IMPROVING CAPACITY BUILDING AND KNOWLEDGE SHARING TO SUPPORT MANAGEMENT OF CADMIUM LEVELS IN COCOA IN LATIN AMERICA AND THE CARIBBEAN FOR EXPORT TO THE EU

REVISED PROJECT PROPOSAL

SEPTEMBER 2021

Project Title	**IMPROVING CAPACITY BUILDING AND KNOWLEDGE SHARING TO SUPPORT MANAGEMENT OF CADMIUM LEVELS IN COCOA IN LATIN AMERICA AND THE CARIBBEAN FOR EXPORT TO THE EU**
Objective	To support countries (Colombia, Ecuador, Peru, and Trinidad) to put in place a coordinated regional pathway to meet the international regulations regarding cadmium concentrations in cocoa and cocoa-derived products
Total project budget	US$ 550,948
Budget requested from STDF	**US$ 381,946**
Co-financing from European Development Fund (EDF) for EPA/CSME	US$ 65,254
Counterpart Contributions in cash and/or in kind	US$ 103,748
Full name and contact details of the requesting organization(s)	International Cocoa Organization (ICCO) ICCO Building II-Plateaux ENA - Avenue Boga Doudou Abidjan Côte d'Ivoire Switchboard: (+225) 22 51 49 50/51
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I. BACKGROUND & RATIONALE

1. RELEVANCE FOR THE STDF

1. This project has been designed as part of a regional approach. This is in response to the introduction of stringent maximum levels (MLs) for cadmium content in chocolate and cocoa products imported into the European Union (EU) market which came into effect in January 2019.

2. The project will facilitate regional efforts as stakeholders in Colombia, Ecuador, Peru and Trinidad & Tobago will together improve the flow of the current state of knowledge to mitigate against cadmium in cocoa in the LAC region. The project will play a catalytic role for expanding knowledge and interventions in the region, and part of the process will be to engage and disseminate beyond the direct project beneficiaries. The project will focus on communication and raising awareness through improved collaboration and information sharing by the research community to cocoa extension service providers. An international working group of cocoa researchers and relevant stakeholders will be formed

to strengthen research activities, identify, and consolidate the current best practice options for cadmium mitigation and remediation and raise awareness of the issue in the LAC cocoa community.

3. The project intends to provide a platform on which scientific agencies such as MINAGRI (SENASA and INIA), INIAP, AGROCALIDAD and CRC can develop a regional policy strategy to mitigate/remediate cadmium issues. In the short term, this project, supported by the Standard and Trade Development Facility (STD) and the 11th European Development Fund (EDF) of the European Union (EU), is designed to bring relevant stakeholders together to achieve consensus on a regional testing protocol and terminology to be used in the determination of cadmium levels in cocoa beans produced for export to the EU. This technical cooperation and knowledge sharing approach could be replicable for other fine and flavour cocoa producing countries in the LAC region. The agreed terminology and regional testing protocol for cadmium will be used to develop a curriculum for and the training of Master Trainers who provide Extension services to cocoa farmers which will scale up the information sharing as well as sustainability of the project.

4. The four countries to participate in the project were identified based on development status and their leadership in area of Cadmium research and mitigation in cocoa. Colombia, Ecuador and Peru are upper middle-income countries and their current and potential capacity for researching and managing heavy metal-related problems in cocoa is recognized. Trinidad & Tobago, though graduated from the DAC list of ODA recipients, and are not a priority for STDF (and funding would be sought from elsewhere for their involvement) are considered valuable to the project due to their research capacity and their perceived status as a small site where focussed work can be carried out, as pilot interventions, which could be transferred to the other project countries and the wider region. The Cocoa Research Centre, The University of the West Indies, also house a germplasm collection from which material can be transferred to other nations.

5. This application form is written on behalf of the project partners, and the project support from STDF is requested by ICCO and is born out of the STDF Project Preparation Grant 577 (‘Mitigation and Remediation of Cadmium Contamination in Cocoa Beans in Latin America & the Caribbean’). In parallel, a regional strategy for capacity development and research has been developed: ‘Regional approach for mitigation & remediation of cadmium contamination in cocoa in Latin America & the Caribbean’, which details the short, medium- and longer-term requirements for managing the cadmium issue in the LAC region.

2. SPS CONTEXT AND SPECIFIC ISSUES/PROBLEMS TO BE ADDRESSED

6. The LAC region currently supplies nearly one fifth of worlds cocoa and is a major producer and supplies over 80% the world’s fine flavour and organic cocoa with key markets in the EU and USA. In January 2019, an EU regulation specifying maximum levels of cadmium in cocoa and chocolate products came into force and similar regulations are being developed by other countries. The geological history and formation of soils in LAC has resulted in cadmium and other heavy metal deposits in isolated pockets of certain countries. These heavy metal deposits are only of concern when they occur in agricultural lands and if the heavy metals are bioavailable or in a form that can be absorbed by the plant roots. When cadmium is absorbed by cocoa it is transported to many parts of the plant including the beans which are used for making cocoa and chocolate products. Cocoa produced in the LAC region is by smallholder farmers and cocoa is a major source of rural employment. It was found recently[1] that cocoa beans from some areas in the region contain high levels of cadmium. Any loss of access to

[1] https://cgspace.cgiar.org/handle/10568/102353

lucrative markets due to high cadmium levels in cocoa beans could result in loss of income and threaten the livelihoods of the most vulnerable producers. In addition, and in some areas, after years of promotion of cocoa by various government and donor agencies, farmers may be forced to abandon the crop and, at worst, return to growing illicit crops.

