners. This included the overall CocoaSoils program overview, benefits on becoming a partner, and the description of partners' different roles.

Various tools and platforms were developed and implemented to support both internal and external communication. The project launched its improved website, hosted by IITA. In 2020, the website received a total of 2275 new users, a 117.5% increase compared with the same period in 2019; 3336 sessions, a 100% increase compared with the same period in 2019; and 6577 pageviews, a 77.95% increase compared with the same period in 2019. The top countries for users visiting the Website were the USA, Netherlands, Cameroon, Ghana, the United Kingdom, and France. Seventy-two percent of users speak English; 13% speak French; 3% speak Dutch; 2% speak Spanish; and 1% speak German. See here for detailed analytics on the Website turnout overview in terms of audience, location of users, and user acquisition during this period.

Three newsletters, which have been widely circulated among partners and other stakeholders, have been published. In 2020; a total of 1226 successful deliveries were made and had an average readership of 30%. See here for detailed analytics on readership for 2020. With the use of MailChimp email services, monthly updates were sent to all partners, including the NARS and private sector companies. A total of 602 successful deliveries were made with 43% readership. See here for detailed analytics on readership in 2020. A Twitter platform has also been created and is already in use by private sector partners and the project for circulating updates. The Twitter platform currently has 68 followers.

Communication with farmers, specifically for the implementation of the STs, was carried out by the field technicians using WhatsApp platforms created for each partner's technician group. To make information and updates easily accessible within the various countries, country Leads have been appointed to be in constant contact with the team at Wageningen University. The country Leads relay the information to both the NARS and private sector partners in the countries; thus, building strong collaboration between the project country Leads and the NARS focal persons working together on specific activities and having regular updates at the country level.

Challenges and proposed changes in milestone timelines

The main challenge for the annual forum for 2021, is the COVID-19 pandemic that could change the form of the forum from physical to virtual. With regards to the website, number of users could be more. However, publications are being received under the project, which would provide new knowledge. This includes

publications by the PhD students and their supervisors. The website has been improved and with the integration of the new knowledge more readers are expected to visit the site.

Workplan for 2021

Activity: Agreement on a reporting framework

- Milestone: Submit timely reports by the applicant and its partners by Q3, 2021

Activity: Agreement on meetings and communication strategy

- Milestone: Organize annual planning and evaluation meetings by Q1, 2021
- Milestone: Facilitate effective communication using various tools by Q4, 2021
- Milestone: Produce three monthly newsletters by Q4, 2021

2.2.3 Convening mechanisms in place

At the time of reporting, the milestone "regular meetings with industry partners facilitated" should have been realized. The table below and the subsequent information provide details on the progress towards the milestones for 2020.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline according to the implementation plan in the proposal.

Table 4: Status of milestones under convening mechanisms in place

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Coordination-related																				
Convening mechanisms in place																				
Organization of regular meetings with the industry																				
Milestone: Meeting schedules agreed upon																				
Milestone: Regular meetings with industry partners facilitated																				

Progress on milestones: At the end of 2019, the regular monthly meetings with the individual industry partners were restructured. Each month, a joint meeting with the industry partners was organized wherein common topics/issues (e.g., fertilizer application for trials, selection of STs, collaboration in dissemination activities, etc.,) were addressed and updates were shared by the partners. This process continued in 2020 and was very well received and attended by partners. During the outbreak of the COVID-19 pandemic, this structure was leveraged to reflect contingency plans of the different partners for the implementation of their activities.

Challenges and proposed changes in milestone timelines

Whereas, in the beginning of 2020, these recurring meetings had many different agenda points suggested by partners, they evolved into meetings with just a round of updates. For that reason, thematic deep dives from the program will regularly be included to keep the partners interested in participating at these meetings.

Workplan for 2021

Activity: Organization of regular meetings with the industry

- Milestone: Facilitate regular meetings with the industry partners by Q4, 2021

2.2.4 Appropriate MEL tools and processes

Achievement of the following milestones is expected at the time of reporting: (1) users of the MEL framework trained; (2) MEL framework continuously updated; (3) learning from the MEL framework fed back into other activities; and (4) baseline study documented for the four target countries (refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for milestone-specific details). The table below and the subsequent information provide details on the progress to the milestones for 2020.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 5: Status of milestones under appropriate ME&L tools and processes

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Coordination-related																				
Appropriate ME&L tools and processes																				
Development of a participatory ME&L framework																				
Milestone: Key outcome and impact indicators identified																				
Milestone: ME&L tools and processes agreed upon																				
Facilitation of the use of the ME&L framework by all project partners																				
Milestone: Users of the ME&L framework trained						X	X	X	X	X	X	X	X	X	X	X				
Milestone: ME&L framework continuously updated																				
Milestone: Learning from the ME&L framework fed back into other activities																				
Implementation of baseline and end-line studies																				
Milestone: Baseline study documented for the four target countries							X	X												
Milestone: End-line study documented for the four target countries																				

Progress on milestones: MEL tools and processes developed in 2019 were reviewed based on feedback from pretesting and discussion with partners. Tools have been developed to document the baseline information and panel data of the partner EAs in terms of their Knowledge, Attitude, Behavior, and Practices (KABP) to enable the measurement of learning among the trained EAs.

With regard to the training of MEL framework users, 82 partner EAs (12% female) have been trained on the use of dissemination event tools to enable them to capture all relevant data regarding the dissemination of ISFM content to farmers. Furthermore, the KAPB baseline and the learning data of these EAs have also been documented using the extension tools. All trainings for EAs in R4D and for technicians in P4D have also been captured using the MEL tools developed and data were uploaded on the ODK Aggregate server.

The MEL plan has been updated with the newly approved results framework and uploaded to the project website.

The analysis of the baseline data has been completed for the four project countries and a presentation was made to partners. Baseline figures for the impact and outcome indicators – income, yield, labor types, previous land use, awareness and knowledge of ISFM among farmers, and use of ISFM – have been analyzed and are presented in the draft report. From the analysis of the baseline data, cocoa farms in Cameroon produced, on average, 429 kg/ha, *Côte d'Ivoire* produced 391 kg/ha, Ghana 523 kg/ha, and Nigeria 369 kg/ha. These data exclude outliers and the results suggest that the current cocoa yields are about 65% below the potential of 1200 kg/ha. In addition, living income analysis of the baseline data was conducted and presented to stakeholders in the cocoa industry during the 2020 CocoaSoils forum.

***Challenges and proposed changes in milestone timelines*:** Due to the integration of MEL user trainings in the partner extension network training, delay in these trainings due to the COVID-19 pandemic also delayed the timelines of the MEL trainings. These trainings have started with the pre-testing of the manual in Ghana and will continue with the various dissemination activities across the four countries. The extension of the timelines to Q4 2021 will cover the refresher trainings based on gaps in the MEL framework that will be identified.

Workplan for 2021

Activity: Facilitation of the use of the MEL framework by all project partners

- Milestone: New users of the ME&L framework trained by Q2, 2021; Refresher training based on GAPS will be organized through to Q4 2021
- Milestone: MEL framework continuously updated
- Milestone: Learning from the MEL framework fed back into other activities

2.3 Key impacts and outcomes of CocoaSoils

The change ultimately expected as impact from the implementation of the CocoaSoils initiative is the intensification of cocoa production, which in turn will increase productivity on existing cultivated land, increase incomes of smallholder cocoa farmers, and help to reduce pressure on forests. The baseline figures for the indicators of impact and indicators have been obtained through the baseline study. See here for presentation. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of indicators under impact and outcomes.

I. ***Outcome 1: New cocoa ISFM-related research products are used by private and public stakeholder partners***

This Outcome is related to the development of the research products and their ultimate use by the extension networks of both private and public organizations. The targets for this reporting period are (i) at least two research products validated and used by private and/or public stakeholders and (ii) at least 100 EAs are using the new research products.

The current knowledge, attitudes, behavior, and practices regarding the use of ISFM by partner extension networks have been documented as part of the partner extension trainings (here in referred to as the EAs' baseline) across the four countries. The analysis of the extension baseline survey is being conducted and will be shared with the 2021 progress report where all EAs on the submitted list have been trained. Research products will be validated in 2021 according to the revised results framework. The following outputs contribute to the achievement of this Outcome: (1.1.) a set of ISFM options generated; (1.2.) documented evidence for understanding the physiological basis of cocoa nutrient uptake and use; (1.3.) decision-support system developed for intensifying cocoa production; (1.4) recommendation domains and forest dynamics; (1.5) sustainability assessment tools; (1.6.) operational open knowledge and data sharing portal for the storage, management, and dissemination of cocoa intensification research results; and (1.7) a new cadre of cocoa scientists having PhD/ MSc with knowledge on new cocoa intensification. See section 2.4 for updates on above outputs.

II. ***Outcome 2: Recommendations generated through research products are used by target households***

Under this Outcome, smallholder farmers are expected to acquire knowledge and use the intensification recommendations for cocoa production. The targets for this reporting period are (i) no households are using the new recommendations/new knowledge (ii) no new recommendation is being used, and (iii) at least four existing (old) recommendations are being used. See section 2.5 for updates on above outputs.

The current knowledge and use of such recommendations by smallholder farmers have been documented in the baseline report. See here for presentation. The outputs of this Outcome include the following: (2.1) agreements with private and/or governmental scaling partners; (2.2) appropriate extension tools for integration in partner-led scaling; (2.3) appropriate Training of Trainer (ToT) Manuals for use in the training sessions for EAs; and (2.4) engagement in policy action in support of cocoa intensification. Outputs 1.4 and 1.5 under R4D also contributed to the achievement of this Outcome, directly linked to Outcome 2.3. Therefore, the status of these outputs is presented under P4D. More details in relation to the Outputs are discussed below.

III. ***Outcome 3: Decision-makers (public and private) are using tools and knowledge to avoid increased deforestation and child labor while promoting cocoa intensification***

Under this Outcome, policymakers and other organizations (including the private sector) are expected to integrate intensification recommendations in (country) policies and support the use of feedback from applying tools developed for sustainability assessment and deforestation monitoring. This outcome is related to the "sustainability" dimension of the project's impact through reducing the risk of deforestation. The target for this reporting period is (i) no information available on land use patterns and ecosystem services using new tools/ supply chains.

The main output related to this Outcome is (2.4) engagement in policy action in support of cocoa intensification. However, outputs 1.4 and 1.5 (as indicated above) also contribute to the achievement of this outcome. See sections 2.4.4 and 2.4.5 for updates on above outputs.

2.4 R4D-related outputs

2.4.1 Output 1.1. A set of integrated soil fertility management options generated

The target for this output in 2020 is to generate no set of ISFM recommendations ready for integration in scaling. Achievement of the following milestones is expected at the time of reporting (Table 6). The table below and the subsequent information provide details on the progress to the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 6: Status of milestones for output 1.1.

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.1. A set of integrated soil fertility management options																				
Activity 1.1.1. Agreement on the design of the Core and STs																				
Milestone 1.1.1.1. Literature on cocoa agronomy reviewed																				
Milestone 1.1.1.2. The design of the Core and STs finalized				X	X	X	X	X	X											
Activity 1.1.2. Implementation of the Core and STs																				
Milestone 1.1.2.1. Sites selected, pending contributions from the industry				X	X	X	X	X	X	X										
Milestone 1.1.2.2. Trials installed following the approved protocols					X	X	X	X	X	X	X	X								
Milestone 1.1.2.3. Trials managed following agreed practices							X													
Activity 1.1.3. Data collection and analysis on the trial data																				
Milestone 1.1.3.1. Data collection protocols finalized				X	X	X	X	X	X											
Milestone 1.1.3.2. Trial data collected																				
Milestone 1.1.3.3. Collected data analyzed																				
Activity 1.1.4. Development of a set of site-specific ISFM recommendations																				
Milestone 1.1.4.1. A prototype ISFM decision-support tool developed																				
Milestone 1.1.4.2. Version 1 of an ISFM																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
decision-support tool developed																				
Milestone 1.1.4.3. Version 2 of an ISFM decision-support tool developed																				

Progress on milestones: All the eight CTs with an additional two in Ecuador and Indonesia (**Error! Reference s ource not found.**) have been established and are being managed based on agreed protocols. A new CT is being established by Mondelez in the south-western part of Ghana and will be managed by the Cocoa Research Institute of Ghana (CRIG). Protocols already developed in 2018 and 2019 (i.e., field mapping and preparation, soil sampling, maize data, nursery, planting material, barcode, and fertilizer application) are in regular use, and data are currently being submitted through the data portal for analysis. Cocoa planting has been completed in all CT sites. In September 2020, barcodes were printed and distributed to seven Core trials: Nigeria (CRIN), Cameroon (IITA and IRAD), Ghana (CRIG), *Côte d'Ivoire* (Barry Callebaut and Nestlé), and Indonesia (Mondelez).

Table 7: List of CTs[1] and dates of cocoa planting

Country	Trial ID	Trial Manager	Institution	Location	Date for cocoa planting
Ghana	C0GH001	Amos Quaye	CRIG	Mabang	Oct 20
Nigeria	C0NI001	Moses Ogunlade	CRIN	Owena	Oct 19
Nigeria	C0NI002	Stefan Hauser	IITA	Ibadan	Jun 19
Côte d'Ivoire	C0CI002	Alexandre Kaminski	Barry Callebaut	Tiassale	Nov 20
Côte d'Ivoire	C0CI003	Arthur Tapi	Nestlé	Aboisso	May 20
Côte d'Ivoire	C0CI001	Jacques Alain Kotaix	CNRA	Divo	May 20
Cameroon	C0CA001	Didier Begoude	IRAD	Nkoemvone	May 20
Cameroon	C0CA002	Hailemariam Mekonnen	IITA	Mbalmayo	Oct 20
Ecuador	C0EC001	Eduardo Chavez	Mars	Guayaquil	Nov 20
Indonesia	C0IN001	Erwin Prastowo	Mondelez	Jember, East Java	Apr 20

A protocol for early cocoa tree evaluation was developed for evaluation in the first two years after planting. Two additional protocols have been developed for maize subplot evaluation and plantain evaluation. The latter is a contingency protocol in a situation where maize information cannot be captured. In October 2020,

[1] Trials in Ecuador and Indonesia are not supported by the NORAD funding.

discussions started, also the writing of the first draft of the advanced measurement protocol. To help technicians and CT managers, a tutorial video for chupon removal was created by the IITA – Ibadan team.

Existing and new ODK forms were translated into French to enable data collection in French-speaking countries. In September and December 2020, a series of virtual trainings was conducted for the CT technicians on the use of ODK (see Table 8).

Table 8: Schedule of the ODK training sessions

Country	Trial ID	Institution	Location	No. of Technicians trained	Training Date
Ghana	C0GH001	CRIG	Mabang	1	Sept 5, 2020
Nigeria	C0NI001	CRIN	Owena	4	Sept 8, 2020
Nigeria	C0NI002	IITA	Ibadan	6	Sept 8, 2020
Côte d'Ivoire	C0CI002	Barry Callebaut	Tiassale	2	Sept 15, 2020
Côte d'Ivoire	C0CI003	Nestlé	Aboisso	2	Sept 15, 2020
Côte d'Ivoire	C0CI001	CNRA	Divo	5	Sept 15, 2020
Cameroon	C0CA001	IRAD	Nkoemvone	6	Sept 21, 2020
Cameroon	C0CA002	IITA	Mbalmayo	5	Dec 2, 2020
Ecuador	C0EC001	Mars	Guayaquil	1	Dec 8, 2020
Indonesia	C0IN001	Mondelez	Jember, East Java		

See here for detailed list of technicians trained in all countries.

Fertilizer requirements were developed for CT sites in Nigeria (IITA and CRIN) and Ghana (GRIG) based on maize data and information from soil analyses. A field map (Figure 1) was designed per trial, and an Excel file with detailed plot-level treatment information (including quantities per plot and tree) was provided. Based on the results from the fertilizer, application started with the IITA trials; the process will be replicated for CRIN in Nigeria and CRIG in Ghana for the next fertilizer season. A methodological pipeline was developed that allows the streamlined generation of trial-specific treatment plans and associated tools for implementation.

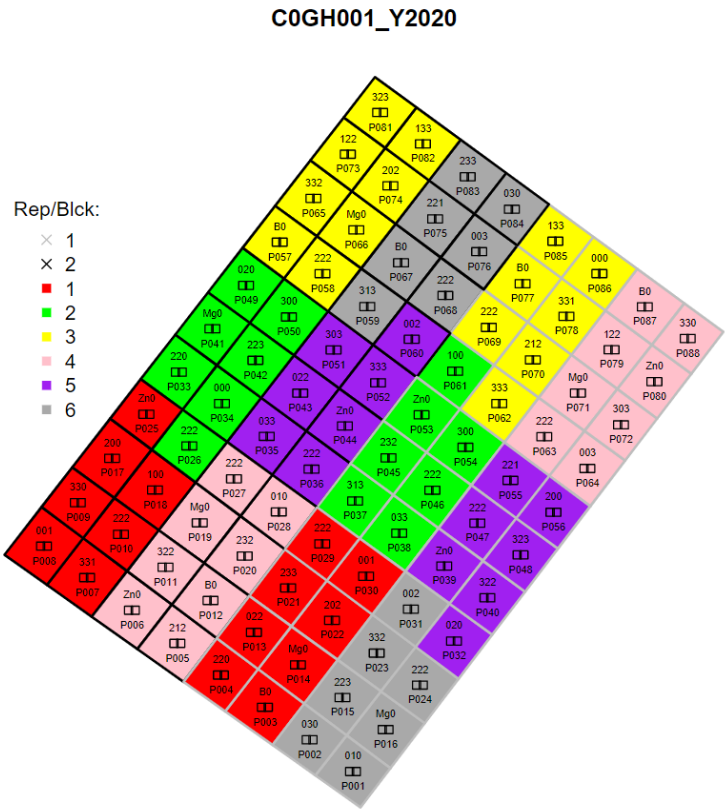

Figure 1: Field map with basic replicate, block, and treatment information, together with a checkbox for application of inputs for C0GH001 (Mabang – Ghana)

Furthermore, weather stations have been installed in six CTs (Divo, Mabang, Owena, Nkoemvone, Mbalmayo, and Ibadan). Irrigation systems have also been installed in all CT sites, except Mbalmayo, which currently hosts the new CT site that was relocated from Bokito, and Nkoemvone that currently has a contractor working on-site.