7. In 2014, the European Commission introduced Regulation No. 488/2014, which sets MLs of cadmium in a range of foodstuffs, establishing levels ranging from 0.1 to 0.8 mg/kg in cocoa and chocolate products (depending on the product and the percentage of total dry cocoa solids it contains). Agencies such as the International Cocoa Organization (ICCO) as well as private sector trade associations such as ECA/CAOBISCO/FCC, worked with the EU policy makers to negotiate a five-year moratorium period before the regulation was brought into force on 1st January 2019. In 2018 the Codex Alimentarius Committee proposed maximum limits of cadmium in cocoa products, 0.8 mg/kg for chocolate containing ≥50% to <70% total cocoa solids and 0.9 mg/kg for chocolate containing ≥70% total cocoa solids. Following suit in the same year, the Office of Environmental Health Hazard Assessment (OEHHA) in the State of California USA, included cadmium limits for chocolate under Proposition 65, stating that cocoa products exceeding these limits should carry a warning on the product labels (0.4 mg/kg for chocolate containing <65% cocoa solids; 0.45 mg/kg 65-95% cocoa solids; 0.96 mg/kg ≥95% cocoa solids). Due to the introduction of these limits for cocoa products, there is the real possibility that other countries will impose similar or even more stringent regulations. The introduction of these limits imposes a serious barrier to the LAC region's cocoa trade and access to their key markets since soils of LAC have been found to be high in cadmium and cadmium levels have been detected at higher levels in cocoa beans from some parts of the region.

8. Why is cadmium such a problem? It is a toxic metal that accumulates in the body over time causing damage to the kidneys, skeletal and respiratory systems and is known to be carcinogenic. Human exposure to cadmium can occur through several different pathways such as smoking tobacco, drinking contaminated water and breathing in particles present in the atmosphere but the greatest risk comes from dietary exposure and the absorption of cadmium from the food we eat. Due to the high risk posed by dietary exposure, food safety organisations have set recommendations for levels of contaminants in food based on tolerable intake by body mass. MLs are generally not set on those foods which contain the highest levels of contaminants but those which contribute to the largest proportion of our diet. As cocoa beans are a major constituent of chocolate, chocolate and cocoa products have been considered by the European Commission as a group of foods that are eaten in sufficient quantities, especially by children, and are considered to be included in this specific food safety legislation.

9. Cadmium present in the soil can originate from natural (geological) and anthropogenic (industrial) sources or a combination of both. Natural sources include weathering of parent rock during soil formation and volcanic activity. Anthropogenic sources include industrial processes such as mining, smelting and combustion of refuse and fossil fuels. Elevated levels of cadmium in agricultural soils is a global concern and though high levels can be attributed to natural sources (as is thought to be the case in the LAC region), many soils are contaminated by polluted water, sediments, atmospheric deposits and the prolonged use of amendments (e.g. phosphate fertilizer).

10. In the soil, a portion of cadmium exists in a form that is available for uptake by plants via membrane transporters. Once absorbed by the roots (and possibly the leaves) of a cocoa tree, cadmium is transported through the xylem and phloem system and is partitioned and stored in different parts of the plants including the beans. This varies depending on the genetic makeup and age of the plant and therefore some types of cocoa have been found to contain more cadmium in their beans than others. Other soil properties also affect the amount of cadmium available in the soil for uptake by plants. These

include: pH, organic matter content, soil texture (clay vs sand), salinity, cation exchange capacity (CEC) and the level of micro and macro nutrients present. With so many factors influencing the availability and rate of uptake of cadmium by plants, the issue becomes very complex.

11. To develop this project proposal, a gap analysis was completed which reviewed the research carried out on cocoa and cadmium in the LAC region. Information was provided by the in-country partners through questionnaires and through group and individual consultations during the Stakeholders Workshop. Several gaps were identified, and others raised by in-country partners during these discussions and have formed the basis for the development of this proposal. The major gaps and challenges and possible solutions have been summarised in the table below:

Table 1: Challenges to be addressed by the project

Challenge/research gaps	Possible solutions	Feasibility & timescale
Coordination and knowledge sharing		
Limited coordination of research and results/information sharing at a national or regional level	Efficient country and regional level coordination of projects would avoid duplication of efforts and align efforts, allow comparison and validation of results	With agreement of partners at a national and regional level, the formation of a working group would contribute to information sharing. Feasible in the short-term – will be addressed by this project proposal
Harmonisation of analysis and capacity building		
Little exchange of information for harmonisation of equipment, analytical standards, protocols for sampling, extraction and analysis of cadmium; making comparison of results between laboratories and studies virtually impossible.	Develop and agree on standard protocol to use for sampling, extraction, and analysis. Link to capacity building for a network of regional analytical laboratories and a glossary of terms. Peru has sampling protocols for cocoa beans, soil, and leaves, as well as water. However, harmonization with the other countries and standardization is required.	Feasible in the short-term with partner cooperation – will be addressed by this project proposal
Lack of a common language or terminology leading to confusion and inaccuracy when attempting to compare studies on cadmium in cocoa	Develop a glossary of terms to accompany the standard protocols mentioned above	Feasible in the short-term with partner cooperation – will be addressed by this project proposal
Mitigation through mapping and agronomic practices		
Slow process in the development and dissemination of current best practices for the mitigation and remediation of cadmium in cocoa and cocoa soils.	Although additional research needs to be carried out to fully understand the issue of cadmium and cocoa, there is an urgent need to review and validate existing results to propose best practices for producers and stakeholders	The project hopes to address this by compilation and simplification of the language of best practices for producers based on the information currently available. The best practices need to be reviewed and validated on a regular basis as more findings become available
Detailed mapping of cadmium distribution in soil and beans in cocoa producing areas is required.	It is necessary to delve into areas or 'Hot spots' where beans are likely to contain high levels of cadmium so measures can be taken: avoidance of these areas for establishment of new cocoa fields; monitoring and blending of batches to reduce overall cadmium content in beans at country level; designating beans from these areas for other purposes. This information can also be used to improve data analysis where modelling is used	This mapping exercise commenced in 2018 and is continuing under a project being implemented with Bioversity, MINAGRI (SENASA, INIA) in Peru and the CLIMA LOCA project (Ecuador, Peru and Colombia) with EU funding. In addition to the progress made in each country, it is necessary to continue mapping the distribution of cadmium to determine its behaviour in the soil, bean, leaf, water, etc. in the short term. This project will consolidate and package the available information for use by extension agencies and producers.
No strategy has been developed for areas identified to have high levels of cadmium in cocoa beans ('hot spots')	Development and validation of a strategy for cocoa from known 'hot spots' taking into account flavor profiles to organize batches that meets MRLs for exports destined for the EU and USA as a short-term measure to maintain market access	Feasible in the short-term and addressed in this proposal

Challenge/research gaps	Possible solutions	Feasibility & timescale
Lack of trained Extension support services to disseminate information to and guide farmers on best practices to ameliorate for Cd in cocoa beans	Based on the knowledge garnered from the preceding, a curriculum of current best practices to address/mitigate the causes for high cadmium levels in cocoa beans from hot spots will be developed and used to train Master Trainers who provide extension services to cocoa farmers for mass dissemination of recommended best practices.	Feasible in the short-term and addressed in this proposal
Research into the use of ameliorants (additives, amendments) to reduce cadmium availability in soil is at a preliminary stage and has given mixed results	Several additives (lime, dolomite, biochar etc.) have been reported to be effective in small scale trials but further research is needed to determine the dose and timing to give optimum results in reducing cadmium availability to cocoa.	Short-medium term research measure not within the scope of this project.
Limited progress in identifying sources of cadmium contamination in soil. There are still questions over whether high cadmium levels in certain areas are due to natural or anthropogenic causes and what if any is the consequence for management	A limited number of studies have been conducted to try to determine the physical and chemical properties of soil and the factors known to increase the availability of cadmium in soils. However, results are very variable and sometimes contradictory. More research in this area is desperately needed to complete our understanding of the problem	Mid-long-term research need – not within the scope of this project
Breeding and genetic manipulation		
Varietal differences of cocoa and uptake of cadmium. Different varieties have been found to uptake and store cadmium at different rates	Additional research needed to identify low cadmium accumulating varieties to be used as root stocks to reduce cadmium uptake in areas of medium/high cadmium soils	A good long-term: outside the scope of this project
Unselective uptake and transport of cadmium in cocoa plants	More research needed to complete identification and manipulation of the genetic pathways involved in the uptake and storage of cadmium in cocoa trees to block/reduce cadmium uptake	A good long term: outside the scope of this project
Remediation		
Scarce options for bioremediation and phytoremediation which could be explored to immobilise, sequester, and remove cadmium from soil	Results are still at a very preliminary stage and further research needs to be conducted to determine if this is an appropriate method for cadmium remediation in cocoa	Longer term: outside the scope of this project

12. Whilst the moratorium period has allowed an opportunity for the cocoa sector as a whole to understand the issues of cadmium availability and uptake to a greater extent, as well as the possibility of mitigation/remediation options, it can be seen from the gap/challenges in the table above that additional research is required to provide information to solve this problem. **This project aims to support short-term interventions** to: i) establish a platform for networking between lead agencies and partners involved with cadmium in cocoa research and providers of support services to cocoa farmers in LAC ii) develop common language for or glossary of terms to enable comparison of research on and results for cadmium in cocoa in LAC iii) agree on a standardized protocols for measuring cadmium in cocoa in LAC and undertake detailed mapping of cadmium hot spots in cocoa producing areas for recommendations on mitigation strategies iv) develop a curriculum for and train Master trainers/extension service providers on current best practices that can be used by farmers to mitigate cadmium levels in their cocoa beans. These aims are discussed in greater detail below.

13. One problem is that there is still not enough understanding of the biology, chemistry and economic issues around cadmium contamination in cocoa, and therefore there is a low understanding on

the way to reduce cadmium contamination in cocoa. All of the available evidence leads to the conclusion that the issue is extremely complex. There are many factors affecting cadmium availability and uptake (germplasm of cocoa trees, soil-related biochemical factors, and physicochemical factors) and so it appears to be almost impossible to pinpoint clearly where cadmium could be a problem. Levels of cadmium can vary wildly across a country, but also down to field level. From the available data, cocoa beans can contain low levels of cadmium when grown in soils supposedly containing high levels of bioavailable cadmium, and vice versa. A concern is that even if the cocoa research community can fully understand data and relationships from lab or field trials, forming the right combination of remediation strategies is almost impossible as a broad-brush recommendation. All possible interventions would have to be locally adapted and site specific. As such, a single project (such as this) cannot fully address the issue of cadmium contamination of cocoa but can make a solid start towards contributing to knowledge management and dissemination of best practices to mitigate site specific cadmium levels in cocoa beans to assist producers in maintaining market access. Many of the possible ideas for mitigation and remediation are out of scope of this project proposal but some quick wins regarding formalizing a network of researchers and relevant agencies in the region to foster a better understanding of the cadmium problem, and some technical means that could support in mitigation have been identified.

14. LAC cocoa-producing countries have realised that the issue of cadmium contamination needs to be addressed and research work is already being undertaken (see Section 4). However, it has become apparent that the **coordination and information exchange between institutes and with food safety authorities has been low** regarding the scale of the cadmium problem and the valuable work being carried out to resolve it. On the positive side, organizations are motivated to carry out research and activities are scaling up.

15. However, the main problem is the lack of coordination among LAC countries which can compound some issues identified, such as the **inability to make direct comparison of methodologies and results from research efforts within and across countries** (since methodologies and terminology are not aligned; the consequence is a lack of compelling international evidence that could contribute to control strategies or be presented to decision makers). There remains a concern that MLs need to be set at realistic levels and this cannot be done without clear understanding of the scale of the problem. While some information exists, including information on the mechanism of cadmium uptake in cocoa plants (both due to naturally occurring cadmium and from anthropogenic sources), without greater clarity about uptake, it is more difficult to plan how to mitigate and remediate against the problem.

16. The **low level of wider awareness of the cadmium issue** is also of concern. There is an urgent need to raise awareness of cadmium for growers in affected areas, and to have them seek advice in the future. Where stakeholders are aware of an incoming problem, there is much confusion in the field as to the scale of the issue, the consequences, and possible ways to solve (or avoid) the issue.

17. Once best practices have been identified, there needs to be an efficient dissemination strategy, so materials reach producers and other stakeholders. Discussion with country experts during the regional workshop highlighted the need for harmonization of sampling, extraction, and analysis protocols as well as the development of a common terminology relating to the physiology of cocoa pods to ensure that results within countries as well as across the region are comparable.

18. A limitation to date is that much of the research going on in the region relating to cadmium in cocoa has been focussing on trying to find the cause of the problem, rather than trying to come up with pragmatic actionable activities/strategies/procedures to avoid high levels of cadmium in beans.