For the STs, the implementation, management, and measurement protocols have been finalized in Q1 and Q2, 2020. Based on the protocols, ODK forms were finalized and uploaded to the server to start data collection. The delineation of plots started in June 2020 according to the Implementation protocol. In September 2020, barcodes were printed and sent to the STs sites (Figure 2). Treatments were assigned and labelled (Figure 3). Plot coordinates and number of cocoa trees and shade trees per trial were collected using ODK forms. Fertilizer application started in July 2020 (Figure 4).

Training for field technicians started in February 2020 (Figure 5). A total of 117 partner technicians in Cameroon (18), *Côte d'Ivoire* (34), Ghana (43), and Nigeria (22) have been trained and are managing a total of 292 sites, which have been installed in accordance with the approved protocols. The remaining 20 technicians would begin operations when the 40 ST sites from Mondelez and Cargill start in January 2021. Due to the wide variability of agro-ecological conditions it has become necessary to increase the numbers of the STs sites to capture as much information as possible and get an understanding on the immediate effects of management and nutrient supply on cocoa pod production. The current distribution of the ST sites are as follows: 131 in Ghana; 54 in *Côte d'Ivoire*; 64 in Cameroon; and 43 in Nigeria. Collection of data related to management and fertilizer application started in July 2020. to facilitate data collection, protocols and ODK forms were translated into French for the francophone countries. To ensure data quality before and after data collection, documents for a workflow for the data check process was developed. To guide activities and

responsibilities, a document on Roles and responsibilities in operationalizing the Satellite Trials was developed.

To provide incentives to the EAs in conducting these measurements and recording observations, rewarding them for the data collected and uploaded was suggested. This reward system is based on allocating points to different activities; each point has a monetary value which is redeemed from time to time by transferring the money to the EA's account and labelling the points as redeemed and no longer valid. For this matter, an outline of the reward systems was developed. The reward system is handled by the Research Assistants in each country working in coordination with the Data Research Assistant in Wageningen.

Figure 2: Barcode placement in a satellite trial in Nigeria

Figure 3: Treatment distribution in Ghana - Bonsu Nkwanta

Figure 4: Weighing fertilizer in Cameroon – OLAM (left). Fertilizer application in Ghana – Rockwinds (right)

Figure 5: ODK training of technicians in Nigeria

Challenges and proposed changes in milestone timelines: The CT in Bokito - Cameroon was managed by IITA but relocated due to poor soil quality detected after detailed soil analysis. The issue was discussed in the annual meeting in Cameroon. A 4-ha piece of land has been selected at Mbalmayo in the Central Region of Cameroon. The site has been delineated and field activities have been carried out since the end of July 2020.

The delay in the installation of the STs due to the COVID-19 pandemic affected the financial commitments of partners, which led to budgetary adjustments and subsequent approval from NORAD. The installation of the ST was therefore extended to Q4 2020 because of the admission of new partners in Nigeria (Tulip and Sucden) and the rescheduling of activities by Cargill and Mondelez in *Côte d'Ivoire*.

Workplan for 2021

Activity 1.1.2. Implementation of the Core and STs

- Milestone 1.1.2.2. Manage Core and STs following the approved protocols by Q4, 2021

Activity 1.1.3. Data collection and analysis of the trial data

- Milestone 1.1.3.2. Collect Core and ST data according to the data collection protocols by Q4, 2021
- Milestone 1.1.3.3. Analyze Core and ST data by Q4, 2021

Activity 1.1.4. Development of a set of site-specific ISFM recommendations

- Milestone 1.1.4.2. Develop version 1 of ISFM decision-support tool by Q4, 2021

2.4.2 Output 1.2. Documented evidence for understanding the physiological basis of cocoa nutrient uptake and use

The production of any papers on cocoa physiology is not expected in 2020. Achievement of the following milestones is expected at the time of reporting (Table 9). The table below and subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 9: Status of milestones for output 1.2.

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.2. Understanding the physiological basis of cocoa nutrient uptake and use																				
Activity 1.2.1. Identification of factors determining high yield/quality in a range of genotypes/environments																				
Milestone 1.2.1.1. Protocols developed			X	X	X	X	X	X												
Milestone 1.2.1.2. Protocols implemented									X	X	X	X								
Milestone 1.2.1.3. Data analyzed and fed back into other activities													X	X	X	X				
Activity 1.2.2. Assessment of interactions between water, light, nutrient status, and growth efficiency																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Milestone 1.2.2.1. Protocols developed			X	X	X	X	X	X	X											
Milestone 1.2.2.2. Protocols implemented											X	X	X	X	X	X	X	X	X	X
Milestone 1.2.2.3. Data analyzed and fed back into other activities																	X	X	X	X
Activity 1.2.3. Development of foliar norms for cocoa																				
Milestone 1.2.3.1. Protocols developed			X	X	X	X														
Milestone 1.2.3.2. Protocols implemented																				
Milestone 1.2.3.3. Data analyzed and fed back into other activities																				
Activity 1.2.4. Assessment of interactions between potassium nutrition and drought stress																				
Milestone 1.2.4.1. Protocols developed			X	X	X	X														
Milestone 1.2.4.2. Protocols implemented															X	X	X			
Milestone 1.2.4.3. Data analyzed and fed back into other activities																				

Progress on milestones: On cocoa physiology, the protocol has been developed to study the interactions among water, light, nutrient status, and growth efficiency. The revised version addresses the issue of balanced nutrition in a single production area. The effect of Nitrogen (N) nutrition on cocoa leaf biomass and pod production is being assessed. This has been pre-tested on 10 sites with a major change in the design to focus on the nutrient status. Data on litter and pod production are currently being collected and initial results suggest positive effects of Phosphorus (P) and Potassium (K), but detrimental effects from N on cocoa production in this area. More nuances are expected from the analysis of the dynamics of litterfall (leaf biomass accumulation and loss in response to nutrition and temporal stress).

The protocols developed to test cocoa physiology and nutrient uptake and to study the relationship between and drought stress in cocoa have been implemented on two chosen sites *in Côte d'Ivoire*. In addition to this, fertilizer trials (treatments with/without K) have been established. Physiological, morphological, phenological, and climatic data, as well as on visual assessment, soil structure. and moisture are being collected on a weekly and monthly basis to account for seasonal variation. At the two sites, the majority of the planned experiments and protocols has been implemented. Data are being analyzed to underline stories contained in each dataset. Part of the preliminary results has been presented in a Conference on Agroforestry and Climate Change in Daloa, *Côte d'Ivoire* (see Abstract). Analysis of the phenology of cocoa trees, as an

early indicator of drought alert, was done on the different groups of genotypes distributed within the plot over the months (Figure 6). Dry months are marked by high degrees of leaf losses (huge amount of defoliation) and wet months with low degrees.

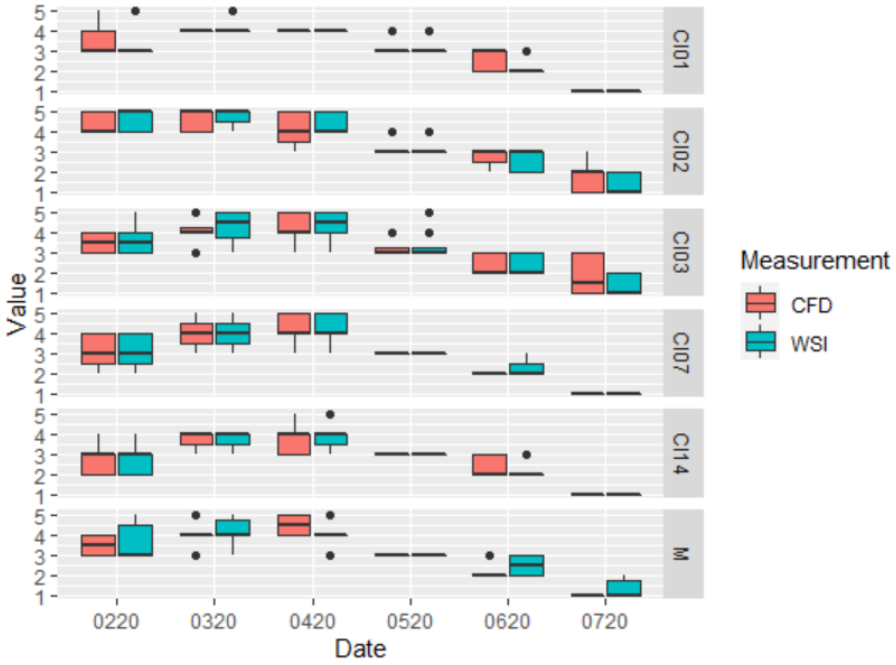

Figure 6: Canopy Foliar Density (CFD) and Water Stress Index (WSI) monthly evolution

Seasonal variations in leaf water potential have been noted in addition. There is a significant difference among the genotypes and treatments (I-K, I+K, -I-K, -I+K) (Table 10).

Table 10: ANOVA Results performed on Leaf Water Potential at Predawn and Midday

Predawn Leaf Water Potential (Bar)						
	Transition Long dry-wet season	Long wet season	Transition Long wet-dry season	Short dry season	Transition Short dry-wet season	Short wet season
Pr(>F)						
Clones	<2e-16	0.17914	<2e-16	0.888	0.00582	0.555
Treatments	<2e-16	<2e-16	<2e-16	104e-14	3.59e-16	<2e-16
Clones:Treatments	0.00142	0.00152	1.69e-07	0.166	4.17e-15	0.516
Midday Leaf Water Potential (Bar)						
Clones	1.60e-15	0.511674	1.38e-12	0.00141	0.444	0.00227
Treatments	<2e-16	2.28e-10	3.05e-08	<2e-16	2.89e-07	<2e-16
Clones:Treatments	2.33e-05	0.000867	0.059	0.07513	0.555	9.02e-05

Yield data analysis from 3834 cocoa farms covering the range of environmental conditions in Ghana has been completed together with climate and soil information. Mixed-effects models were used to explore the relationship between environmental conditions and on-farm annual cocoa yields (kg/ha). Quantile mixed-effects models were then used to gain insights into how such effects differ between farms achieving, on average, low or high yields. Figure 7 shows the model results of the relevant climatic and edaphic effects on

annual cocoa yields (A) and how they differ between the 10% lowest (B) and 90% highest (C) yielding farms. Generally, a farm-to-farm variation explaining 80% of the variability in annual cocoa yields is used while the fixed effects (i.e., environmental conditions) explained only 7%, meaning that management-related factors predominated. Generally, climatic effects have a larger effect than edaphic factors. Notably, the high-yielding farms are affected more by variation in climate and by edaphic factors than the low-yielding. Hence, the less cocoa is limited by management (e.g., low fertilizer input) the more sensitive it is to climate and soil.

To explore the role of management, a subset (105 farms) of the yield data was used where information on management was available including on cocoa and shade trees/ha, fertilizer use, and farm age. Surprisingly, by including management in the mixed effect model, the fixed effects (i.e., environment and management factors) explained 25% more of the variation in cocoa yield, with cocoa tree density being the strongest and most influential variable with a significant effect on annual cocoa yield. This result confirms that management is very important in determining variation in annual cocoa yield.

Although yield data analysis has been completed, the results are yet to be integrated into other activities, including model development and climate change effects on cocoa yields.

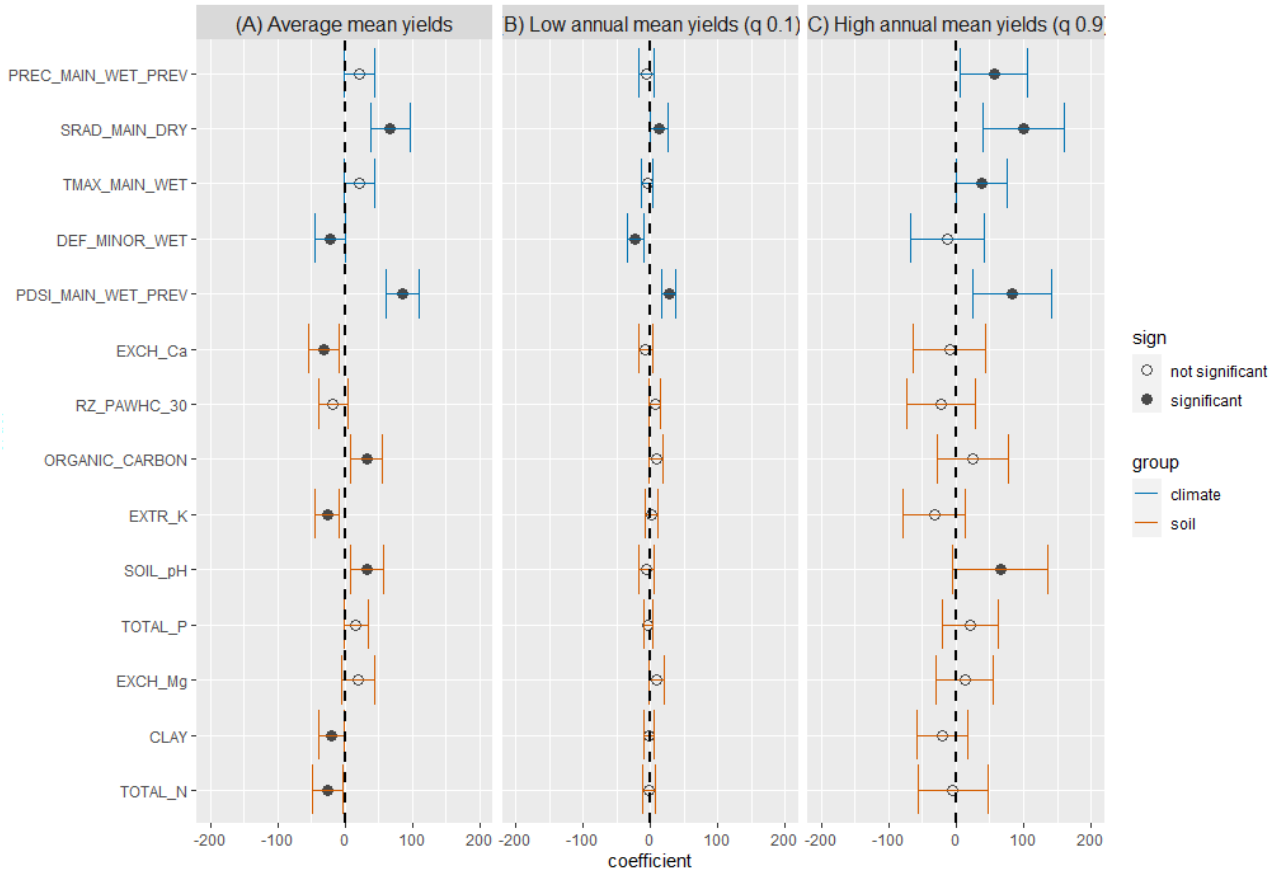

Figure 7: Mixed effect model results of annual yield as a function of environmental conditions (A) and quantile mixed effect model results of annual yield quantile as a function of selected environmental variables (B and C). Standardized coefficients with 95% confidence intervals are included

Challenges and proposed changes in milestone timelines: In identifying factors that determine high yield/quality in a range of genotypes/environments the main challenge was the delay in starting the development of the model, running Python version of CASE2, and simulation of water-limited yields for yield gap analysis and extension to include CO_2 effects. Due to the COVID-19 global crisis, this activity, which was

scheduled for April - August 2020, could not be undertaken. This was due to the fact that the PhD student working on the project could not travel from Ghana to WUR to set up the model due to travel restrictions. To achieve the set objectives despite delays, the model RCASE2 developed by Dr Alejandro Morales Sierra of Wageningen University was used. RCASE2 is a wrapper around CASE2 which allows CASE2 to be run in R. Preliminary simulations of water-limited yields have been run and the few bugs found are being corrected. The implementation of protocols and data collection is ongoing and will continue until the fieldwork of the PhD students is completed by Q1, 2022.

The COVID-19 global pandemic has also delayed the establishment of the trials in relation to the interactions among water, light, nutrient status, and growth efficiency. Activities such as data collection, maintenance of field materials, and delivery of consumables for field activities were also delayed due to restrictions resulting from the pandemic. However, activities have been resumed, thanks to adjustments provided by R4D team.