19. At the Codex Alimentarius level, a code of practice (COP) is being developed for the prevention and reduction of cadmium contamination in cocoa beans chaired by Peru and co-chaired by Ecuador and Ghana, the scope of this COP is to provide guidance on recommended practices to prevent and reduce Cd contamination in cocoa beans before planting or in new plantations, during the production stage up to the harvest and post-harvest phases of cocoa beans.

20. This project intends to contribute to addressing the problems outlined above and proposes a large-scale regional cooperation of research activities, improvement of knowledge sharing and capacity building in Cocoa Extension service providers for small farmers in LAC.

3. LINKS WITH NATIONAL/REGIONAL DEVELOPMENT PLANS, POLICIES, STRATEGIES, ETC.

21. The governments of Colombia, Ecuador, Peru and Trinidad and Tobago are promoting the production of cocoa through their national plans especially the production of fine flavour cocoa. Due to concerns about the introduction of the EU cadmium legislation, levels adopted by Codex Alimentarius and Proposition 65 issues by The Office of Environmental Health Hazard Assessment (OEHHA) in California, USA, many governments of cocoa producing countries in the LAC region are starting to introduce national policy and programmes to address high levels of cadmium in cocoa.

22. In Peru, through Law No. 30355, Law for the Promotion and Development of Family Farming, the responsibilities of the State are established in the promotion and development of family farming, based on its recognition, as well as the importance of its role in food security, in the conservation of agrobiodiversity, in the sustainable use of natural resources, in revitalization in local economies, and in the contribution to rural employment and the validity of communities, through the implementation of state policies . In addition, there is a Multiannual Multisectoral Agenda as a coordination mechanism between financial agencies, to implement actions related to the mitigation of heavy metals with an emphasis on cadmium, for cocoa as well as the intermediate and final products. In addition, the countries are in the process of preparing the national plan for the development of the cocoa and chocolate chain, with a 2020-2030 vision.

23. **Ecuador**'s National Development Plan/third National Plan for Good Living (2013-2017) had an objective to promote the transformation of the producer structure. Under this is a key policy to promote production and sustainable productivity, encouraging inclusion and redistributing production factors and resources in the agricultural, aquaculture and fisheries sectors. In August 2017, the 'Gran Minga Agropecuaria' was inaugurated containing the following specific priorities: to give title deeds, so that the farmers obtain credits, irrigation, kits with seeds, agricultural and livestock insurance, technical assistance, and agricultural mechanization, as well as sustained access to markets. In 2018, the Ministry of Agriculture in Ecuador introduced a national plan to mitigate cadmium in cocoa to address high levels of cadmium in cocoa beans.

24. In **Trinidad & Tobago**, although agriculture is not a major contributor to GDP, developing agriculture is included as a policy that has development goals including the diversification of the economy and the reduction of the food import bill. Cocoa was named as a strategic crop in the country's 'Agriculture Now' plan, and formation of the Cocoa Development Company of Trinidad & Tobago Limited (CDCTTL) indicates the importance of this crop.

25. Further to the above, supporting the cocoa industry in some regions of relevance to the project countries could be a crucial element in developing alternative livelihoods to narcotics. Whilst not attractive to young people, the growing of cocoa can be seen as a very positive alternative livelihood to

the growing of illicit crops, and is encouraged especially in **Colombia**. The present National Development Plan of Colombia (for 2014-2018) is prioritising the 'transformation of the countryside and green growth' as one of its five strategies, thereby trying to reduce the gap between rural and urban livelihoods. The importance of cocoa is illustrated by the Ministry of Agriculture and Rural Development Council Nacional Cacaotero Development Plan (2012-2021) which states that along with the planting of new areas with cocoa, the rehabilitation of plantations with low productivity should impact the supply of the grain produced in the country (to generate a surplus for export). This aligns well with the proposed project.

26. Whilst specific policies relating to mitigation or avoidance of cadmium contamination of cocoa are only just being developed or introduced in most countries, the development of a framework for action and planning of mitigation and remediation is absolutely in line with general agricultural policies in each of the participating countries for this project. As part of the STDF PPG, a Regional Strategy for Capacity Development and Research was outlined.

4. PAST, ONGOING OR PLANNED PROGRAMMES AND PROJECTS

27. Each project country has active research projects related to cadmium contamination including its effects and implications on cocoa production and trade. The status and progress of these PROJECTS varies since the scale of the problem is different in each country. For example, in Trinidad and Tobago the distribution of cadmium contaminated soils is well characterised, whereas in Peru the size of the country and scale of the heterogeneity in soil types, farming types, cadmium levels, cadmium sources are vast and understanding of the problem is incomplete. A more detailed analysis of past and ongoing projects of relevance was undertaken as part of the STDF PPG 577 project. In addition to the workshop that was part of STDF/PPG/577 project, there have been several other conferences and workshops relating to the new MLs for Cd in cocoa and cocoa products. An international workshop was organised by CIRAD and CIAT in March 2018 to bring experts together to formulate a draft research proposal for Colombia, Ecuador, and Peru to solve the challenges of cadmium in cocoa. This has led to the development of a proposal for a programme to be submitted for funding by the EU. As the focus of the CIRAD/CIAT proposal is applied research, the two projects would be complimentary for the region as this project is based on capacity building and knowledge sharing.

28. There is a separate project that is under review by STDF, with implementation to be led by KU Leuven and partners from Colombia and Ecuador: 'Improving the institutional capacity of Colombia and Ecuador to mitigate trade barriers due the high cadmium levels in cacao' (STDF/PG/681). Should these projects be taken forward to implementation, there would be considerable scope for complementary work, for example harmonizing methods for analysis (towards certification/accreditation), improving mapping, and developing GAP guidelines for lower cadmium in cocoa. That work proposes to agree and distribute reference samples and quality control/quality assurance guidelines, which could be used and implemented in the capacity building activities proposed for the present project (below). STDF/PG/681 is also working towards accreditation or certification, and the activities herein would contribute towards that. The cadmium mapping activities proposed for STDF/PG/681 cover Colombia and Ecuador.

29. **Colombia**: The first study in Colombia to investigate levels of cadmium in cocoa and soils was carried out by CORPOICA in 2008. Total and available levels of cadmium in soils, cocoa beans and fertilizers were sampled from 217 cocoa farms across eight departments. The results reported that total cadmium levels were found to be highly variable (0.1-10mg/kg) within the areas sampled. The 207 samples of cocoa bean analysed showed that 15.4% were above the maximum allowable cadmium limit

of 0.5mg/kg (recommended by the Association of the German Confectionery Industry). Cadmium levels in the beans were found to be highly correlated with available cadmium in the soil. This initial extensive study provided valuable baseline data for cadmium levels in soils and beans, and formed the basis of Colombia's cadmium map identifying zones relating to the distribution of cadmium levels in soil and beans. The study also investigated the effects of combinations of three different soil treatments (compost, biofertilizers, organic fertilizer, lime and mycorrhizal soil) however, analysis showed that there were no significant changes in soil properties due to the effect of the organic matter or the total and available cadmium levels in soils or beans and leaves.

30. The USAID/USDA Foreign Agricultural Service's 'Cacao for Peace' project has been active in Colombia since January 2016 and will run for 5 years. The aims of the study are to strengthen the key institutions for cocoa from both the public sector and private sector. The capacity building project has twin goals of developing Colombia into a reliable supplier of cocoa to the US and providing Colombian farmers with a substitute for illicit crops. Education and fellowships are key components, and a research symposium in March 2017 had research areas including soil (including cadmium mitigation). The programme also promoted, supported, and funded an agreement with USDA's Agricultural Research Service and CORPOICA which includes a key activity to generate new cacao varieties with improved traits, such as high productivity, disease resistance, and limited cadmium uptake.

31. **Ecuador**: In 2014-2016 VECO Andino conducted a study to assess the cadmium contents in cocoa and factors influencing the uptake of cadmium under organic production in the province of Esmeraldas. The study found that cadmium concentrations in soil and beans from the study farms were very variable but similar to those in other cocoa growing regions in Ecuador. No geographical consistency was found in cadmium levels of beans and the conclusion was that future monitoring can only be carried out on a farm-to-farm basis. Zn and Mn were found to show some correlation with cadmium in soil and reported that a ratio of 4:1 for Zn:Cd and a ratio of 20:1 for Mn:Cd could theoretically reduce cadmium uptake in cocoa beans though competition. Further research is needed to confirm the theory and initial findings, and to understand the implications of optimised macronutrient levels and cadmium uptake in cocoa beans.

32. The Escuela Superior Politécnica del Litoral (ESPOL) and the Université Catholique de Louvain in Belgium are collaborating on a 4-year project that began in 2017 on food standards and sustainability in the cocoa chain in Ecuador. The study will investigate medium and long-term strategies for cadmium mitigation in the cocoa value chain. As the project is in its early stages, it has not produced results, however activities include sampling of soil, leaves and pods (pulp, bean and testa) from 14 provinces in Ecuador to determine the concentration of cadmium. Analysis will be carried out using ICM-MS in the laboratory in Belgium. The results will be used to construct a map of high cadmium 'pockets' in cocoa beans in Ecuador. Demonstration farms will be set up to observe the effects of soil amendments such as lime, gypsum, organic matter and micro nutrients to be evaluated over a period of 3 years. Greenhouse experiments will also observe the effect of other treatments such as nano particles, iron and biochar.

33. ESPOL is conducting the FONTAGRO funded project entitled "Multi Agency Platform of cocoa for Latin America and the Caribbean Cacao 2030-2050". The project which ends in 2022 is well aligned with this project and aims to generate knowledge for the management of cadmium in the cocoa, it will establish and standardize methodology for measuring cadmium to generate maps and techniques to reduce the levels of cadmium and generate socio-economic information of the impact of international regulations.

34. This project will also interface with the Europe-Aid funded Clima-LoCa (Fostering Climate-relevant and Low Cadmium innovations to enhance the resilience and inclusiveness of the growing cocoa sectors in Colombia, Ecuador, and Peru) project which commenced in September 2020 and aims to foster the development and scaling of low cadmium and climate-relevant production practices and innovations that fit the diverse contexts of smallholder cocoa production.

35. **Peru:** Numerous studies have been conducted in Peru to determine the concentration of cadmium and other heavy metals in soil, water and beans from different regions. One study was carried out by The Instituto de Cultivos Tropicales (2013-2016). The project funded by INNOVATE Peru and USDA sampled cocoa from the Northern, Central and Southern regions of Peru to determine the levels of heavy metals in leaves and beans of cocoa. Different cocoa clones showed different rates of cadmium accumulation suggesting that varietal differences may play a part in cadmium uptake and that selection of low uptake varieties could be potentially used to reduce cadmium in the beans. A follow-on study identified additional cocoa genotypes with low rates of cadmium accumulation and nursery trials concluded that with 56 different cocoa genotypes in soil spiked with different concentrations of cadmium, cocoa clones of both low and high uptake of cadmium were identified. With the Clima Loca Project, new studies are ongoing to study the clones under field conditions.

36. Two studies conducted by the Universidad Nacional de la Selva in 2011 reported that the average cadmium level in cocoa beans was 0.56 mg/kg with young trees between the ages of 11-15 years having the lowest concentrations in their beans. One common variety of cocoa selected had the highest levels of cadmium in beans reaching 1.18 mg/kg. Soil where amendments had been applied had the lowest levels of cadmium. A second study was carried out to determine the available cadmium concentrations of the soil and beans. The level of cadmium in beans was reported to be very variable in the 71 samples analysed. Available cadmium levels in the soil also fluctuated, with an average of 0.55 mg/kg. Analysis of the phosphate fertilizer used in the area showed that it had a very high concentration of cadmium at 12.782 mg/kg. These findings suggest that systematic screening needs to be carried out to confirm these initial findings and this theory.

37. The project called “Study on the prevention and mitigation of cadmium accumulation in cocoa through a better use of genetic diversity, mycorrhizal inoculation and soil management (2018-2020)” led by Bioversity International is ongoing in partnership with MINAGRI, SENASA and INIA. The project will identify short and long-term solutions to mitigate against cadmium uptake in cocoa through field trials assessing the efficiency of using different amendments, the use of cadmium accumulating yeasts and mycorrhiza in soils. The study will also identify cocoa genotypes with low leaf cadmium levels growing in soils with high cadmium which could be used for rootstocks selections in different regions and characterise low accumulating genotypes using genetic markers (TC SNP615) to better understand the role of genetics in cadmium uptake. The project which started in 2018 will be concluded in 2020.