Workplan for 2021

Activity 1.2.1. Identification of factors determining high yield/quality in a range of genotypes/environments

- Milestone 1.2.1.3. Analyze data collected on the yield and quality in a range of genotypes/environments. Integrate results (analyzed data) into other activities by Q4, 2021
    - Model development: Running CASE2 (Python version of CASE2), Simulation of water limited yields with CASE2 - Yield gap analysis, Extend CASE2 to include effects of CO_2 fertilization on cocoa yields (Adapt Photosynthesis model in CASE2) by Q4, 2021
    - Climate change effects on cocoa yield: Climate scenario with CASE3 by Q4, 2021
    - Writing, discussion/conclusion, and submission of manuscript 2: Cocoa yield gap, temporal variability in yield potential and their determining factors in Ghana by Q2, 2021
    - Writing, discussion/conclusion, and submission of manuscript 1: Effects of climate and soil characteristics on on-farm cocoa yields in Ghana by Q2, 2021
    - Writing, discussion/conclusion, and submission of manuscript 3: Climate change effects on cocoa production in West Africa using process-based modelling by Q4, 2021

Activity 1.2.2. Assessment of interactions between water, light, nutrient status, and growth efficiency

- Milestone 1.2.2.2. Implement the protocols on yield/quality range of genotypes/environment by Q4, 2021
- Milestone 1.2.2.3. Data analyzed and fed-back into other activities by Q4, 2021

Activity 1.2.3. Development of foliar norms for cocoa

- Milestone 1.2.3.3. Analyze data collected on foliar norms. Integrate results (analyzed data) into other activities by Q4, 2021

Activity 1.2.4. Assessment of interactions between potassium nutrition and drought stress

- Milestone 1.2.4.2. Analyze data collected on the assessment of interactions between potassium nutrition and drought stress by Q4, 2021

2.4.3 Output 1.3. A decision-support system developed for intensifying cocoa production

As a target for this Output for 2020, the project will adapt tools for farmer segmentation and stepwise intensification for cocoa producing areas, with a “draft 1” of segmentation and stepwise investment tools validated in *Côte d’Ivoire* and Ghana. Achievement of the following milestones is expected at the time of reporting (Table 11). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an ‘X’ indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 11: Status of milestones for Output 1.3

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.3. A decision-support system for intensifying cocoa production																				
Activity 1.3.1. Development of a decision-support framework for cocoa intensification																				
Milestone 1.3.1.1. Prototype decision-support framework developed							X	X	X											
Milestone 1.3.1.2. Decision-support tool populated									X	X	X	X	X	X	X	X				
Milestone 1.3.1.3. Version 1 of a decision-support tool available											X									
Activity 1.3.2. Validation of the decision-support framework with target user groups																				
Milestone 1.3.2.1. Feedback on version 1 assembled																				
Milestone 1.3.2.2. Version 2 available and evaluated																				
Milestone 1.3.2.3. Final version delivered for scaling																				
Activity 1.3.3. Production and multiplication of a handbook on cocoa intensification																				
Milestone 1.3.3.1. Draft concept available																				
Milestone 1.3.3.2. First draft available and validated																				
Milestone 1.3.3.3. Handbook multiplied and available to the cocoa community																				

Progress on milestones: Changes have been made to the prototype of a decision-support application (CSC implementer), which was available and awaiting validation by the Research Committee in Q1 of 2021. A decision has been taken to revise the analytics on which the tool is based (i.e., combining both structural and functional farmers' characteristics and tactical agronomic decision-making with the use of the additional data from the project baseline). Originally, the analytics were based on data from CCAFS projects. The additional data needed for the analytics will be derived from the CocoaSoils baseline database that is still being cleaned

and is likely to be completed in Q3, 2021. This entails the development of a new version, which will be ready by Q4 of 2021. The tool is scheduled to be populated for Ghana and the other three countries by Q3 of 2021. The CSC Implementer is a mobile application tool that combines the farmer segmentation tool and stepwise investment pathways in best management practices for improved productivity. The tool also maps the farmers' clusters based on management intensity shown by their position on the stepwise pathway, and the CSA packages for easy use by the end-users (e.g., extension workers from both private and public companies).

Figure 8: The dashboard of the current prototype of the cocoa intensification decision application

A draft concept of the cocoa intensification handbook has been produced and circulated among members of the core team for review and inputs. A first draft of the handbook is expected in Q1 of 2021. .

Challenges and proposed changes in milestone timelines: The delay in the development and population of the decision-support framework was due to the need to improve the robustness, applicability, and scalability of the analytics on which the app is built. The analysis is still pending and will be undertaken in close cooperation with software engineers, including content from CCAFS cocoa research work in Ghana when the baseline data are available, to improve the initial prototype. Progress of the handbook has delayed due to delays in new insights from the STs and CTs. This will be completed when enough data is obtained for valid analysis to be made and translated into new insights.

Workplan for 2021

Activity 1.3.1. Development of a decision-support framework for cocoa intensification

- Milestone 1.3.1.3. Make available to partners Version 1 of the decision-support tool across the countries by Q3, 2021

Activity 1.3.2. Validation of the decision-support framework with target user groups

- Milestone 1.3.2.1. Assemble feedback on Version 1 by Q4, 2021

Activity 1.3.3. Production and multiplication of a handbook on cocoa intensification

- Milestone 1.3.3.1. Develop draft concept for production and multiplication of a handbook by Q4, 2021
- Milestone 1.3.3.2. Validate and make available the first draft of the handbook by Q4, 2021

2.4.4 Output 1.4: Recommendation domains and impact of sustainable intensification on forest pressure identified

The target in 2020 for Output 1.4 is to develop climate change impact maps on cocoa and include improved scenarios of improved practices of sustainable intensification. Achievement of the following milestones is expected at the time of reporting (Table 12). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 12: Status of milestones for output 1.4

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.4. Identification of recommendation domains and impact of sustainable intensification on forest pressure																				
Activity 1.4.1. Identification of representative trial sites under current and future climates																				
Milestone 1.4.1.1. Historical climate data compiled																				
Milestone 1.4.1.2. Future climates for the target regions down-scaled																				
Milestone 1.4.1.3. AEZ for site selection assessed					X	X	X	X												
Activity 1.4.2. Scale indicators and recommendations of trials to spatial domains																				
Milestone 1.4.2.1. Spatial proxies of key CSA packages and indicators identified																				
Milestone 1.4.2.2. Scaling spatial domains mapped													X	X	X	X				
Milestone 1.4.2.3. Suitability of domains															X	X				

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
discussed/validated with stakeholders																				
Activity 1.4.3. Ex-ante assessment of cocoa intensification packages and interventions on cocoa suitability																				
Milestone 1.4.3.1. Adaptation potential of CSA packages quantified													X	X	X	X				
Milestone 1.4.3.2. Cocoa suitability models based on 3.1 re-run																				
Milestone 1.4.3.3. Intensification potential for each intervention spatially quantified																				
Activity 1.4.4. Quantification of the impact of intensification scenarios on forest protection/deforestation																				
Milestone 1.4.4.1. Historical deforestation baseline built using Terra-I					X	X	X	X	X	X	X	X								
Milestone 1.4.4.2. Cocoa intensification with deforestation scenarios combined																				
Milestone 1.4.4.3. Impact of different intensification scenarios on forest protection/deforestation assessed																				

Progress on milestones: The first results from analysis of datasets have provided valuable information regarding the type of decisions that can be informed on broader spatial domains. A total of 4003 data points of cocoa yield records have been collected, representing 3471 farms (i.e., some farms have yield data for multiple years) distributed along all relevant AEZ of the cocoa growing areas of Ghana. The key insights include the following: (1) variability in yield is mainly driven by differences in management, while differences of climate and soil account for only 8%. However, when using a subset of the data with yield estimates from pod counts only (instead of also including farmer's recall data), climate and soil accounted for 21%; (2) high yields are more sensitive to climate than low yields; and (3) when including management (cocoa planting density, shade trees, farm age, and whether fertilizers were used (yes/no), 37% of yield variation was explained. This means that substantial farm-to-farm variability remains that is not explained by the climate and soil data, and these refer to agronomic management such as pruning, plant nutrition, and pest and disease control.

This study further allowed identification of the most influential climate variables (precipitation and radiation during the main dry season (December, January, February) and maximum temperature during the main wet season (March-June). Therefore, these variables were further analyzed for each ST site regarding historical trends (1980-2020) and how year-to-year variability changes the conditions for these sites. Many management practices including agroforestry design and fertilization will depend on the year-to-year variability of these climate variables. Taking into consideration the relevance of rainfall distribution for cocoa growth and yield and the importance of good description of climate, different climate data sets are being compared, namely TerraClimate (CHIRPS (Funk et al. 2015), Abatzoglou et al. (2018), Cand Era5-Land (Muñoz Sabater 2021), and data sets have been created on consecutive dry months (< 100 mm) as suggested by Wood and Lass (2008) and Läderach et al. (2013). Drought indices such as the standardized precipitation-evapotranspiration index (SPEI) are being calculated for various time scales. See, for example, maps and figures of different climate indices in the CocoaSoils Climate Atlas.

In the next step the CASE2 cocoa crop model would be used to translate the climate and soil data into theoretically calculated potential (i.e., driven by solar radiation and temperature and not limited by water and nutrients or reduced by pests and disease or weeds, etc.) and water limited yield (i.e., reduced only by water). Comparing these yield levels with actual farmer yield will provide insights into the yield gap and thereby the opportunity to increase yields based on the insights gained by CocoaSoils on best management practices and integrated soil fertility management. To assess effects of climate change on cocoa yield, the photosynthesis module of the CASE2 model will be replaced by the biochemical model of Farquhar et al. (1980). It is important to consider interactive effects between temperature and an elevated atmospheric carbon dioxide concentration. A research paper is currently being drafted, which reviews different modelling approaches contrasted with observational insights on key eco-physiological processes related to adaptation of cocoa to climate change.

Next to climatic conditions, sustainable intensification pathways also need to take into account the landscape context. For example, more complex agroforestry systems can be incentivized in areas of high ecological importance (e.g., biodiversity and carbon stocks), while focusing on increasing cocoa yields could be prioritized in areas of less ecological importance (e.g., on existing cocoa areas of less ecological importance). Therefore, Land use data from various sources (i.e., satellite imagery of different spatial and temporal resolution) have been analyzed to gain a comprehensive understanding of spatial variability and temporal change in tree cover within areas suitable for cocoa as shown in the land use maps. Substantial forested areas have been lost in the last 20 years and tree cover has changed significantly within agricultural areas. This affects local, regional, and global ecosystem services and future trajectories of where and how cocoa will be managed and substantially contributes in defining the future state of ecosystem services. As a next step, the compiled analyses on climate, soil and land use will be integrated to prioritize areas for different pathways of cocoa sustainable intensification. These can then be used together with the diverse stakeholders in shaping the future cocoa to assess different solution spaces.

Regarding progress on the monitoring of deforestation near STs, an online geographic information system has been set up to track potential deforestation activities. A manual for using the online map for Ghana can be accessed here. The map shows all satellite trial sites including a circle with a specified radius around the STs (e.g., 4 km). Initial choice of radiuses has been made, based on the baseline survey where farmers have been asked about the distance in walking minutes between the cocoa plot and the homestead. This gives an indication of how far a cocoa farmer might go to set up a new plot. If the circles overlap with remaining forests, then particular attention needs to be devoted to these areas regarding potential deforestation events as identified by remote sensing analyses. Local partners can verify whether deforestation has taken or is taking place and whether it is related to CocoaSoils activities. The on-line map will be expanded to other CocoaSoils countries, now that all ST sites have been defined. The maps will be constantly updated with the

most recent deforestation detection. Testing feedback from the ground (e.g., using KoboCollect Tool) to manage deforestation risks will be done.

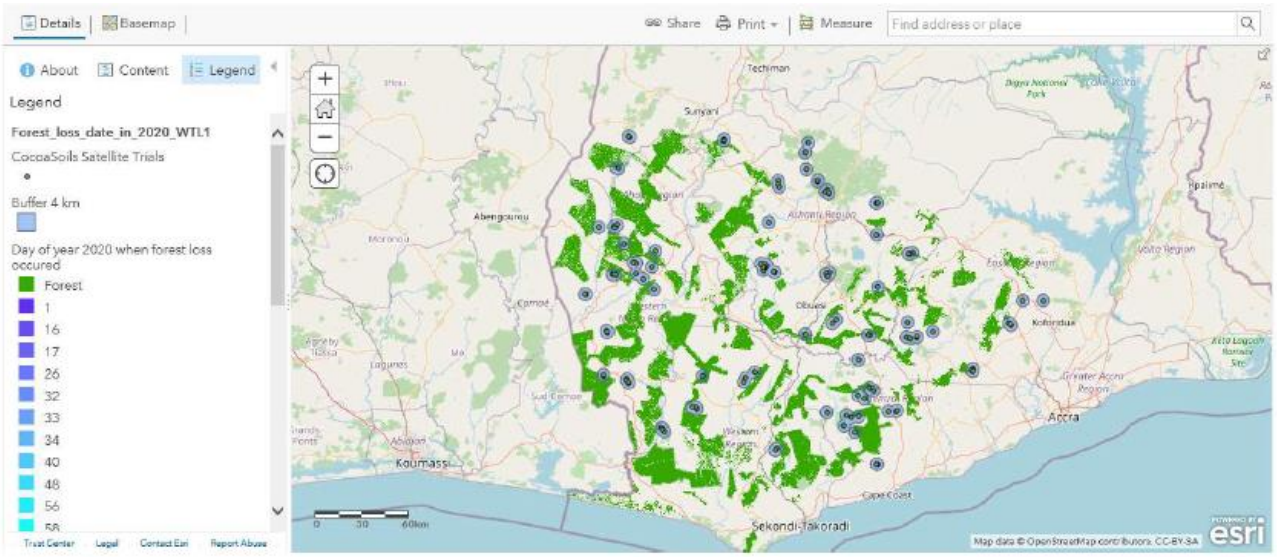

Figure 9: On-line map to monitor potential deforestation near to ST sites

Land-use classification focused on cocoa in a case study area in Ghana to identify drivers of deforestation. Deforestation was defined as tree cover loss in areas with more than 30% tree cover. However, this does not include only forests but also agricultural areas with perennial crops and agroforestry systems (e.g., cocoa, oil palm, etc.). Hence, the analysis focusing on deforestation did not exclusively consider forest loss but also tree cover loss in agricultural areas with relatively high tree cover.

Challenges and proposed changes in milestone timelines

The mapping of scaling spatial domains which is dependent on the selection of the STs was delayed. Thus, the findings from the STs have not yet been used in identifying relevant indicators. However, indicators were identified, based on the analyses done in collaboration with the student working on "Climate change Effects of Cocoa Production and its potential Consequences for forest" and her supervisors through synthesis from published literature. Currently, this analysis has been constrained to Ghana. Once measurements are available from STs in Cameroon, *Côte d'Ivoire*, and Nigeria, these can be scaled to the different spatial domains by Q4 2021.

There was a delay in the translation of the Wageningen cocoa crop model (CASE2) from Fortran to Python, which has directly delayed work under activity 1.4.3. The pandemic added some complications, as the plan was for the PhD student working on the project to travel from Ghana to WUR to set up the model, but this didn't happen due to travel restrictions. While selected indicators can be scaled to provide valuable recommendations, crop models will be required to assess the yield gaps and for improved understanding of how climate change might affect cocoa yield. This translation to Python is important to run the model automatically. for multiple scenarios and sites. The original Fortran version allows only manual runs of the model, making it not feasible to run it for hundreds to thousands of times. As an alternative option, the CASE2 Fortran version was connected to R statistics and is being adapted for successful use. This activity has been extended and will be completed by Q4, 2021.

For the cocoa crop modelling work, additional collaborations with partners in Colombia have begun. Setting up these partnerships took longer than expected but they are highly beneficial due to the extensive observational data on cocoa ecophysiology and agroforestry design, which is key for robust modelling and is scarce elsewhere in the world. The focus of these partnerships is on the following: (1) developing a cocoa

model for translating seasonal climate forecasts for decision-making at farm level; and (2) integrating different observational data sets on cocoa response to water stress and overall improvement of our understanding on cocoa transportation through a modelling approach.

Workplan for 2021

Activity 1.4.2. Scale indicators and recommendations of trials to spatial domains

- Milestone 1.4.2.1. Expand analyses done in 2020 to other countries
    - Create an Atlas with key climate indicators mapped for STs by Q4, 2021
    - Expand online map to Cameroon, *Côte d'Ivoire*, and Nigeria by Q2, 2021
- Milestone 1.4.2.2. Map areas for which the findings of the STs can be applied due to similarity in climatic conditions (= analogue sites) by Q4, 2021
- Milestone 1.4.2.3. Validate suitability of domains with stakeholders by Q4, 2021

Activity 1.4.3. *Ex-ante* assessment of cocoa intensification packages and interventions on cocoa suitability

- Milestone 1.4.3.1. Quantify the adaptation potential of CSA packages by Q4, 2021
    - Mapping cocoa with limited water and potential yields with different shade levels
        - The inter-annual variability will be translated into potential (yield only as a function of climate without water or nutrient limitations and not reductions due to pests and diseases) and water limited yield (same as potential but considering water limitation) using the Case2 model
        - Calculate yield gap by comparing actual farmers' yields with modelled potential and water limited yield
- Milestone 1.4.3.2. Re-run cocoa suitability models based on 3.1 by Q4, 2022
- Milestone 1.4.3.3. Quantify intensification potential for each intervention spatially by Q4, 2022

Activity 1.4.4. Quantification of the impact of intensification scenarios on forest protection/deforestation

- Milestone 1.4.4.1. Historical deforestation baseline built using Terra-I by Q4 ,2021
- Milestone 1.4.4.2. Cocoa intensification with deforestation scenarios combined by Q4, 2021
- Milestone 1.4.4.3. Impact of different intensification scenarios on forest protection/deforestation assessed by Q4, 2021

2.4.5 Output 1.5: Sustainability assessment tools developed and validated to support the sustainable development of cocoa production in relation to biodiversity and the ecosystem services at the landscape level

Target for this Output for 2020 is to produce the first draft of sustainability assessment tools, validated at the site level. Achievement of the following milestones is expected at the time of reporting (Table 13). The table below and the subsequent information provide details on the progress for the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 13: Status of milestones for output 1.5.

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.5. Sustainability assessment tools																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.5.1. Assessment of climate smart cocoa scenarios and impacts on biodiversity and ecosystem services																				
Milestone 1.5.1.1. Baseline of natural capital and ecosystem functions produced																				
Milestone 1.5.1.2. Implications for biodiversity and ecosystem services of potential shifts in cocoa suitability areas mapped							X	X	X	X										
Milestone 1.5.1.3. Potential impacts on biodiversity and ecosystem services of intensification scenarios assessed								X												
Activity 1.5.2. Assessment of landscape vulnerability and potential co-benefits of climate-smart cocoa																				
Milestone 1.5.2.1. Areas of vulnerability for natural capital and ecosystem services under shifting suitability ranges identified									X	X	X	X								
Milestone 1.5.2.2. Area where climate-smart cocoa may help mitigate such impacts identified and mapped																				
Milestone 1.5.2.3. Guidance materials produced							X	X	X	X	X	X								
Activity 1.5.3. Review of potential synergies among industry and national commitments regarding forests supported by sustainable cocoa intensification																				
Milestone 1.5.3.1. Synergies and trade-offs among industry and national commitments supported by intensification scenarios reviewed																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.5.4. Validation of results and stakeholder engagement																				
Milestone 1.5.4.1. Two multi-stakeholder workshops organized							X				X				X					
Milestone 1.5.4.2. Policy brief on workshop recommendations finalized						X		X		X		X	X		X					

Progress on milestones: The milestones under this Output are steps in the production of a collection of knowledge products to support decision-making at different scales, as well as activities to help understand where such knowledge and tools can help to address the sustainability challenges in the cocoa sector and support existing action by different stakeholders. The knowledge products consist of maps, planning steps, and a toolkit to help understand risks and to plan for opportunities arising from the interaction between cocoa production, its intensification, climate change, forests, biodiversity, and ecosystem services. Maps have been developed for the national scale and guidance has been given in the form of spatial planning steps. A toolkit of existing tools to support such assessments will be developed for the landscape to site scale.

As activities under this Output consist of a set of products to be developed over the course of the project, "draft 1" is defined as the step where results are brought together in consolidated draft outputs for which validation can be sought.

There are potential implications for biodiversity and ecosystem services from shifts in cocoa suitability areas due to climate change. At the national level, these implications were assessed based on the gradients in climate change impact for cocoa developed by Schroth et al. (2016). The aim is to analyze the implications of shifting suitability classes in terms of risk to biodiversity and ecosystem services. Highlighting areas most at risk due to high suitability for cocoa in the future and splitting such areas into impact zones are described in Schroth et al. (2016) (e.g., intensification, expansion, less suitable, and diversification zones), to highlight where choosing different strategies or conservation interventions may be relevant in growing cocoa.

In collaboration with CIAT, analysis is in progress on the implications of shifting suitability for cocoa under climate change. New data and mapping cocoa production areas in *Côte d'Ivoire* will enrich this analysis.

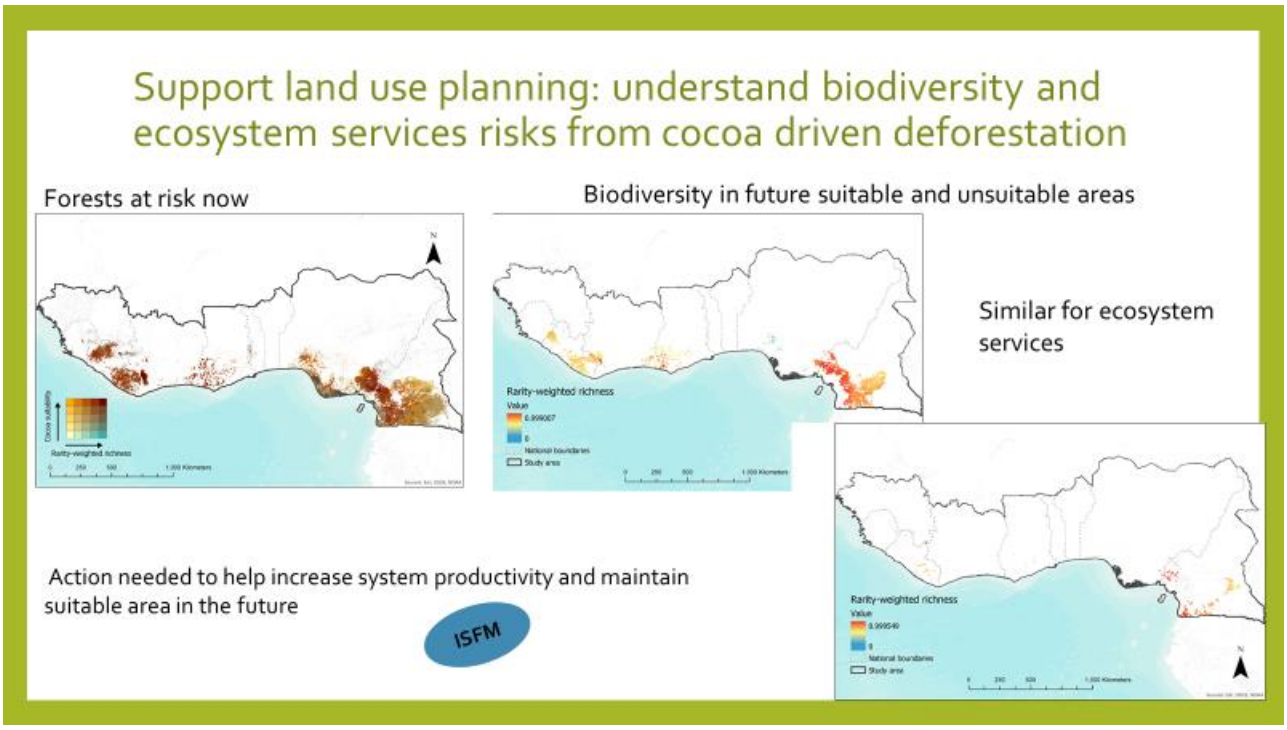

Figure 10: Potential implications for biodiversity and ecosystem services of shifts in cocoa suitability areas due to climate change, and the role of ISFM/sustainable intensification

At the landscape to site scale level, field assessments will take place in 2021 in at least two ST sites applying appropriate tools from the toolkit.

The model of biodiversity impacts of different cocoa systems was developed in 2018 and 2019. A paper setting out the method and results of the analysis of the biodiversity response to land-use change in areas of cocoa cultivation is being finalized and will be submitted in Q1 of 2021. This was originally planned for the end of 2020; the delay was caused largely by the reduced working hours of the Lead modelling specialist due to Covid-19. The use of the model is to map the potential implication of two simple scenarios: transforming all cocoa to either full sun or agroforestry systems, which was explored in 2019 for a subregion in *Côte d'Ivoire*. With new data (source: Videconomics), this model will be applied it to the whole country and in Ghana as well.

At the national scale, areas of particular vulnerability within the cocoa zone have been identified because of potential shifts in the cocoa producing area under a changing climate (e.g., showing potential risk to protected areas or others of high biodiversity or those at an increased risk of soil erosion from cocoa expansion). Work is ongoing to publish the results of the analyses conducted so far.

Progress is being made on the first analysis of how future climate change might lead to different scenarios of land-use change and the implications for biodiversity and ecosystem services will be finalized in collaboration with CIAT. This will include scenarios of intensification and the adaptation of cocoa, as well as the potential transformation to other systems of land use. This work depends partly on data from the STs, but initial results of these analyses will be available in 2021.

Stakeholder consultations on definitions and criteria relevant to the analyses have been held, including an online consultation workshop to review the method and initial results with 23 participants from civil society, the private and public sectors, and Research Institutes. Due to elections in *Côte d'Ivoire* this workshop was held in January 2021 and not November 2020, as planned. The workshop report was shared through the

CocoaSoils newsletter. Most of the work in 2020 consisted of gathering data and resolving challenges related to the difficulty in distinguishing between canopy cover of cocoa and shade trees in remote sensing products of tree cover. In addition, there are some challenges with regard to the matching of the list of highly degraded classified forests (done by *Côte d'Ivoire*) targeted for restoration through cocoa agroforestry, within the available spatial database. The analysis is ongoing and the final results will be presented at the annual *"Partenariat 1 pour 20"* workshop, which was originally planned for the end of 2020, but has been re-scheduled for 2021.

Analysis has started on exploring the potential for cocoa agroforestry to contribute to *Côte d'Ivoire's* target of restoring forest cover to 20% of the land area by 2030, while supporting increased cocoa production and mitigating impacts on biodiversity and ecosystem services, This analysis will support the UN-REDD program in *Côte d'Ivoire* and contribute to the objective of CocoaSoils of getting decision-makers to use tools and knowledge developed under the project to avoid increased deforestation and child labor while promoting cocoa intensification. Stakeholder consultations on definitions and criteria to inform the analyses are ongoing. An online consultation workshop to review initial results was held in November 2020 and the final results will be presented at the annual "*Partenariat 1 pour 20*" workshop, which was originally planned for the end of 2020 but has been re-scheduled for 2021.

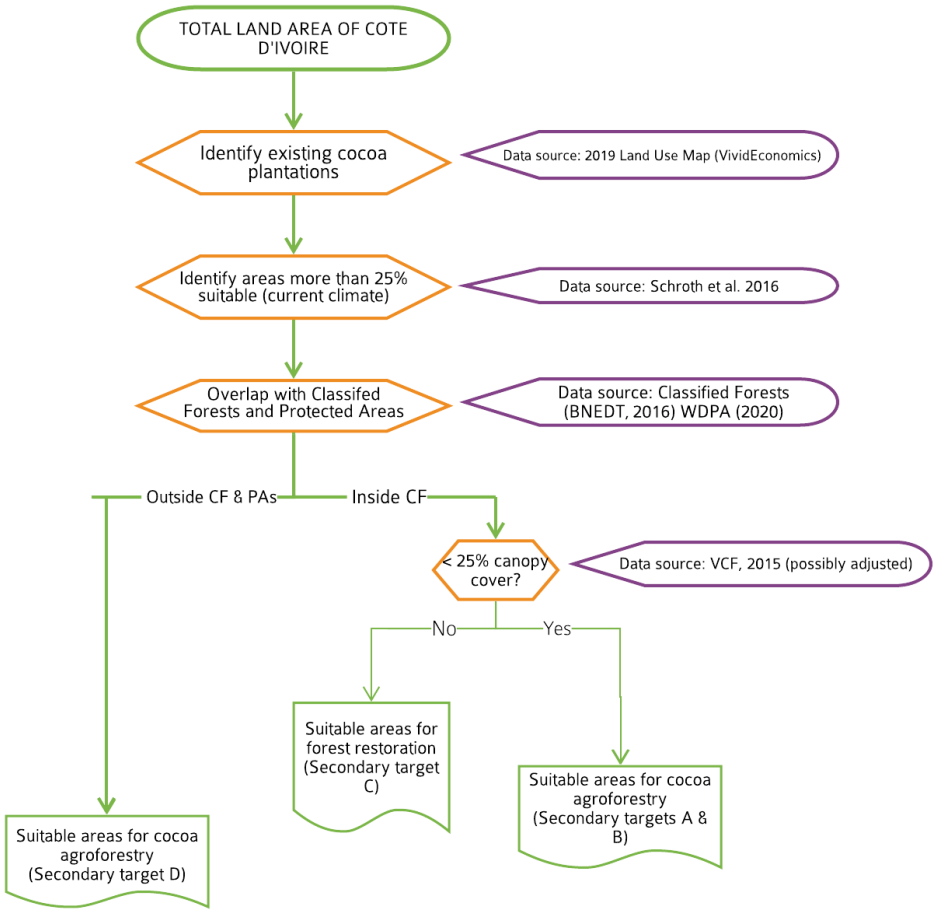

Figure 11: Draft decision tree to identify potentially suitable areas for cocoa agroforestry to be implemented in *Côte d'Ivoire*

All guidance materials have been developed that are aimed at balancing trade-offs and synergies with forests, biodiversity, and ecosystems in planning for sustainable cocoa production for the future. The objective is to help in identifying the best areas in which to intensify cocoa production (and avoid deforestation) and with what type of systems (in particular, the potential of agroforestry).

In collaboration with CIAT, a draft set of planning steps has been developed at the national level to help national or supply chain stakeholders to understand the risks and plan for the opportunities arising from the interactions between increases in cocoa production that have been planned at the national level. Different strategies have been used (e.g., intensification, climate-smart cocoa, and expansion) in climate change, forests, biodiversity, and ecosystem services These steps integrate the R4D components of the project, as well as part of the P4D, in support of Outcomes 1-3.

Based on responses to a first consultation survey finalized in 2020, the ecosystem services in cocoa toolkit were re-framed and current activities include a literature review to inventory relevant tools (Figure 12), sustainable cocoa development initiatives, and related objectives that the toolkit may support (Figure 13). Work is now ongoing to populate the database structure that will underlie the toolkit. The work on the toolkit was delayed in 2020 because the member of staff coordinating this work left UNEP-WCMC and it took some time to find a replacement. Work is now back on track but the planned consultation on a more advanced draft, including a user interface, will now take place in 2021.

Tool name	Link	Contact/ref	Summary	Scale	Type of tool	Objective of toolkit user	Process	Principle skills/knowledge etc needed for application	Intended users e.g. gov/private sector/farmers groups	Case studies (i.e. use/implementation of tool)	Relevance- agroforestry/cocoa/other agricultural
		Minang PA. 2013. Integration. In: van	negotiation support.				place at each step.				
The Talking Toolkit	http://www.worldagroforestry.org/output/talking-toolkit	Simelton E, Dam VB, Finlayson R, Lasco R. 2013. The Talking Toolkit. How	toolkit to help everyone better understand the exposure of farmers to		guidance exercises		collection of participatory exercises, which we call 'tools', are designed for those who facilitate discussions with farmers: development workers,				
The Shade Tree Advice Tool	https://core.ac.uk/download/pdf/132	Van der Wolf et al (2016)	(prototype-only for arabica and				pick country -> pick region -> pick crop ->pick sub-zone ->	Intended users are public and private extension agents assisting farmer			

Figure 12: Tool database in progress for the toolkit

Objectives	Type of Resource	Relevance to Ecosystem Services	Cocoa-Specific?	Spatial Coverage	Main Focus	Skill Needed	Cost
Mitigation of Deforestation Risk and Supply Chains	Guidance	High	Yes	Local / Site-based	Policy / Planning / management	High	Free
Sustainable Intensification	Step-by-step manual	Low	No	Provincial	Socioeconomic / financial analysis	Intermediate	Free for non-commercial use
Agroforestry & Crop	Desktop application	Unsure	Unsure	National	Spatial analysis / modeling	Basic	One-time fee
Climate Smart Agriculture	Web-based/ Mobile application			Regional	Risk & opportunities analysis / impact assessment	Unknown	Subscription
Capacity Building and Agricultural Extension	Spreadsheet application			Global	Mapping / assessing ecosystem services		
Planning & Management for	Modelling tools			Multiple	Multiple		
REDD & Carbon Sequestration	Other						

Figure 13: Tool database structure and user selection criteria

In 2019, existing and potential synergies within the private sector were reviewed with regard to their zero-deforestation commitments, national-level goals and targets, and other relevant initiatives on forests and biodiversity, with reference to the cocoa sector in West and Central Africa. New initiatives and entry points for the work of CocoaSoils are constantly being identified to support synergies. There has also been more interaction with the Cocoa and Forests Initiative (CFI), supported by IDH.

A paper on "Mapping biodiversity and ecosystem services at risk in cocoa growing areas of West Africa" was submitted to Agriculture, Ecosystems, and Environment in early 2021 instead of at the end of 2020. The journal considered the work highly relevant but not appropriate for their journal. Work is underway to submit the paper to a more appropriate journal. A second paper on "Potential implications for biodiversity and ecosystem services of shifting suitability for cocoa due to climate change in West Africa" will be submitted by Q1, 2021. The potential for policy briefs based on results is also being considered.

Challenges and proposed changes in milestone timelines: Due to the global health crises, the potential of sharing the work of CocoaSoils in relevant fora and engaging with stakeholders was limited in 2020. However, links to support synergies that were made in 2019 were followed-up including the following.

- Through UN-REDD: assess the potential of cocoa agroforestry to contribute to the *Côte d'Ivoire* national target of restoring forest cover to 20% of land area by 2030 (see Milestone 1.5.2.2); and
- Supplied a data layer on biodiversity values associated with different land uses, including cocoa, to Vivideconomics to include in the data platform images, built for and maintained by the Ministry of Planning and Development of *Côte d'Ivoire* to support the Cocoa Forest Initiative (CFI).
- Further considered the potential of sustainable intensification of cocoa to contribute to forest protection and increasing ecosystem services in agricultural landscapes in collaboration with CIAT, in preparation for the Annual Meeting held in January 2021.

Two multistakeholder workshops were originally planned for 2022, in *Côte d'Ivoire* to support work on identifying and mapping areas where climate-smart cocoa may help mitigate landscape vulnerability. These were restructured as a webinar-based workshop with more restricted scope.

Workplan for 2021

Activity 1.5.1. Assessment of climate-smart cocoa scenarios and impacts on biodiversity and ecosystems

- Milestone 1.5.1.3. Assess potential impacts on biodiversity and ecosystem services of intensification scenarios by Q4, 2021

Activity 1.5.2. Assessment of landscape vulnerability and potential co-benefits of climate-smart cocoa

- Milestone 1.5.2.1. Identify areas of vulnerability for natural capital and ecosystem services under shifting suitability ranges by Q1, 2021
- Milestone 1.5.2.2. Identify areas where climate-smart cocoa may help mitigate such impacts by Q4, 2021
- Milestone 1.5.2.3. Work towards producing guidance materials has already started and will continue by Q4, 2021

Activity 1.5.3. Review of potential synergies among industry and national commitments regarding forests supported by sustainable cocoa intensification

- Milestone 1.5.3.1. Review synergies and trade-offs among industry and national commitments supported by intensification scenarios by Q4, 2021

Activity 1.5.4. Validation of results and stakeholder engagement

- Milestone 1.5.4.1. Organize multi-stakeholder workshops by Q3, 2021
- Milestone 1.5.4.2. Finalize scientific papers submitted and policy briefs on workshop recommendations in Q1 and Q3, 2021

2.4.6 Output 1.6. Operational open knowledge and data sharing portal for the storage, management, and dissemination of cocoa intensification research results

As target for this Output in 2020, a final version of the data portal will be available and a minimum of 25% of all datasets submitted. Achievement of the following milestones is expected at the time of reporting (Table 14). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 14: Status of milestones for Output 1.6

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.6. Operational open knowledge and data sharing portal																				
Activity 1.6.1. Development of data capture, structure, and publication mechanisms, and user requirements analysis																				
Milestone 1.6.1.1. Data structure for all functions in AgroSTAC implemented			X	X	X	X	X	X	X	X	X	X	X	X						

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Milestone 1.6.1.2. Overall architecture and publication mechanism designed			X	X	X	X	X	X	X	X	X	X	X	X						
Milestone 1.6.1.3. Data Capture app developed				X	X	X	X	X	X	X										
Milestone 1.6.1.4. User requirements analysis completed				X	X	X	X	X	X	X	X	X								
Activity 1.6.2. Development of outward-facing parts of the knowledge and data-sharing portal																				
Milestone 1.6.2.1. Public-facing portal and data visualization platform, prototype 1 developed												X	X	X	X	X				
Milestone 1.6.2.2. Public-facing portal and data visualization platform, beta release available																X	X			
Milestone 1.6.2.3. Public-facing portal and data visualization platform, final release available																				
Activity 1.6.3. Development of consortium-dedicated parts of the knowledge and data-sharing portal																				
Milestone 1.6.3.1. Scientific analysis facility and data publication facility, prototype 1 developed									X	X	X	X	X							
Milestone 1.6.3.2. Scientific analysis facility and data publication facility, beta release available												X	X	X						
Milestone 1.6.3.3. Scientific analysis facility and data publication facility, final release available																X	X			
Activity 1.6.4. Maintenance, user testing, and targeted improvements of knowledge and data-sharing portal																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Milestone 1.6.4.1. Data and knowledge sharing portal maintained																				
Milestone 1.6.4.2. Testing and targeted improvements used																	X	X	X	

Progress on milestones: The ODK server has been developed and is used as the sole application for data capture for the project.