38. One of the most important findings presented in the framework of a study conducted by SENASA and INIA found that the high concentrations of cadmium in cocoa beans are not present in all of Peru, but are concentrated in only a few areas. More than 1,000 samples of cocoa beans were analyzed, in which the high cadmium concentrations mainly belonged to the northern regions and some areas of the center of the country, the south is not affected. However, the pattern of cadmium accumulation is not that simple. Although cocoa trees that grow in soils with higher levels of cadmium tend to have higher concentrations of cadmium in their beans, there is much variability. This means that even in the northern areas where cadmium is generally high in beans, there are valleys, farms, and trees that produce beans

with low levels of cadmium. This illustrates the complex interactions between geology, soil, farm management, and genotype on cadmium accumulation in individual trees.

39. **Trinidad and Tobago**: The majority of studies carried out in Trinidad and Tobago on cocoa and cadmium have been led by the Cocoa Research Centre of the University of the West Indies. A recent project financed by the ECA/CAOBISCO/FCC Joint Research Fund has just concluded Phase 1 and is entering into Phase 2. During Phase 1 of the project (2014 -2017) a map was developed showing the distribution of total cadmium in the soil of cocoa growing areas. The highest levels of cadmium were found in volcanic soils, areas prone to regular flooding and areas where phosphate fertilizers had been previously applied. Several soil ameliorants were screened during laboratory studies; both lime and biochar were selected for additional greenhouse experiments. Results showed that when lime and biochar were applied together the effects were found with increases how effect improves with time with regards to lime while the effect decreases over time for biochar. During field trials it was found that the amendments were difficult into incorporate the soil further studies are planned to evaluate more efficient application methods. Germplasm screening revealed that some accessions had low bioaccumulation rates for cadmium uptake and a limited genome wide associated study was carried out and showed promise for identifying varieties which uptake low levels of cadmium.

40. Phase 2 will build on findings from Phase 1 incorporating additional studies to validate genetic differences based on hydroponic experiments and candidate genes to reduce uptake of cadmium. Grafting study will be carried out to assess the effectiveness of using low cadmium uptake germplasm as rootstock and technologies will be investigated for more efficient methods of incorporating ameliorants. The project will conclude with the development of combined strategies to include genetic, cultural and amelioration methods for the reduction of cadmium in cocoa beans.

41. Similar research activities are currently being carried out in parallel in Colombia, Ecuador, Peru and Trinidad and Tobago (as can be seen in the selection of projects above). The majority of studies carried out in each country are mapping activities to determine the cadmium contents of the soil and cocoa beans in specific locations. Mapping activities to identify hot spots of high cadmium levels in the soil and the beans appears to be the main priority of each country and will be supported by this project to help fill in the gaps where only predictive data exists. This would be a short-term success for the work: if areas are identified as hot spots, countries can avoid using cocoa from those areas, or potentially blend beans with low cadmium cocoa or use it for other purposes (e.g. cocoa butter).

42. Other research topics include identification of low cadmium uptake germplasm and investigation into the use of soil ameliorants to reduce the availability for cadmium in the soil to uptake by cocoa. Several studies in different countries have also highlighted the issue of high concentrations of cadmium in soil amendment/fertilisers and issues with recycling of cadmium in cocoa cropping systems. These are both areas of importance that have not been addressed adequately in previous studies and issues this project hopes to address by implementing screening of fertilizers to determination of cadmium content cycling in cocoa systems. As each of the countries is carrying out research along similar themes and issues in each country are comparable, it would be beneficial to coordinate research at a regional level to foster collaboration and knowledge sharing.

43. There are a number of on-going initiatives on cadmium mitigation and remediation. The Project will take advantage of the existing body of knowledge already developed and in the public domain by coordinating and liaising with existing donor-supported initiatives so as to avoid duplication of efforts.

5. PUBLIC-PUBLIC OR PUBLIC-PRIVATE COOPERATION

44. The project will involve stakeholders and buyers from key points along the cocoa supply chain. This will include farmers, collectors, processors, and exporters. Involvement of the public and private sector (see list below), and interactions between them, will be important for the project. Such interactions are vital in promoting the exchange of local knowledge, local ownership, and lead to strength through partnership. The project will also promote co-operation between government organizations (both within country and between countries), with various publicly funded agencies being involved in the project to their mutual benefit. The project partners include publicly funded organizations. Other publicly funded organizations to benefit from the proposed action will include ministries of agriculture, ministries of health, environmental protection agencies, national research organizations and trade and standard boards/bodies.

45. The project conception, design and implementation would be in line with Paris Principles in that there is active support and participation from in-country partners, stakeholders, and committees. The in-country partners will own the processes (as described in section 6 and 12 (Sustainability)). Mainly, the participation of the ministries of agriculture of the participating countries as governing bodies should be made visible, in collaboration with the Inter-American Institute for Cooperation on Agriculture - IICA, due to their collective presence in all the countries within the scope of the project.

46. Public-public or public-private cooperation. The project will involve a range of partners, including the following public and private sector institutes:

- Colombia: Federación Nacional de Cacaoteros (Fedecacao) [private], CORPOICA [public], MADR [public]
- Ecuador: Instituto Nacional de Investigaciones Agropecuarias (INIAP) [public]; Agencia para el Aseguramiento de la Calidad del Agro (AGROCALIDAD) [public], Facultad de Ciencias de la Vida: Escuela Superior Politécnica del Litoral (ESPOL) [public], Ministerio de Producción, Comercio Exterior, Inversión y Pesca (MPCEIP) [public] and Ministerio de Agricultura y Ganadería (MAG) [public]
- Peru: MINAGRI [public], SENASA [public], INIA [public], Universidad Nacional Agraria La Selva [public], Instituto de Cultivos Tropicales [public], Universidad Nacional de Piura [public] Alliance CIAT-BIOVERSITY, (cooperation) and IICA (Inter-American Institute for Cooperation on Agriculture) [cooperation entity]
- Trinidad & Tobago: Cocoa Research Centre, The University of the West Indies [public], MALF [public]
- IICA (Inter-American Institute for Cooperation on Agriculture) [public]
- ICCO (International Cocoa Organisation) [international, public]
- CABI (Centre for Agriculture and Biosciences International) [international, public]
- CIAT (International Center for Tropical Agriculture) [international, public]
- Other stakeholders consulted and involved include the University of Nottingham (UK) [public]
- CABISCO/ECA/FCC [private]

6. OWNERSHIP AND STAKEHOLDER COMMITMENT

47. Maintaining market access for cocoa growers, manufacturers, and exporters from all stages of the supply chain is a priority for each cocoa growing country in the region. This includes ministries of agriculture, national cocoa bodies, and food safety authorities for each country.