A cocoa-specific ontology essential for the proper collection, management, and storage of data was discussed with stakeholders during the annual forum in January 2020 to standardize and formalize all agronomic measurements. The feedback allowed a revised draft version of the ontology and its report, which was developed and shared with all stakeholders. A webinar on the ontology was organized in October 2020. The aim was to give the ontology more usability and credibility, while enhancing data interoperability among researchers, allowing them to seamlessly share data and results.

The data team from WENR developed the database structure and implemented a content management system coupled with an ODK server. The team has assisted in the development of collection forms in ODK for all ST and CT data. An interactive ODK Data Collection manual for all CT forms has been developed, as follows

- Early Cocoa Evaluation ODK Manual;
- Field Preparation ODK Manual;
- Field Soil sampling ODK Manual;
- Nursery ODK Manual;
- Planting ODK Manual;
- Plot Coordinates ODK Manual; and
- Seedling Sample ODK Manual for effective data collection.

A universal OneDrive has also been created to facilitate data exchange among partners and stakeholders.

There is a need for a new PostgreSQL database (curated data storage) with user management (Figure 14). This database will store all quality checked databases and the data associated with each partner. Within this database, we will seamlessly separate the privacy-sensitive data and non-sensitive data. Privacy-sensitive data will be accessed for consortium partners only. The non-sensitive data will be available for downloading. This may delay the developments on the Knowledge Portal for the publication process of data till 2022.

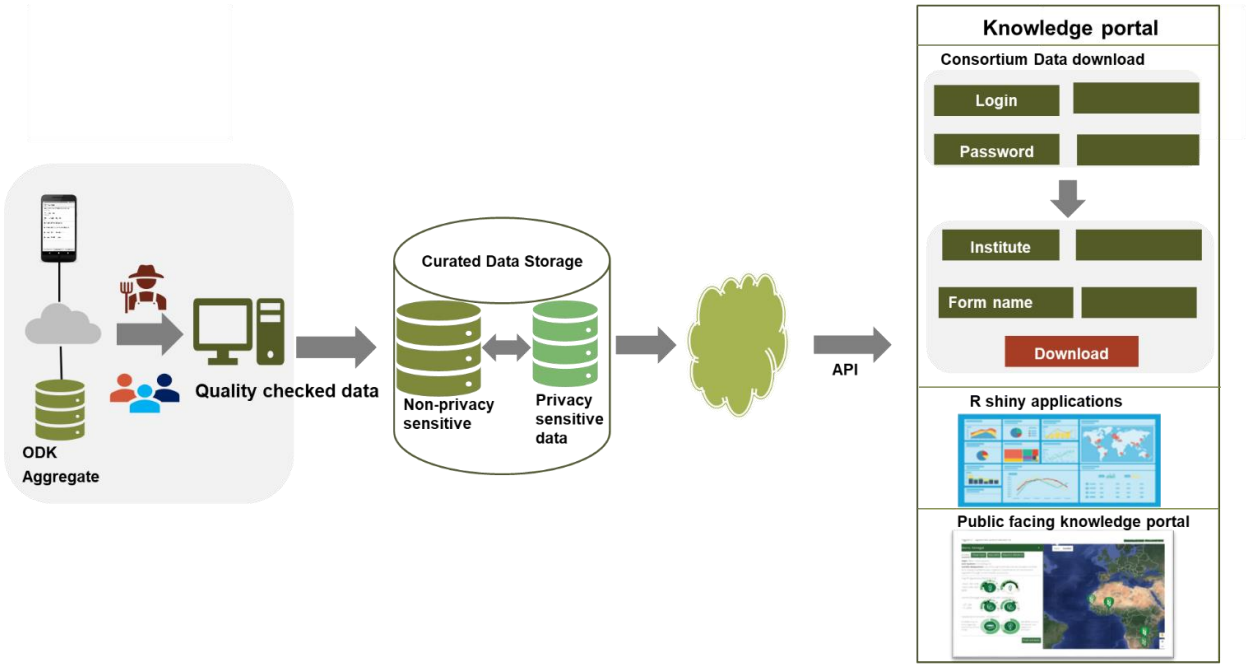

Figure 14: New plan for steps of data curation and sharing within the consortium

Challenges and proposed changes in milestone timelines: Due to the COVID-19 pandemic, it was not possible to provide physical training. Hence, the WENR team developed virtual training materials on ODK data acquisition and conducted seven online interactive trainings for participants from Ghana, Nigeria, *Côte d'Ivoire,* and Cameroon. The trainings were effective and further trainings are planned for Q1 2021.

Workplan for 2021

Activity 1.6.1. Development of data capture, structure, and publication mechanisms, and user requirements analysis

- Milestone 1.6.1.1. Implement data structure for all functions in AgroSTAC by Q2, 2021
- Milestone 1.6.1.2. Design overall architecture and publication mechanism by Q2, 2021

Activity 1.6.2. Development of outward-facing parts of the knowledge and data-sharing portal

- Milestone 1.6.2.1. Develop a Prototype 1 of the Public-facing portal and data visualization platform by Q4, 2021
    - Set up a new PostgreSQL database (curated data storage) with a user management role for secure and efficient Data-Sharing with partners by Q4, 2021
    - Install the ecosystem of open software (Geo-server, GeoNetwork) in the Kubernetes container platform by Q1, 2021.

Activity 1.6.3. Development of Consortium-dedicated parts of the knowledge and data-sharing portal

- Milestone 1.6.3.1. Develop prototype 1 of the scientific analysis facility and data publication facility by Q1, 2021
- Milestone 1.6.3.2. Make available, the beta version of the scientific analysis and data publication facilities by Q2, 2021
- Milestone 1.6.3.3. Make available, the final release of the scientific analysis facility and data publication facility by Q4, 2021

Activity 1.6.4. Maintenance, user testing, and targeted improvements of knowledge and data-sharing portal

- Milestone 1.6.4.2. Use the testing and targeted improvements to develop the data portal further by Q4, 2021

2.4.7 Output 1.7. A new cadre of PhD and MSc-holding cocoa scientists with knowledge in new cocoa intensification options (including Output 1.2 results)

As target for this Output in 2020, the project will approve at least two MSc theses. Achievement of the following milestones is expected at the time of reporting (Table 15). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 15: Status of milestones for output 1.7

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
R4D (Research-for-Development)-related																				
Output 1.7. A new cadre of PhD and MSc-holding cocoa scientists																				
Activity 1.7.1. Identification of PhD and MSc topics																				
Milestone 1.7.1.1. Agreements with universities hosting the students finalized																				
Milestone 1.7.1.2. Research proposals approved				X	X	X	X	X	X											
Activity 1.7.2. Implementation of the PhD and MSc projects																				
Milestone 1.7.2.1. Best candidates identified																				
Milestone 1.7.2.2. Regular discussions with the Supervisory Committees held																				
Activity 1.7.3. Submission and approval of the PhD and MSc theses																				
Milestone 1.7.3.1. Papers in relation to thesis chapters drafted and reviewed																				
Milestone 1.7.3.2. Theses submitted																				
Milestone 1.7.3.3. Theses defended																				

Progress on milestones: Work of PhD students is progressing steadily. Below is a summary of activities of the PhD students.

Deo-Gratias Hougni, the PhD student stationed at CRIN, is working on ISFM in Nigeria, and has published his first paper on nutrient leaching from cocoa pod husks in the journal Plant and Soil. The work on farm typology and farmer practices based on the baseline data is on hold until a final version of the database is released. A discussion paper on the paradigm of ISFM is currently being developed. The trials have been set up and data is being collected for the assessment of the effect of Nitrogen (N) supply on cocoa productivity. The results of his work were presented in a poster at the January 2020 CocoaSoils Forum in Cameroon.

Lucette Adet, the PhD student stationed at Nestlé in *Côte d'Ivoire* and working on cocoa physiology, is developing and testing protocols for a study of the relationships between potassium and drought stress in cocoa. The first draft of one article titled '*Experimental imposed water stress effects on cocoa development*' is currently being developed, and analysis of the data for the article is ongoing simultaneously. Meanwhile, thesis chapters have been structured and the required data defined, organized, and collected. Data collection for the next paper on '*The effects of water deficit and the role of potassium nutrition on fruit set dynamics*' is ongoing. A poster for the work was presented at the forum in 2020 in Cameroon.

Paulina Ansaa-Asante, the PhD student stationed in Ghana at CRIG, has completed chapter one of her thesis entitled, "*Effects of climate and soil characteristics on on-farm cocoa yields in Ghana"*. Chapter two, entitled, "*Yield gap, temporal variability in yield potential and their determining factors of Cocoa in Ghana"*, is currently an MSc thesis topic being worked on by an MSc student, Maris van der Baan from the Forest Ecology and Forest Management research group of Wageningen University. She is currently undertaking data analysis and the simulation of water-limited yields. A poster for the work was presented at the forum in 2020.

Urcil Kenfack, the PhD student, stationed at IRAD in Cameroon, presented a poster on sustainable cocoa intensification through ISFM adoption at the CocoaSoils forum. One manuscript entitled *"Farmers' perceptions as a driver of agricultural practices: Understanding soil fertility management practices in cocoa agroforestry systems in Cameroon"* has been submitted on Human Ecology and is now undergoing a second round of revision after major reviews. Data collection for the next paper on services' landscapes in the cocoa sector in Cameroon started in Q2, 2020.

Three MSc students have been recruited in Nigeria, two in Cameroon, four in Ghana, and one in *Côte d'Ivoire*. See Table 16 below for details of MSc student progress.

Table 16: MSc students recruited under CocoaSoils

NAME	THESIS TOPIC	STATUS
Nigeria		
Ajibona Olusade Adeola	Biomass estimation and nutrient partitioning in cocoa trees of different ages	The topic required the selection of cocoa trees of different ages and the permission to cut them down. Due to COVID-19 lockdown and travel restrictions, this was delayed to the second half of 2020. The student used the time to develop a protocol for the dissection of the trees. Currently, the fieldwork is conducted at CRIN and the cocoa tree parts are taken to IITA for drying and sampling for nutrient analysis.
Oluwafemi Oyedele	Quantification of litterfall, decomposition, and nutrient release in cocoa plantations	The student has collected litter and placed litter decomposition bags in a number of farms. Litter bag collection started but was interrupted by the

NAME	THESIS TOPIC	STATUS
		travel restrictions due to the COVID-19 pandemic. In mid-2020 IITA obtained permission to travel and the decomposition bag collection continued. This will be completed in Q4, 2020 and the data analysis will commence.
	The improvement of the pod count approach to estimate bean yields	Yet to begin. Discussions are ongoing to find either another candidate or change the thesis topic.
Cameroon		
Nsangou Njankouo Abdoulay	*Mapping du système de vente d'intrants pour la cacaoculture dans les localités de Ntui et Makenene, région du centre au Cameroun*	The student worked under the supervision of Dr Precillia Ngome. He has completed his fieldwork and defended his thesis in August 2020 at the University of Dschang. The thesis is available here.
Tsouga Manga Milie Lionelle	Influence of management options and some ecological factors on fertility and yields of cocoa in Cocoa agro – ecosystems in the Ntui subdivision	The student is working under the supervision of Dr Didier Begoude. She is currently doing field work.
Ghana		
Samuel Yeboah	Effects of foliar fertilization and fertigation on nutrient uptake and growth of cocoa seedlings	He has just commenced writing his thesis.
Bernard Darko Quarshie	Yet to begin	He has been admitted at the Kwame Nkrumah University of Science and Technology - M.Phil. Soil Sciences
Amos Obiri Mornyuie	Yet to begin	He has been admitted at the University of Energy and Natural Resources – M.Phil. Agronomy
Godwin Addo	Yet to begin	Yet to be admitted
Côte d'Ivoire		
KOFFI Kouadio Stanislas	Effects of the organo-mineral fertilization management method on the growth and production of cocoa trees in the south-central part of *Côte d'Ivoire*	He has been admitted at *Université Jean Lorougnon Guédé of Daloa (Côte d'Ivoire)*
Associated students[2]		
Anne-Juul Welsink	Deforestation in south-west Ghana – Direct drivers, the size of clearings and emerging hotspots	She is a student from Wageningen University and Research. She has classified land-use focusing on cocoa in a case study area in Ghana. While her first thesis concentrated on evaluating different

[2] Associated students are students that use the services of the CocoaSoils project, but have personal funding.

NAME	THESIS TOPIC	STATUS
		approaches to classify cocoa land use. Her second thesis focused on identifying drivers of deforestation. She defined deforestation as tree cover loss at areas with more than 30% tree cover. However, this does not only include forests but also agricultural areas with perennial crops and agroforestry systems (e.g., cocoa, oil palm, etc.). Hence, the analysis focusing on deforestation did not exclusively consider forest loss but also tree cover loss in agricultural areas with relatively high tree cover. Her thesis can be accessed here.
Miguel Laitao	Shade trees and cocoa production in western Ghana – A Case Study	He is a student from Wageningen University and Research. He has completed his fieldwork and thesis. See here for his thesis.
Marente Lokin	Integrated Soil Fertility Management: Understanding cocoa farmers' motivation and unpacking adoption of ISFM practices	She is a student from Wageningen University and Research. She has completed her fieldwork and thesis. See here for her thesis.
Ernestina Quansah	The quality of Cocoa Pod Husk Biochar produced with the Kon-tiki kiln technology, and its effects on soil chemical and physical properties, and the growth rate of cocoa seedlings	She is a student of Norwegian University of Life Sciences (NMBU). She has completed her fieldwork and doing her data analysis in Ghana.
Mina Fredrikke Bohne	Smallholder cocoa farmers' prospects for social and economic upgrading in global value chains	She is a student from Oxford University. She has completed fieldwork in Ghana and writing her thesis.

Workplan for 2021

Activity 1.7.2. Implementation of the PhD and MSc projects

- Milestone 1.7.2.1. Identify best MSc candidates in Cameroon, *Côte d'Ivoire*, and Nigeria by Q4, 2021
- Milestone 1.7.2.2. Hold regular discussions with the Supervisory Committees of all students across the countries by Q4, 2021

Activity 1.7.3. Submission and approval of the PhD and MSc theses

- Milestone 1.7.3.1. Write and submit the manuscripts of PhD theses' chapters by Q4, 2021
- Milestone 1.7.3.2. Submit theses by Q4, 2021
- Milestone 1.7.3.3. Defend theses by Q4, 2021

2.5 P4D-related outputs

The P4D component ensures the transfer of the research products to end-users through existing initiatives for dissemination to partners. The main outcomes of the P4D component are to ensure the research products and tools are used by target households and policymakers.

2.5.1 Output 2.1: Agreements with private (including digital partners) and/or governmental scaling partners developed and signed to disseminate new recommendations/knowledge through their existing structures/ frameworks (H.E protocol or ILO protocol)

As target for this output in 2020, the project will develop and sign at least six agreements with scaling partners and at least one agreement with digital partners (

Table 17). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 17: Status of milestones for output 2.1

Activities and milestones	2018				2019				2020				2021				2022			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
P4D (Partnerships-for-Delivery)-related																				
Output 2.1. Agreements with private and/or governmental scaling partners																				
Activity 2.1.1. Identification of relevant dissemination networks																				
Milestone 2.1.1.1. Potential scaling partners/initiatives mapped			X	X	X	X	X	X												
Milestone 2.1.1.2. Preliminary agreements with scaling partners established			X	X	X	X	X	X	X	X										
Activity 2.1.2. Facilitation of agreements with partners having dissemination networks																				
Milestone 2.1.2.1. Agreements with scaling partners formalized					X	X	X	X	X	X	X	X	X	X						
Milestone 2.1.2.2. Agreements updated (as relevant/needed)									X	X										

Progress on milestones: In 2020, Olatunde International and Sucden signed the Participation Statement, which was developed for new partners for STs and scaling. Eight partners have signed the (dissemination agreements) workplans of activities which is part of formalizing the scaling agreement. This allows partners who are adopting trials to leverage parts of their dissemination network for dissemination of recommendations. See Table 18 for details of scaling partners and status of agreements.