48. During 2017 and 2018, CABI and the ICCO Secretariat engaged in consultations with a range of public and private sector institutes active in the region in order to understand the concerns and scale around the cadmium issue, and identify priority areas for action. This centred on a workshop in Lima, Peru (July 2017) at which stakeholders presented the current state of knowledge and research capabilities in the field of heavy metal contamination, breeding and biotechnology of cocoa. Key parties together generated a well-formed picture of the current state of knowledge and priority future actions, which have been formulated into the present project concept. The group also agreed the objective for a proposed project, which has been slightly rephrased but remains current in the present document.

II. PROJECT GOAL, OBJECTIVE, OUTPUTS & ACTIVITIES (LOGICAL FRAMEWORK)

7. PROJECT GOAL / IMPACT

49. **The goal** of this project is **to provide the pathway for meeting ML regulations for cadmium in cocoa and cocoa-derived products from the LAC region (primarily Colombia, Ecuador, Peru and Trinidad and Tobago).** This is in the face of challenges posed mainly by natural or nonanthropogenic cadmium contamination of soils in Latin America and the Caribbean. By developing capacity and compiling, proposing, and developing best practices for mitigating against problems of cadmium contamination in cocoa, the value chains in the LAC region can be better able to comply with trade requirements, and the research community can be equipped with tools and strategies for supporting the cocoa industry. Further, importing markets will also benefit from continued access to high quality fine flavour cocoa from the LAC region, which is prized among the cocoa industry.

50. Activities and results proposed in this project are important steps towards supporting cocoa research, cultivation, processing, and trade in the region and if successfully implemented, would lead to longer term impacts. The impact of the project will include poverty alleviation and improved livelihoods, access to markets for LAC countries and access to the LAC market for the EU, improved consumer health through reduced heavy metal intake. Each of these could be follow-on effects (long-term impacts) of avoidance of problems caused by cadmium in cocoa. For the present project, maintaining market access by mitigating and remediating some of the problems caused by cadmium in the cocoa production, processing and marketing in the LAC region should be a goal to which progress could be made and can be measured. Indicators to measure the contribution of the project to the goal would be: 1. Established network or working group for LAC to build consensus for mitigating levels of cadmium in cocoa and cocoa products; 2. Agreement among 4 countries on standardized terminology and protocols to test for cadmium in cocoa and technical staff trained to enable comparison of results across LAC 3. Improved knowledge on cadmium hotspots in cocoa growing areas in 4 cocoa producing countries of LAC 4. Curriculum/ modules developed and Master Trainers trained in current best practices to mitigate levels of cadmium in cocoa hot spots to raise awareness in farmers on cadmium issues in cocoa and mitigation strategies. The project logical framework (log frame) is presented in Annex 1.

8. TARGET BENEFICIARIES

51. The immediate beneficiaries of the project will mainly be cocoa public sector agencies, such as lab facilities that conduct tests for cadmium in cocoa and the research community in project countries, and providers of Extension services to farmers. The research community across LAC will better collaborate on research and coordinate their efforts towards understanding and solving issues around cadmium in cocoa taking into account governmental security protocols established to manage the Covid-19 pandemic which limits the development of face-to-face activities. Each partner has strengths and specialisms in carrying out research or trials on a particular topic or in a particular way. Through better

collaboration, capacities will be built to form consensus and derive agreed protocols for testing cadmium and deciphering context based best practices for mitigating cadmium in cocoa. The agreed protocols will be used by labs to provide testing services to farmers and exporters of cocoa. The deciphered best practices will be used to develop modules to Train Master Trainers in Extension Service providers who will then disseminate information to farmers on how to mitigate cadmium levels in the cocoa they produce.

52. The ultimate beneficiaries of this work should be cocoa growers and traders of all scales, within the project countries, and beyond, who are able to continue selling their cocoa to eventual destination markets including the EU. Small scale growers are a particular concern since their livelihoods are especially threatened by loss of income resulting from unsaleable cocoa. The urgency of the problem is highlighted by the observations that socioeconomic impacts are beginning to be seen already as a consequence of the MLs imposed. While cocoa growing is largely a male-dominated pursuit, women are integral to the support of family enterprises which rely heavily on selling their cocoa beans (see below for details). Other value chain actors include post-harvest processors, buyers, and exporters, who rely on sourcing good quality cocoa from the region. These groups would be targeted in project countries through awareness raising activities. Messages raising awareness of the issue will be spread to areas where cadmium levels are elevated, and to other countries within the region, with the aim of spreading the impact of the work to the above groups of beneficiaries in other countries in the region (indirectly).

(a) Gender-related issues

53. During scoping work for the project, each partner organization gave an overview of gender roles and issues in the cocoa sector in their country.

54. In **Colombia**, some areas are heavily affected by conflict so there are more women than men. Despite this, decision making regarding crops is done by men (and they have access to credit), women participate in all chores (where appropriate, but these are mostly postharvest actions since strong labour is required for other roles). Training can be mostly for men, but in many areas, women can be involved in training (for example in technology transfer) because organizations are sometimes chaired by women (when this occurs, it is likely to get more women attending). The rural population is (on average) older than in urban areas.

55. Agricultural practices in **Ecuador** are dominated by men but growing cocoa is an inclusive activity. The women also share the work (close to the home) on harvesting and pod breaking, postharvest processing and packaging. Women participate in meetings and decision making within co-operatives; men and women will represent the family at meetings and they tend to co-own the land. Some farmers will hire women to do administrative work, and associations that involve processing for chocolate will hire women for this.