Table 18: Scaling partners and status of agreements

Partner	Country	Participation Agreement	Workplan (Dissemination Agreements)
Olam	Cameron	Signed	Signed
	Côte d'Ivoire	Signed	Signed
	Ghana	Signed	Signed
	Nigeria	Signed	In progress
Cargill	*Côte d'Ivoire*	Signed	Signed
	Ghana	Signed	In progress
Mondelez	*Côte d'Ivoire*	Signed	Signed
	Ghana	Signed	In progress
Kuapa Kooko	Ghana	Signed	Signed
Rockwinds/Transroyal	Ghana	Signed	Signed
Sucden	Nigeria	Signed	In progress
Olatunde International	Nigeria	Signed	Signed
Tulip	Nigeria	In progress	In progress

In addition to these scaling partners, the project is explored the use of digital dissemination platform to help in scaling activities. In Q4 2020, two service providers, VIAMO and ANADER, were contracted to undertake digital dissemination in Ghana, Nigeria, Cameroon, and *Côte d'Ivoire.*

In 2020, IDH continued discussions with new companies that might be interested in leveraging their extension networks. The focus was on Cameroon and Nigeria to bring more scaling partners. Discussions with four companies (AMS and ETG in Cameroon; Sucden and Tulip Cocoa in Nigeria) are ongoing but have not yet led to the signing of another Participation Statement. See status on agreements with partners.

Challenges and proposed changes in milestone timelines: There were challenges in getting Sucden to sign the scaling agreement due to their policy on data sharing. A response from their legal team took longer than expected. However, the participation agreement has been signed.

Workplan for 2021

Activity 2.1.2. Facilitation of agreements with partners having dissemination networks

- Milestone 2.1.2.1. Agreements with scaling partners formalized by Q2, 2021
- Milestone 2.1.2.2. Update agreements (if necessary) with scaling partners (as relevant/needed) across the countries by Q4, 2021

2.5.2 Output 2.2: Appropriate extension tools assembled and revised for integration in partner-led scaling including integration into digital platforms of new recommendations/tools

As target for this Output in 2020, the project will develop and make available a Version 2 of adapted extension tools based on information and feedback from ME&L, and Version 1 of adapted digital platform based on secondary ISFM-related information (Table 19). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 19: Status of milestones for output 2.2.

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
P4D (Partnerships-for-Delivery)-related																				
Output 2.2. Appropriate extension tools for integration in partner-led scaling																				
Activity 2.2.1. Assessment of cocoa producers' capacity needs																				
Milestone 2.2.1.1. Producer associations identified					X	X	X													
Milestone 2.2.1.2. Training needs assessed					X	X	X													
Activity 2.2.2. Production of extension tools																				
Milestone 2.2.2.1. Draft version of the extension tools produced					X	X	X	X	X	X										
Milestone 2.2.2.2. Extension tools validated with cocoa producers' associations					X	X	X	X	X	X										
Milestone 2.2.2.3. Extension tools multiplied										X	X	X								
Activity 2.2.3. Facilitation of feedback sessions with dissemination partners on the extension tools																				
Milestone 2.2.3.1. Feedback session schedule organized									X	X										
Milestone 2.2.3.2. Feedback received and analyzed																				

Progress on milestones: The draft extension manual and farmers' handbook have been validated virtually in all four countries by the members of the P4D committees. Both documents have been translated into French. A formal physical validation with the P4D committee was done in Ghana, *Côte d'Ivoire,* and Cameroon in Q3 and Q4, 2020.

A pre-testing of the manual by the partners' EAs has been carried out in Ghana, *Côte d'Ivoire,* and Cameroon. See here for training report for Ghana. The pre-validated versions of the manual and handbook have been shared with partners for pretesting through their dissemination channels.

The process of organizing feedback sessions has started with the involvement of dissemination partners through the P4D committees in the validation process. Initial feedback has been received through virtual validation. Feedback was also received during the EA pre-testing of the manual in Ghana and it will be the same in other countries. The feedback received has already been integrated into the validated manual and farmers' handbook. This is a continuous process with the engagement of the dissemination partners through their extension and farmer networks.

Challenges and proposed changes in milestone timelines: Due to the COVID-19 pandemic, there were delays in the formal validation and pre-testing of the manual and farmers' handbook due to restriction on movement and face-to-face meetings. However, with easing of restrictions in Ghana and *Côte d'Ivoire*, this challenge was overcome.

Although there has been an easing of restrictions in *Côte d'Ivoire* and Nigeria, the political unrests and the #Endsars protests delayed the activities of the validation process.

Workplan for 2021

Activity 2.2.2. Production of extension tools

- Milestone 2.2.2.3. Multiply the extension tools produced by Q1, 2021

Activity 2.2.3. Facilitation of feedback sessions with dissemination partners on the extension tools

- Milestone 2.2.3.2. Analyze feedback received across the countries and integrate this into the extension tools by Q4, 2021

2.5.3 Output 2.3: Appropriate training-of-trainer manuals developed for use in the training sessions for EAs

As target for this Output in 2020, the project will develop and make available a Version 2 of adapted extension tools, identify appropriate digital platforms, sign contracts, and integrate revised ISFM-related information. At least 6 sessions of ToT will be organized, at least 100 EAs will be trained (gender disaggregated), and at least 10 000 cocoa farmers will be trained on new recommendations and the child labor concept. Achievement of the following milestones is expected at the time of reporting (Table 20). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 20: Status of milestones for Output 2.3

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
P4D (Partnerships-for-Delivery)-related																				
Output 2.3. Appropriate training-of-trainers manuals for use in the training sessions for extension																				
Activity 2.3.1. Identification of EA for engaging in training-of-trainers' activities																				
Milestone 2.3.1.1. Functioning of participating dissemination networks mapped					X	X	X													
Milestone 2.3.1.2. EA identified					X	X	X	X	X	X										
Milestone 2.3.1.3. Training needs assessed					X	X	X	X	X											
Activity 2.3.2. Implementation of training-of-trainers' sessions																				

Activities and milestones	2018				2019				2020				2021				2022			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Milestone 2.3.2.1. Training schedule organized					X	X	X	X	X	X										
Milestone 2.3.2.2. Training sessions held																				
Activity 2.3.3. Collection of feedback on the effectiveness of the training-of-trainers sessions and eventual modification of the approach																				
Milestone 2.3.3.1. Collection of feedback on the effectiveness of the training																				
Milestone 2.3.3.2. Continuous improvement of the training modules and processes																				

Progress on milestones: A list of 619 EAs has been submitted by the partners for the dissemination activities. The assessment of the training needs by EAs has been conducted in Ghana, *Côte d'Ivoire,* Cameroon, and Nigeria focusing on their knowledge, attitude, behavior, and practice.

Table 21: List of partners and EA submitted

Country	Partners	Number of EAs
Cameroon	Olam	62
Côte d'Ivoire	Olam	202
	Mondelez / Cargill	120
Ghana	Cargill	27
	Kuapa Kooko	62
	Mondelez	31
	Olam	5
Nigeria	Olam	77
	Olatunde International	18
	Sucden	15
TOTAL		619

A cumulative number of 153 EAs have been trained on the basis of the revised and validated training manual in all four countries. See here for Training Reports and Manuals used. See Table 22 for a breakdown of numbers.

Table 22: Number of EAs trained

Country	Partner	Number
Cameroon	Olam	25

Country	Partner	Number
Côte d'Ivoire	Olam	30
Ghana	Rockwinds	5
	Cargill	5
	Kuapa Kooko	5
	COCOBOD-CHED	5
	Mondelez	5
	Olam	4
Nigeria	Olam	67

The feedback system has been developed under the MEL component and is being implemented during P4D training sessions. This includes participant evaluation on content, methodology, master trainers' skills, logistics, and knowledge gained.

To broaden the project's scope for dissemination, discussions are being held with Viamo, through the Grameen Foundation. This contractor will work in Ghana, Cameroon, and Nigeria. The Grameen Foundation participated in the P4D platform workshop for the physical validation of the Training Manual. This enabled them to contribute to the logical flow of the content to aid in the dissemination process.

Viamo will develop tools and information packages based on the content of the manual and disseminate these through Interactive Voice Response (IVR) and short messaging services (SMS) in Cameroon, Ghana, and Nigeria for about 24 000 farmers. In *Côte d'Ivoire*, an agreement has been signed with Radio Gagnoa with an objective of reaching 10 000 farmers and discussions are ongoing with ANADER for the use of their e-extension platform. Currently, a strategy for full integration of the use of digital platforms for dissemination under the project is being developed.

Challenges and proposed changes in milestone timelines: Due to restrictions on travel and movement imposed on countries as a result of the COVID-19 pandemic, most physical training sessions were delayed. To counter the delays in training of trainers, more trainings were done in small numbers to respond to the C-Protocols. This helped to catch up on the numbers. However, organizations with competences in digital dissemination platforms have been engaged to help in reaching the number of targeted farmers.

The initial training schedule for the EAs training did not work fully due to the delay in the process of manual development and the in-country validation through the P4D Committee, as a direct effect of COVID-19. The training of the EAs will continue as per agreed timelines with partners by October 2020, based on country-specific COVID-19 regulations. However, the dissemination activities with farmers will happen through the digital dissemination platforms in conjunction with the traditional farmer trainings by the partners.

Workplan for 2021

Activity 2.3.2. Implementation of ToT sessions

- Milestone 2.3.2.2. Hold training sessions with 150 scaling partner EAs in *Côte d'Ivoire* and Nigeria by Q4, 2021

Activity 2.3.3. Collection of feedback on the effectiveness of the ToT sessions and eventual modification of the approach

- Milestone 2.3.3.1. Collect and document feedback on the effectiveness of the trainings held by Q4, 2021
- Milestone 2.3.3.2. Improve the training modules and processes based on the feedback collected by Q4, 2021

2.5.4 Output 2.4: Engagement in policy action in support of sustainable cocoa intensification ensuring avoidance of deforestation and child labor in applying new recommendations

As the target for this Output in 2020, the project will not develop any policy brief, but undertake at least two extra interactions with policymakers in at least two countries, and engage at least ten public and private sector partners in testing and validating the draft tools and knowledge. Achievement of the following milestones is expected at the time of reporting (Table 23). The table below and the subsequent information provide details on the progress of the milestones for 2020. Refer to **APPENDIX 1 – Status of Project Results with Mitigation plans** for current status of the targets.

Columns with an 'X' indicate new timelines for the milestone. Columns in grey indicate the original timeline for the milestone according to the implementation plan in the proposal.

Table 23: Status of milestones for output 2.4

Activities and milestones	2018				2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
P4D (Partnerships-for-Delivery)-related																				
Output 2.4. Engagement in policy action in support of the sustainable intensification of cocoa																				
Activity 2.4.1. Identification of relevant and specific policy briefs																				
Milestone 2.4.1.1. Cocoa-related policy environment documented for target countries						X	X	X	X	X	X	X	X	X						
Milestone 2.4.1.2. Policy briefs formulated									X	X	X	X	X	X	X	X	X	X	X	X
Activity 2.4.2. Engagement with relevant policymakers																				
Milestone 2.4.2.1. Relevant policy-related processes identified and activated					X	X	X	X	X	X	X	X	X	X	X	X				
Milestone 2.4.2.2. Interactions with policymakers held in relation to products developed under Outputs 1.3, 1.4, and 1.5																				

Progress on milestones: Through the establishment of the Partnership Committees in Cameroon and Nigeria, IDH helped to facilitate the engagement in policy action for the CocoaSoils program. Unfortunately, the COVID-19 pandemic stopped IDH from facilitating physical Partnership Committee meetings in the first half-year of 2020. However, the validation process of newly developed training materials continued by

communication via e-mail and telephone with the Partnership Committee members and a formal physical validation was done in Ghana, *Côte d'Ivoire,* and Cameroon in Q3 and Q4, 2020, as the measures around physical meetings were partially lifted in the various countries.

A consultation meeting was organized in Divo *Côte d'Ivoire* with public sector partners, CNRA, FIRCA, CCC, and private sector partners. The objective of the meeting was to clarify the roles and commitments of all stakeholders involved in the project in *Côte d'Ivoire*.

In Ghana, a consultation meeting was held with the FC on how the work of CocoaSoils on avoiding deforestation will fit in the overall framework of the Ghana emission reduction project and the REDD+ project. The directorate of the climate change division of the commission has agreed in principle to partner with CocoaSoils in its first policy dialogue meeting in November 2020. CRIG has also affirmed its support for the policy dialogue meeting.

Challenges and proposed changes in milestone timelines: During the lockdown, most convening activities were put on hold as strict measures about movement were imposed by the authorities. This has delayed the process in organizing physical Partnership Committee meetings, which will lead to policy dialogue in Cameroon and Nigeria. Additionally, this has delayed the identification and activation of policy processes in the countries. However, some meetings were held in Ghana and *Côte d'Ivoire* on plans for policy dialogue in 2021, while plans are underway for Nigeria and Cameroon to plan with the P4D committees to arrange meetings with policymakers in 2021. Meanwhile, work is underway to document existing policies on cocoa deforestation in the four countries and will be completed by Q1, 2021.

Based on the results framework, policy briefs will be formulated on a yearly basis, starting from 2020 to 2022. This has therefore resulted in the extension of the timelines in the results framework.

Workplan for 2021

Activity 2.4.1. Identification of relevant and specific policy briefs

- Milestone 2.4.1.1. Document Cocoa-related policy environment for the target countries by Q1, 2021
- Milestone 2.4.1.2. Formulate policy briefs for further discussions with policymakers by Q4, 2022

Activity 2.4.2. Engagement with relevant policymakers

- Milestone 2.4.2.1. Identify and activate relevant policy-related processes for further dialogue by Q4, 2021
- Milestone 2.4.2.2. Hold interactions with policymakers in relation to products developed under Outputs 1.3, 1.4, and 1.5 (sustainability and impact domains) by Q4, 2022

APPENDIX 1 – Status of Project Results with Mitigation plans

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
Project impact				
Impact 1. Smallholder cocoa farmers benefit from sustainably increased cocoa productivity and income generated through cocoa production	→ No change in cocoa yield → No change in income generated through cocoa production → No households achieve the yield and income increases → No visible increases in deforestation compared to control sites → No evidence for child labor obtained → No change in carbon stock, water, and biodiversity indexes in cocoa zones of *Côte d'Ivoire* and Ghana	Baseline figures for yield, income, and labor types have been established for Cameroon, *Côte d'Ivoire*, Ghana, and Nigeria. See presentation for details. An online system accessible to all project partners has been set up to monitor deforestation near the STs in Ghana. This activity will be replicated in the other four countries now that all ST sites have been defined.	Due to the COVID-19 pandemic, there were delays in the development of the farmer and EA manuals. This further delayed most physical training sessions for both the EAs and farmers.	Virtual validation meetings were organized to finalize the manuals. Digital dissemination partners have been engaged to help reach the targeted number of farmers.
Project outcomes				
Outcome 1 New cocoa ISFM -related research products are used by private and public stakeholder partners	→ At least two research products (validated and used by private and/or public stakeholders → At least 100 EAs are using the new research products	Official country-level cocoa manuals from the four countries and specific dissemination partners' manuals have been developed and formally validated by the P4D committees in Ghana and *Côte d'Ivoire*. A pretesting of the manuals by the EAs is being undertaken.	The project experienced delays in formally validating the developed manuals. This was due to travel restrictions and social distancing protocols as a direct response to the COVID-19 pandemic.	The use of the products by EAs will start in Q4, 2020 during farmer trainings across the countries.
Outcome 2. Recommendations generated through research products are	→ No households are using the new recommendations /new knowledge →No new recommendation is being used	Integration of manual content to digital platforms to reach 25 000 by Q2, 2021. Farmers reached through partner traditional dissemination networks to begin Q4, 2020.		

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
used by target households	→ At least four existing (old) recommendations are being used			
Outcome 3. Decision-makers (public and private) are using tools and knowledge to avoid increased deforestation and child labor while promoting cocoa intensification	→ No information available on land-use patterns and ecosystem services using new tools →No policy document of the target countries has integrated new tools → No public or private sector organization is using new tools and knowledge to promote deforestation-free supply chains → All public and private sector organizations engaged in CocoaSoils initiative are enforcing the HE and ILO protocols on child labor-free production to promote new recommendations/ knowledge	-	-	-
Project results				
Project Outputs				
Output 1.1. A set of integrated soil fertility management options	→ No ISFM recommendations generated	All the eight CTs are being managed, based on agreed protocols Weather stations and irrigation systems have been installed in all CTs Cocoa planting has been completed in all CT sites	The CT in Bokito - Cameroon managed by IITA was relocated due to poor soil quality detected after detailed soil analysis.	The issue was discussed in the annual meeting in Cameroon, and a 4-ha piece of land has been selected at Mbalmayo in the Central Region of Cameroon. The site has been delineated, and

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
		A protocol for early cocoa tree evaluation was developed for evaluation in the first two years after planting Two additional protocols have been developed for maize subplot evaluation and plantain evaluation Fertilizer requirements were developed for CT sites in Nigeria (IITA and CRIN) and Ghana (GRIG) based on maize data and soil analyses information Irrigation systems have also been installed in all CTs sites, except for Mbalmayo and Nkoemvone A total of 292 STs (ST) have been installed in accordance with the approved protocols and are being managed by 117 technicians across the four countries In Nigeria, 64 sites have been selected and the team is currently in the field for site validation, delineation, and initial site characterization To ensure data quality before and after data collection, documents for a workflow, and roles and responsibilities were developed.	Due to the COVID-19 pandemic, the implementation of the STs faced delays The delay of the instalment of the STs due to the COVID-19 pandemic, affected the financial commitments of partners, which led to budgetary adjustments and subsequent approval from NORAD. The installation of the ST was extended to Q4 2020 due to the admission of new partners in Nigeria (Tulip and Sucden) and the rescheduling of activities by Cargill and Mondelez in *Côte d'Ivoire.*	field activities have been carried out since the end of July 2020. Activities began as soon as travel and movement restrictions were eased in the various countries.
<u>Output 1.2.</u> Understanding the physiological basis of cocoa nutrient uptake and use	→ No papers on cocoa physiology accepted	A protocol to study the interactions between water, light, nutrient status, and growth efficiency has been developed. Data on litter and pod production are currently being collected and initial results suggest positive effects of Phosphorus (P) and Potassium (K), but detrimental effects of Nitrogen (N) on cocoa production in this area.	In identifying factors that determine high yield/quality in a range of genotypes/environments, the main challenge was the delay in starting the development of the model and in running Python version of CASE2 and simulation of water-limited yields for yield	To achieve the set objectives despite delays, the model RCASE2 developed by Dr Alejandro Morales Sierra of Wageningen University was used. The implementation of protocols and data collection are ongoing and will continue till the

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
		The protocols developed to test cocoa physiology and nutrient uptake and to study the relationship between potassium and drought stress in cocoa have been implemented on two chosen sites in *Côte d'Ivoire.* Fertilizer trials (treatments with and without potassium) have been established. Physiological, morphological, phenological, and climatic data, visual assessment, soil structure, and moisture data are being collected on a weekly and monthly basis to account for seasonal variation. Analysis of cocoa trees phenology as an early alert drought indicator was done on the group of different genotypes distributed within the plot over the months. Analysis of yield data from 3834 cocoa farms covering the range of environmental conditions in Ghana together with climate and soil information has been completed. Although analysis of yield data has been completed, the results are yet to be integrated into other activities, including model development and climate change effects on cocoa yields.	gap analysis and extension to include CO2 effects. There was a delay in the establishment of the trials in relation to the interactions between water, light, nutrient status, and growth efficiency. Activities such as data collection, maintenance of field materials, and delivery of consumables for field activities were also delayed due to restrictions resulting from the pandemic.	fieldwork of the PhD students is completed by the by Q1, 2022.
Output 1.3. A decision-support system for intensifying cocoa production	→ Draft 1 of segmentation and stepwise investment tools validated in *Côte d'Ivoire* and Ghana	Changes have been made to the prototype of a decision-support application. A decision has been made to revise the analytics on which the tool is based (i.e., combining both structural and functional farmers' characteristics and tactical agronomic decision-making with the	The delay in the development and population of the decision-support framework was due to the need to improve the robustness, applicability, and	The analysis has been undertaken in close cooperation with software engineers, including content from CCAFS cocoa research work in Ghana, to improve the initial prototype,

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
		use of the additional data from the project baseline). A draft concept of the cocoa intensification handbook has been produced and circulated among the core team for review and inputs. A first draft of the intensification manual is expected in Q1 of 2021.	scalability of the analytics on which the app is built.	which will be ready when the baseline data is available.
Output 1.4. Recommendation domains and impact of sustainable intensification on forest pressure identified	→ Climate change impacts maps on cocoa include scenarios of improved practices of sustainable intensification	Knowledge products consisting of maps and spatial planning steps to help understand risks and plan for opportunities arising from the interaction between cocoa production, its intensification, climate change, forests, biodiversity, and ecosystem services have been developed at the national scale. The first results from analysis of datasets have provided valuable information regarding the type of decisions that can be informed on broader spatial domains. A total of 4003 data points of cocoa yield records representing 3471 farms distributed along all relevant agroecological zones of the cocoa growing areas of Ghana have been collected. An online geographic information system has been set up to track potential deforestation activities. The on-line map will be expanded to the other CocoaSoils countries now that all ST plantations have been defined.	The delay in selecting the STs has also delayed the setup of the experiments on these plots. There was a delay in the translation of the Wageningen cocoa crop model (CASE2) from Fortran to Python, which has directly delayed work under activity 1.4.3.	Indicators have been identified based on the analyses done in collaboration with the student working on "Climate change: Effects of Cocoa Production and potential Consequences for forest" and her supervisors through synthesis from published literature. Currently, this analysis has been limited to Ghana. Once measurements are available from STs in Cameroon, *Côte d'Ivoire,* and Nigeria, these can be scaled to the different spatial domains. As an alternative option, the CASE2 Fortran version was connected to R statistics and is being adapted for successful use

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
		Land-use classification has been done, focusing on cocoa in a case study area in Ghana to identify drivers of deforestation.		
Output 1.5. Sustainability assessment tools developed and validated to support the sustainable development of cocoa production in relation to biodiversity and ecosystem services at the landscape level	→ Draft 1 of sustainability assessment tools validated at site level	Maps have been developed and guidance has been given in the form of spatial planning steps, and a toolkit of existing tools to support such assessments will be developed. Potential implications for biodiversity and ecosystem services of shifts in cocoa suitability areas due to climate change have been assessed, based on the climate change impact gradients for cocoa. Areas most at risk from cocoa production in terms of biodiversity loss have been identified and implications of future deforestation scenarios for ecosystem services have been mapped. Analysis on exploring the potential for cocoa agroforestry to contribute to *Côte d'Ivoire's* target of restoring forest cover to 20% of land area by 2030 whilst supporting increased cocoa production and to mitigate impacts on biodiversity and ecosystem services has started. All guidance materials aimed at balancing trade-offs and synergies with forests, biodiversity, and ecosystems in planning for sustainable cocoa production for the future have been developed.	Due to the global health crises, the potential of sharing the work of CocoaSoils in relevant fora and engaging with stakeholders was limited in 2020.	Links to support synergies made in 2019 were followed-up.

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
Output 1.6. Operational open knowledge and data sharing portal for the storage, management, and dissemination of cocoa intensification research results	→ Final version of a portal available → At least 25% of all datasets submitted	The ODK server has been developed and is the only app currently used for data capture in the project. A revised cocoa ontology for proper data collection management and storage and an ontology report have been developed and shared with all stakeholders. The ontology report was presented during the webinar organized in October 2020. A database structure and a content management system coupled with an ODK server have been implemented. Data collection forms in ODK for all ST and CT data have been developed and are available in French and English. An interactive ODK Data Collection manual for all CT forms has been developed. A universal OneDrive has also been created to facilitate data exchange among partners and stakeholders.	Physical trainings were not possible. Hence, virtual training materials on ODK data acquisition were developed.	Seven virtual interactive trainings were held for participants in Ghana, Nigeria, *Côte d'Ivoire.* and Cameroon. Further trainings are planned for Q1, 2021.
Output 1.7. A new cadre of PhD and MSc-holding cocoa scientists with knowledge on new cocoa intensification options	→ At least two MSc theses approved	All PhD students are currently working on their thesis chapters, fieldwork, and manuscripts. Three MSc students have been recruited in Nigeria, two in Cameroon, four in Ghana, and one in *Côte d'Ivoire.*	Some delays in fieldwork and data collection have been delayed since some travel restrictions were enforced in some countries due to COVID-19. Two MSc students are yet to be recruited in Cameroon and *Côte d'Ivoire*. The third MSc student is yet to begin his thesis.	Discussions are ongoing to find either another candidate or change the thesis topic for the MSc student in Nigeria.

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
Output 2.1. Agreements with private and/or governmental scaling partners developed and signed to disseminate new recommendations/knowledge through their existing structures/frameworks (HE Protocol or ILO Protocol)	→ At least six agreements with scaling partners developed and signed → At least one agreement with digital partners developed and signed	Olatunde International and Sucden signed the Participation Statement which was developed for new partners for STs and scaling. Eight partners have signed the (dissemination agreements) workplans of activities, which is part of formalizing the scaling agreement. The project is exploring the use of digital dissemination platform to help in scaling activities. In Q4, 2020, two service providers, VIAMO and ANADER, were contracted to undertake digital dissemination in Ghana, Nigeria, Cameroon, and *Côte d'Ivoire*. New scaling partners identified/mapped were required to sign a Participation Statement.	There has been a challenge in getting Sucden to sign the scaling agreement due to their policy on data sharing.	Discussions are still ongoing and waiting for a response from their legal team.
Output 2.2. Appropriate extension tools assembled and revised for integration in partner-led scaling of new recommendations/tools	→ Version one of adapted extension tools available, with inclusion of new information → Draft of adapted digital platforms available, based on secondary ISFM-related information	The draft extension manual and farmers' handbook have been validated virtually in all four countries by the members of the P4D committees. Both documents have been translated into French. A formal validation with the P4D committee was done in Ghana, *Côte d'Ivoire,* and Cameroon. A pre-testing of the Manual by the partners' EA was done in Ghana after the formal validation. Initial feedback has been received through the virtual validation and has already been integrated into the validated manual and farmers' handbook.	Due to the COVID-19 pandemic, there were delays in the formal validation and pre-testing of the manual and farmers' handbook due to restriction on movement and face-to-face meetings In Cameroon and Nigeria, although there has been an easing of restrictions, the current political unrests and the #Endsars protests impeded the activities of the validation.	This challenge was overcome with the easing of restrictions in Ghana and *Côte d'Ivoire*.

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
		A total of 153 EAs have been trained in all four countries		
Output 2.3. Appropriate ToT manuals developed for use in the training sessions for EAs	→ Version two of adapted extension tools available →Appropriate digital platforms identified, contract signed and ISFM revised information integrated → At least six ToT sessions organized →At least 100 EAs trained (gender disaggregated) →At least 10 000 cocoa farmers trained on new recommendations and child labor concept	A list of 619 EAs have been submitted by the partners for the dissemination activities. The assessment of the training needs by EAs has been conducted in Ghana, *Côte d'Ivoire*, Cameroon, and Nigeria focusing on their knowledge, attitude, behavior, and practice. A cumulative number of 153 EAs have been trained in all four countries. The feedback system has been developed under the MEL component and is being implemented during P4D training sessions. To broaden the project's scope for dissemination, discussions are being held with Viamo through the Grameen Foundation. This contractor will work in Ghana, Cameroon, and Nigeria, and will develop tools and information packages based on the content of the manual and disseminate these through Interactive Voice Response and short messaging services in Cameroon, Ghana, and Nigeria for t 24,000 farmers. In *Côte d'Ivoire*, an agreement has been signed with Radio Gagnoa (with the objective of reaching 10, 000 farmers) and discussions are ongoing with ANADER for the use of their e-extension platform.	Due to restrictions on travel and movement imposed on countries as a result of the COVID-19 pandemic, most physical training sessions were delayed. The initial training schedule for the EAs training did not work fully due to the delay in the manual development process as a direct effect of COVID-19.	Organizations with competences in digital dissemination platforms have been engaged to help in reaching the number of targeted farmers. The training of the EAs continued as per agreed timelines with partners in Q4, 2020 based on country specific COVID-19 regulations.
Output 2.4. Engagement in policy action in support of	→ No policy briefs → At least two extra interactions with	A consultation meeting was organized in Divo *Côte d'Ivoire* with public sector partners, CNRA, FIRCA, CCC, and private sector partners	During the lockdown, most convening activities were put on hold as strict movement measures were imposed by the	Some meetings were held in Ghana and *Côte d'Ivoire* on plans for policy dialogue in 2021.

Project results	2020 Targets	Status as of December	Delays experienced and reasons why	Mitigation plans to recover delays
sustainable cocoa intensification ensuring avoidance of deforestation and child labor in applying new recommendations	policymakers in at least two countries →At least 10 public and private sector partners involved in testing / validating the draft tools and knowledge	In Ghana, a consultation meeting was held with the FC of Ghana on how CocoaSoils work on avoiding deforestation will fit in the overall framework of the Ghana emission reduction project and the REDD+ project.	authorities. This has delayed the process in organizing physical Partnership Committee meetings, which will lead to policy dialogue in Cameroon and Nigeria. Additionally, this has delayed the identification and activation of policy processes in the countries.	Plans are underway for Nigeria and Cameroon to plan with the P4D committees to arrange meetings with policymakers in 2021. Work is underway to document existing policies on cocoa deforestation in the four countries and will be completed by Q1, 2021. Based on the results framework, policy briefs will be formulated on a yearly basis, starting from 2020 to 2022.

APPENDIX 2 - Contingency plan

Table 24: Implementation Plan with Mitigation measures for 2020

(All GREY cells are initial timelines per 2019 progress report. All RED cells are revised timelines due to effect of COVID-19; all empty cells are either completed or no milestones to be achieved in 2020. Fully completed activities are in GREY fonts)

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Project Coordination												**655324**	**652,667**	**2,657**	
Project coordination team established											IITA/WUR	**296,940**	**316,234**	**(19,294)**	Additional staff time of $43, 000 in Cameroon and Nigeria to support ST implementation. There were savings from staff salary cuts of 4 months which amounted to $ 23, 707which was used to offset some of the additional staff time costs. 21,951 from MEL after $40,000 to MTR review absorbed excess staff costs of (19,294) to leave a balance of 2,657 as differential for project coordination. The cuts in staff salary were based

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															on IITA's internal organization's decision to enable IITA to continue its internal operations during the COVID period. This resulting amount is therefore available to the projects for other use.
Activity: Recruitment of project staff												296,940	306,234	(19,294)	
Milestone: Interviews based on specific terms of reference organized for a new Postdoc (Technicians to be recruited for STs)									Medium	All four countries have recruited technicians responsible for the ST implementation. Ghana – 1 Cameroon – 2 *Côte d'Ivoire* – 2 Nigeria – 3					
Milestone: Negotiations and signing of contracts completed															
Activity: Procurement of capital equipment												0	0	0	
Milestone: List of required capital items assembled										Completed					
Milestone: Capital items procured and delivered (laptops)										Completed					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Project management and administration functional												**156,636**	**196,636**	**(40,000)**	This has been revised to include midterm review of $40, 000 which was initially not budgeted in 2020. Conduct of the MTR was confirmed to be in 2020 during the January 2020 project annual planning meeting when the 2020 budget had been submitted and approved by NORAD in November 2019.
Activity: Agreement on reporting framework											IITA	48,136	62,136	(14,000)	This includes fixed costs for rent, supplies, etc., and part of the MTR cost. The excess cost comes from the mid-term (MT)review (14,000 + 26,000 = 40,000)
Milestone: A reporting framework established										Completed					
Milestone: Timely reports by the application and its partners submitted										2019 report has been revised with feedback from NORAD and resubmitted.					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Activity: Agreement on a meeting and communication strategy												108,500	134,500	(26,000)	~~Preparation towards forum 2020, travel for remaining of 2020~~ The increase is due to the MT review as explained above.
Milestone: Annual planning and evaluation meetings organized										Completed	IITA/WUR/IDH				
Milestone: Effective communication using various tools facilitated											IITA				
Milestone: A 3-monthly newsletter produced											IITA				
Convening mechanisms in place												**62,500**	**62,500**	**0**	
Activity: Organization *of regular meetings with the industry*												62,500	62,500	0	
Milestone: Meeting schedules agreed upon										Completed					
Milestone: Regular meetings with industry partners facilitated											IITA				
Appropriate MEL tools and processes												**139,248**	**77,297**	**61,951**	The saving is from staff salary cuts of 4-months based on ~~projections till December 2020~~, IITA organization, a

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															A panel survey will take place in 2021 due to delayed dissemination activities and routine data collection on dissemination activities. The total savings include salary cuts, trainings 'and MEL platform implementation postponed to 2021.
Activity : Development of a participatory ME&L framework												0	0	0	
Milestone: Key outcome and impact indicators identified										Completed					
Milestone: ME&L tools and processes agreed upon										Completed					
Activity: Facilitation of the use of the ME&L framework by all project partners												139,248	77,297	61,951	This includes fixed costs for rent, supplies, etc., salary cuts, and Mel activities that have been postponed as explained above.
Milestone: Users of the ME&L framework trained									High	This training has started with the pre-test of the manual with EA. Framework has been developed and will be an	IITA				
Milestone: ME&L framework continuously updated											IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differenti al	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone: Learning from the ME&L framework fed back into other activities										integral part of all extension and partner trainings. Discussions are ongoing to integrate required information in the digital platforms based on the framework.	IITA				
Activity: Implementation of baseline and end-lines studies												0	0	0	
Milestone: Baseline study documented for the 4 target countries										Completed (All data available and used for potential satellite site selection and protocol design), also shared with partners who requested them. A draft report including all the four countries has been presented to partners and their feedback will be integrated in the final report for submitted to NORAD by first week in October. Baseline of partner EA has been conducted during the pre-test of the extension manual.					
Milestone: End-line study documented for the 4 target countries															
R4D (Research-for-Development)-related												**1,631,191**	**1,488,226**	**142, 965**	Total savings under R4D= 241,470 Total required= (98,505) Remaining 142, 965.

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															The R4D level total Savings of $142,965 comprise the following: Output 1.1 = $20,423; Output 1.5= =$40,000; Outputs 1.6 =$65,442; Output 1.7= $17,100.
Output 1.1. A set of integrated soil fertility management options												**769,742**	**749,319**	**20,423**	This saving was made from data collection and prototype ISFM decision tool based on fund projections for data collection till end of 2020 and the prototype decisions-support tool. The funds under output 1.3 will be sufficient to support the decision-support tool. The savings are being used to support P4D as indicated under P4D related section.

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Activity 1.1.1. Agreement on the design of the Core and STs												126,561	126,561	0	Includes fixed costs (personnel, rent, etc).
Milestone 1.1.1.1. Literature on cocoa agronomy										Completed					
Milestone 1.1.1.2. The design of the Core and STs finalized										Completed	IITA				
Activity 1.1.2. Implementation of the Core and STs												232,561	331,065	(98,505)	), This is additional funding required to support under-budgeted ST activities and a new implementation of reward system for data collection under ST. Below is how the reward system is being implemented. The reward system is a point-based reward system to motivate Technicians for quality data. Technicians are awarded points, based on the difficulty of data collection related to

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differenti al	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															an activity and the frequency of the activity. Each point cost is one dollar. A technician is paid the reward after data submitted have been verified and cleared as meeting the required data protocol. →Data collection for the ST is ongoing currently and this amount is being used for the reward system.
Milestone 1.1.2.1. Sites selected, pending contributions from the industry									High	411 Satellite sites (plantations) have been selected and validated in Cameroon (64), *Côte d'Ivoire* (152) and Ghana (131). In Nigeria, 64 sites have been selected and the team is currently in the field for site validation, delineation, and initial site characterization.	IITA				
Milestone 1.1.2.2. Trials installed following the approved protocols										A total of 115 partner technicians in Cameroon (16), *Côte d'Ivoire* (42), Ghana (47), and Nigeria (10) have been	IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differenti al	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										trained and are leading installation of the trials. A total of 292 trials have been installed in accordance with the approved protocols. **Cameroon**: Plot delineation, initial site characterization, and fertilizer application has been completed for the **64** validated plantations. Data for 48 sites have been uploaded for plot delineation/site characterization and to 60 for fertilizer application. The second round of all the management practices has been done and data have been uploaded. ***Côte d'Ivoire***: 64 sites (plantation) validated, **54** sites delineated and fertilized out of the 64 Olam plantations 88 validated sites for Cargill (48) and Mondelez (40) will be delineated in 2020 and subsequent activities implemented in 2021(as agreed with the organizations). Data uploading is ongoing. **Ghana**: A total of **131** plantations have been					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differenti al	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										validated, delineated, characterized, and fertilized. Data uploading has been done for 129 sites. The first round of activities has been completed. A refresher training of the technicians has been conducted to help the technicians to use the tools and mobile devices for data collection effectively. **Nigeria**: **43** farms out of 64 plantations have been delineated and fertilizer applied to them. An additional 21 plantations from Sucden and Tulip are earmarked for delineation and fertilizer application. The agreement with Sucden is yet to be signed. Data uploading is ongoing.					
Milestone 1.1.2.3. Trials managed following agreed practices											IITA				
Activity 1.1.3. Data collection and analysis on the trial data												284,061	231,000	53,061	Includes fixed costs (personnel, rent, supplies, etc). Reasons for savings as indicated under output 1.1. This fund has been saved from data

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															collection and analysis of trial data due to the late installation of the trials as a result of COVID-19.
Milestone 1.1.3.1. Data collection protocols finalized										Completed	IITA				
Milestone 1.1.3.2. Trial data collected											IITA				
Milestone 1.1.3.3. Collected data analyzed											IITA				
Activity 1.1.4. Development of a set of site-specific ISFM recommendations												126,561	60,694	65,867	Reasons for savings as indicated under output 1.1
Milestone 1.1.4.1. A prototype ISFM decision-support tool developed											IITA				
Milestone 1.1.4.2. Version 1 of a ISFM decision-support tool developed															
Milestone 1.1.4.3. Version 2 of a ISFM decision-support tool developed															
Output 1.2. Understanding the physiological basis of cocoa nutrient uptake and use												**87,667**	**87,667**	**0**	
Activity 1.2.1. Identification of factors determining high yield/quality in a range of genotypes/environments												10,000	10,000	0	
Milestone 1.2.1.1. Protocols developed										Completed					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.2.1.2. Protocols implemented															
Milestone 1.2.1.3. Data analyzed and fed back into other activities											IITA				
Activity 1.2.2. Assessment of interactions between water, light, nutrient status, and growth efficiency												38,833	38,833	0	
Milestone 1.2.2.1. Protocols developed										Completed	ICRAF				
Milestone 1.2.2.2. Protocols implemented											ICRAF				
Milestone 1.2.2.3. Data analyzed and fed back into other activities											IITA				
Activity 1.2.3. Development of foliar norms for cocoa												24,417	24,417	0	
Milestone 1.2.3.1. Protocols developed										Completed					
Milestone 1.2.3.2. Protocols implemented											ICRAF				
Milestone 1.2.3.3. Data analyzed and fed back into other activities											IITA				
Activity 1.2.4. Assessment of interactions between potassium nutrition and drought stress												14,417	14,417	0	
Milestone 1.2.4.1. Protocols developed										Completed					
Milestone 1.2.4.2. Protocols implemented											ICRAF				
Milestone 1.2.4.3. Data analyzed and fed back into other activities															

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Output 1.3. A decision-support system for intensifying cocoa production												**271,994**	**271,994**	**0**	
Activity 1.3.1. Development of a decision-support framework for cocoa intensification												101,498	101,498	0	Includes fixed costs (personnel, rent etc)
Milestone 1.3.1.1. Prototype decision-support framework developed											IITA				
Milestone 1.3.1.2. Decision-support tool populated											IITA				
Milestone 1.3.1.3. Version 1 of a decision-support tool available											IITA				
Activity 1.3.2. Validation of the decision-support framework with target user groups												79,498	79,498	0	Includes fixed costs (personnel, rent etc)
Milestone 1.3.2.1. Feedback on version 1 assembled											IITA				
Milestone 1.3.2.2. Version 2 available and evaluated															
Milestone 1.3.2.3. Final version delivered for scaling															
Activity 1.3.3. Production and multiplication of a handbook on cocoa intensification												90,998	90,998	0	Includes fixed costs (personnel, rent etc)
Milestone 1.3.3.1. Draft concept available											IITA				
Milestone 1.3.3.2. First draft available and validated											IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.3.3.3. Handbook multiplied and available to the cocoa community															
Output 1.4. Identification of recommendation domains and impact of sustainable intensification on forest pressure												**89,800**	**89,800**	0	
Activity 1.4.1. Identification of representative trial sites under current and future climates												0	0	0	
Milestone 1.4.1.1. Historical climate data compiled										Completed					
Milestone 1.4.1.2. Future climates for the target regions down-scaled										Completed					
Milestone 1.4.1.3. Agro-ecological zones for site selection assessed										Completed					
Activity 1.4.2. Scale indicators and recommendations of trials to spatial domains												38,484	38,484	0	
Milestone 1.4.2.1. Spatial proxies of key CSA packages and indicators identified											CIAT				
Milestone 1.4.2.2. Scaling spatial domains mapped											CIAT				
Milestone 1.4.2.3. Suitability of domains discussed/validated with stakeholders											CIAT				
Activity 1.4.3. Ex-ante assessment cocoa intensification packages and interventions on cocoa suitability												38,487	38,487	0	
Milestone 1.4.3.1. Adaptation potential of CSA packages quantified											CIAT				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differenti al	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.4.3.2. Cocoa suitability models based on 3.1 re-ran											CIAT				
Milestone 1.4.3.3. Intensification potential for each intervention spatially quantified											CIAT				
Activity 1.4.4. Quantification of the impact of intensification scenarios on forest protection/deforestation												12,829	12,829	0	
Milestone 1.4.4.1. Historical deforestation baseline built using Terra-i											CIAT				
Milestone 1.4.4.2. Cocoa intensification with deforestation scenarios combined															
Milestone 1.4.4.3. Impact of different intensification scenarios on forest protection/deforestation assessed															
Output 1.5. Sustainability assessment tools												**94,300**	**54,300**	**40,000**	These savings are from activities such as trainings and workshops (including travels) which have been postponed to 2021.
Activity 1.5.1. Assessment of climate smart cocoa scenarios and impacts on biodiversity and ecosystem services												22,050	21,300	750	

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.5.1.1. Baseline of natural capital and ecosystem functions produced										Completed					
Milestone 1.5.1.2. Implications for biodiversity and ecosystem services of potential shifts in cocoa suitability areas mapped															
Milestone 1.5.1.3. Potential impacts on biodiversity and ecosystem services of intensification scenarios assessed											WCMC				
Activity 1.5.2. Assessment of landscape vulnerability and potential co-benefits of climate smart cocoa												17,100	18,000	(900)	
Milestone 1.5.2.1. Areas of vulnerability for natural capital and ecosystem services under shifting suitability ranges identified															
Milestone 1.5.2.2. Area where climate-smart cocoa may help mitigate such impacts identified and mapped											WCMC				
Milestone 1.5.2.3. Guidance materials produced											WCMC				
Activity 1.5.3. Review of potential synergies among industry and national commitments regarding forests supported by sustainable cocoa intensification												7,050	3,000	4,050	

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.5.3.1. Synergies and trade-offs among industry and national commitments supported by intensification scenarios reviewed															
Activity 1.5.4. Validation of results and stakeholder engagement												48,100	12,000	36,100	
Milestone 1.5.4.1. Two multi stakeholder workshops organized											WCMC				
Milestone 1.5.4.2. Policy brief on workshop recommendations finalized											WCMC				
Output 1.6: Operational open knowledge and data sharing portal												**203,188**	**137,746**	**65,442**	Savings made by WUR but will be spread for additional activities 2021 and 2022
Activity 1.6.1 Development of data capture, structure, and publication mechanisms and user requirements analysis												81,274	15,832	65,442	
Milestone 1.6.1.1. Data structure for all functions in AgroSTAC implemented										Completed					
Milestone 1.6.1.2. Overall architecture and publication mechanism designed										Completed	WUR				
Milestone 1.6.1.3. Data Capture app developed										Completed					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.6.1.4. User requirements analysis completed										Completed	WUR				
Activity 1.6.2. Development of outward-facing parts of the knowledge and data-sharing portal												40,638	40,638	0	
Milestone 1.6.2.1. Public-facing portal and Data Visualization platform, prototype 1 developed											WUR				
Milestone 1.6.2.2. Public-facing portal and Data Visualization platform, beta release available															
Milestone 1.6.2.3. Public-facing portal and Data Visualization platform, final release available															
Activity 1.6.3. Development of consortium-dedicated parts of the knowledge and data-sharing portal												40,638	40,638	0	
Milestone 1.6.3.1. Scientific analysis facility and data publication facility, prototype 1 developed															
Milestone 1.6.3.2. Scientific analysis facility and data publication facility, beta release available											WUR				
Milestone 1.6.3.3. Scientific analysis facility and data															

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
publication facility, final release available															
Activity 1.6.4. Maintenance, user testing, and targeted improvements of knowledge and data-sharing portal												40,638	40,638	0	
Milestone 1.6.4.1. Data and knowledge sharing portal maintained															
Milestone 1.6.4.2. Testing and targeted improvements used											WUR				
Output 1.7. A new cadre of PhD and MSc-holding cocoa scientists												**114,500**	**97,400**	**17,100**	Savings made by WUR will be spread for additional activities in 2021 and 2022. IITA savings of $8,579 have been used to support P4D digital platforms.
Activity 1.7.1. Identification of PhD and MSc topics												0	0	0	
Milestone 1.7.1.1. Agreements with universities housing the students finalized										Completed					
Milestone 1.7.1.2. Research proposals approved										Completed					
Activity 1.7.2. Implementation of the PhD and MSc projects												114,500	97,400	17,100	
Milestone 1.7.2.1. Best candidates identified															

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 1.7.2.2. Regular discussions with the supervisory committees held											WUR/IITA				
Activity 1.7.3. Submission and approval of the PhD and MSc theses												0	0	0	
Milestone 1.7.3.1. Papers in relation to thesis chapters drafted and reviewed															
Milestone 1.7.3.2. Theses submitted															
Milestone 1.7.3.3. Theses defended															
P4D (Partnerships-for-Delivery)-related												**400,681**	**432,341**	**(31,660)**	This additional fund for P4D is based on the new dissemination strategy to involve digital partners and to support multiplication/production of the Manuals. Contributions from various outputs below: Project Coordination- $2,657, R4D - $20,423, from output 1.1 and $8, 579 from output 1.7

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Output 2.1. Agreements with private and/or governmental scaling partners												**165,480**	**105,480**	**60,000**	These savings are due to the inability to have the yearly meetings with scaling partners or to organize P4D committees' meetings due to COVID-19. Mostly done virtually reducing meetings; travel cost reduced.
Activity 2.1.1. Identification of relevant dissemination networks												21,330	21,330	0	
Milestone 2.1.1.1. Potential scaling partners/initiatives mapped															
Milestone 2.1.1.2. Preliminary agreements with scaling partners established															
Activity 2.1.2. Facilitation of agreements with partners having dissemination networks												144,151	84,151	60,000	Includes fixed costs (personnel, rent, etc). Savings from not traveling and meeting with scaling partners due to COVID-19.
Milestone 2.1.2.1. Agreements with scaling partners formalized										Completed (Participation agreement has been signed with scaling partners) and work plan agreements signed with					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										seven partners across the four countries. (i) Discussion with Grameen Foundation ongoing on finalization of concept note and Budget. (ii) Agreement with Gognoa Radio in *Côte d'Ivoire*, to be signed for six months broadcasting (Oct. 2020 to March 2021). Discussion started with Cocoa Link in *Côte d'Ivoire*.					
Milestone 2.1.2.2. Agreements updated (as relevant/needed)											IITA/IDH				
Output 2.2. Appropriate extension tools for integration in partner-led scaling												**73,059**	**85,107**	**(12,048)**	Revised to support the production of extension manuals based on expenditures so far
Activity 2.2.1. Assessment of cocoa producer's capacity needs												14,220	14,220	0	Includes fixed costs (personnel, rent, etc)
Milestone 2.2.1.1. Producer associations identified										Completed for all partners who participated in the baseline. However, this is a continuous process, new partners /producer groups have expressed interest in joining					

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										the partnership and such will be included.					
Milestone 2.2.1.2. Training needs assessed										Completed (through baseline, review of partner extension materials and partner-specific follow ups), also during the development of the P4D strategy.					
Activity 2.2.2. Production of extension tools												31,420	51,245	(19,825)	Includes fixed costs (personnel, rent, etc). Revised to support the production of extension manuals based on expenditures so far
Milestone 2.2.2.1. Draft version of the extension tools produced									High	The draft extension manual and farmers' handbook have been completed. The manual and handbook have been translated into French and shared with the P4D committees in Cameroon and *Côte d'Ivoire*.					
Milestone 2.2.2.2. Extension tools validated with cocoa producer associations (completed in 3 countries by end of 2019)									High	Both the manual and farmer handbook have been validated virtually in all four countries by the members of the P4D committees with technical inputs from the NARs partners. Formal validation at P4D committee done in Ghana. To be done in *Côte d'Ivoire* second	IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										half of September, Cameroon and Nigeria second week of October 2020. Pre-testing of the manual: done in Ghana, to be done in *Côte d'Ivoire* first week of October, in Cameroon and Nigeria third week of October 2020.					
Milestone 2.2.2.3. Extension tools multiplied										The pre-validated versions were multiplied for partners use alongside discussions of training schedules.	IITA				
Activity 2.2.3. Facilitation of feedback sessions with dissemination partners on the extension tools												27,420	19,643	7,777	Includes fixed costs (personnel, rent, etc)
Milestone 2.2.3.1. Feedback session schedule organized										This process has started with the involvement of dissemination partners through the P4D committees in the validation process. Initial feedback has been received through the virtual validation. Feedback also received during the EA pre-testing of the manual in Ghana and will be the same in other countries.	IITA				
Milestone 2.2.3.2. Feedback received and analyzed										Feedback received has already been integrated into the validated manual and this is a continuous process with the engagement of the dissemination partners through	IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
										the P4D committees. Initial pilot to test the manual with partners is scheduled for September 2020.					
Output 2.3. Appropriate training-of-trainers manuals for use in the training sessions for EA												**86,484**	**191,095**	**(104,611)**	This budget has been revised to engage digital platform partners to integrate the ISFM knowledge into their platforms and to disseminate this to larger farmers to reach the agreed target within the given period.
Activity 2.3.1. Identification of EA for engaging in training-of-trainer activities												28,133	28,133	0	Includes fixed costs (personnel, rent, etc)
Milestone 2.3.1.1. Functioning of participating dissemination networks mapped										Completed					
Milestone 2.3.1.2. EA identified										Completed	IITA				
Milestone 2.3.1.3. Training needs assessed										Completed (for baseline participating partners)	IITA				
Activity 2.3.2. Implementation of training-of-trainer sessions												30,220	134,831	(**104,611**)	Includes fixed costs (personnel, rent, etc).

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															The budget has been revised to include additional funds to engage digital platform partners to integrate the ISFM knowledge into their platforms and to disseminate to larger farmers to reach the agreed target within the given period. This will also include training of EA in such platforms.
Milestone 2.3.2.1. Training schedule organized									Medium	Initial training schedule did not work due to the delay in the manual development process through the effect of COVID-19. The trainings are dependent on the training schedules of our partners. Initial EA training schedules have been agreed upon with partners.					
Milestone 2.3.2.2. Training sessions held										Trainings will start based on the agreed timelines with partners by October 2020 based on country-specific COVID regulations. Timelines remain the same.	IITA				

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Activity 2.3.3. Collection of feedback on the effectiveness of the training-of-trainers sessions and eventual modification of the approach.												28,132	28 ,132	0	Includes fixed costs (personnel, rent, etc)
Milestone 2.3.3.1. Collection of feedback on the effectiveness of the training										Feedback system has been developed (including participant evaluation on content, methodology, and knowledge gained). This has been implemented during the training session in Cameroon in 2019. Baseline and follow-up data from EAs have also been collected during the pre-testing of the manual in Ghana. This will be implemented for subsequent trainings.	IITA				
Milestone 2.3.3.2. Continuous improvement of the training modules and processes										Feedback received will be used immediately to modify training methods and processes	IITA				
Output 2.4. Engagement in policy action in support of the sustainable intensification of cocoa												**75,659**	**50,659**	**25,000**	Though some policy makers have been engaged through the P4D committees, engagement/ interactions on policy briefs on generated recommendations have been deferred to 2021, awaiting

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
															first set of recommendations from trials. Again, initial engagements for testing/validating of the draft manuals has been mostly done virtually. The savings have been reallocated to output 2.3 to engage digital partners.
Activity 2.4.1. Identification of relevant and specific policy briefs												39,329	19,329	20,000	
Milestone 2.4.1.1. Cocoa-related policy environment documented for target countries											IITA				
Milestone 2.4.1.2. Policy briefs formulated											IITA				
Activity 2.4.2. Engagement with relevant policymakers												36,330	31,330	5,000	Same as indicated under output 2.4. The savings have been reallocated to output 2.3 to engage digital partners.

Activities and milestones	2019				2020				Impact Level	Mitigation	artner	Approved budget for 2020	Revised budget for 2020	Differential	Comment
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4							
Milestone 2.4.2.1. Relevant policy-related processes identified and activated															
Milestone 2.4.2.2. Interactions with policymakers held in relation to products developed under Outputs 1.3, 1.4 and 1.5															
SUBTOTAL												**2,687,196**	**2,573,234**	**113,963**	
OVERHEAD (7%)												188,104	180,126	7,977	
CSP (2%)												53,744	51,465	2,279	
GRAND TOTAL												**2,929,044**	**2,804,825**	**124,220**	Excess funds from UNEP – 40,000, WUR - 73,963, to be shifted to 2021 and 2022.

APPENDIX 3 - Financial Report