56. In **Peru** there is an important role of women in cocoa production, as contrast to other activities where women are left aside to care for children or carry out less-demanding activities. In some areas, women can be seen participating in almost every level of the cocoa chain (production, postharvest processes, transformation, trade, and as leaders of their own businesses or associations). This is because of a significant proportion of mothers acting as head of the family due to problems of terrorism and drug trafficking. Some activities are shared between men and women (preparing fertilizers for example) and decision making can be similar. In production, women are more active in selecting seeds, filling bags, and maintaining conditions for certification.

57. Women participate in training when offered- there can be more women than men sometimes- especially in areas with strong levels of international collaboration (which often require a certain percentage of women's involvement). Training is mostly from such international cooperation, so there is no discrimination, but a constraint is that few groups can get a woman to leave the home for a whole week of training- local events are more appropriate. These processes have had an improving influence on initiatives, as they work with the people that do most of the work. Women (as with men) should have access to financing as there is a payment culture in cocoa. This could encourage opportunities to work in added-value activities locally.

58. Cocoa growing in **Trinidad and Tobago** is male-dominated (almost all the farmers are male). It is intensive, the terrain is hilly and physically demanding and the rewards on investment/effort are not high. Cocoa is not seen as a desirable trade. Farms are small in scale and women may be involved in breaking pods and processing (drying, fermenting etc.) at family level, plus women are involved in value addition (the chocolate, beverage, cuisine making process/industry, where men are generally not as involved). The average age of cocoa farmers is high (around 60) and young people favour other professions and there is negativity against farming in general since there are higher paid, easier jobs.

59. Several similarities and differences have been identified which will be used to guide the present project design. For example, in Colombia the population engaged in cocoa farming is old (in the region cocoa is generally not seen as a desirable trade; young people favour other professions), with prevalence of women (due to conflict), whereas in Trinidad men are mostly employed in cocoa pursuits (except in processing and value addition). However, in both cases decisions are made by men.

60. Taken together, lessons for the present project include:

- Women play key roles in cocoa production and processing, particularly in Colombia and Peru, and should be included or targeted as such in any consultations, surveys or communications work
- Targeting of messages to women can be successful through gender-sensitive means- for example, Fedecacao works with a famous female farmer in Santander to be the 'face' of cacao (an official image of women growers) to promote the industry to women.
- Participation of women in activities should be encouraged, taking in mind the typical roles (e.g. in Trinidad women are typically not involved pre-harvest, so targeting messaging on production methods to women may be less beneficial than messages focussed on value addition, although they would need to be aware of the issues).
- Cocoa growers tend to be from older generations in many areas, so it is important not to focus entirely on one high tech (or low-tech) means of messaging. Encouraging young growers to grow cocoa in a Cadmium-aware manner could be done though mobile messaging.
- Implement technological tools for widespread dissemination, taking into account the limitations due to Covid-19.

9. PROJECT OBJECTIVE, OUTPUTS AND ACTIVITIES

61. The Objective of the project is to support countries (Colombia, Ecuador, Peru, and Trinidad) to put in place a coordinated regional pathway to meet the international regulations regarding cadmium concentrations in cocoa and cocoa-derived products.

The **Outputs/Expected Results** are:

1. Platform or network for information sharing and consensus formation amongst premier cadmium in cocoa research agencies for consensus on standardized terminologies, testing

protocols, national strategies for signature by officials and Best Practices for cadmium Mitigation and Remediation in cocoa and cocoa products from Colombia, Ecuador, Peru and Trinidad and Tobago.

2. Technical staff in 4 countries trained in agreed standardized protocols to analyze Cadmium levels in cocoa and cocoa products.
3. Improved Knowledge and Mapping of Cadmium Presence/Hotspots in Cocoa Growing Areas, main causes determined and best practices recommended for mitigation and/or remediation.
4. Curriculum developed for and training of Master Trainers in recommended best practices for raising awareness and dissemination of information on massive scale to cocoa farmers across 4 countries.

Activities : To achieve these results/outputs, the project would perform the following activities:

Expected Result 1: Countries in LAC are supported in their coordination and information sharing efforts on best practices for cadmium mitigation and remediation in cocoa.

Activity 1.0*: Project inception workshop*

62. A virtual inception workshop will be held to launch the project in month two. Attendance to the workshop will include the key implementing partners and all other relevant stakeholder organisations from the countries. Experts from Latin American cocoa producing countries also concerned by the issue of cadmium contamination (Nicaragua, Honduras, Bolivia, Costa Rica, Belize) will be invited to take part in the meeting to promote experience sharing and sub-regional cooperation.

63. The purpose of this meeting is for planning, the participants would agree and finalize the work plan, milestones, budgets and training and capacity building plans. The workshop would also provide the opportunity to discuss and agree progress and outputs for several technical activities such as the glossary of terminology.

Activity 1.1*: Form a Platform on managing heavy metals issues in cocoa to share and systematized relevant knowledge and build consensus on standardized methodologies across the region*

64. Since research activities in the region are disparate and to a large degree uncoordinated between countries, and groups are not sharing information as effectively as they could be, there is a need for a partnership of researchers and decision makers from each country in order to coordinate efforts and share current knowledge and future plans. Whilst there have been several research symposia in the region there does not appear to be a formal working group or network at the regional level. The project partners intend to adopt a more coordinated approach on who is carrying out research on which topic, with what conditions/parameters/variables, and therefore what research outcomes are generated for the mutual benefit of moving the state of cocoa heavy metal research forward. Similarly, systematizing of published and unpublished documentation is desirable to fast-track sharing of knowledge. Thus far organisations in Ecuador and Peru have published some work on cadmium in cocoa, as have Trinidad & Tobago, but there is a wealth of knowledge and data within each country and institute that would benefit all sides if published, or at least shared. The Platform for the working group could also function as a data repository collating information on Cd levels in soils and cocoa beans and efforts taken to date to mitigate the issue. It should be noted that publication of sensitive information would be carefully considered for example

areas of countries that suffer from high cadmium amounts (Since a danger would be to put local economies at risk from alerting buyers unnecessarily to issues that may or may not be founded in fact).

65. External to the project Platform, formation of a working group has already commenced through those present, sharing and contributing to the discussion during the workshop in Lima (2017). Such an operational working group would have the workshop participants at its core, with addition of representatives from (for example) ministries of agriculture.

66. The roles/responsibilities of the working group can include: meeting at least twice per year, with internal communications in between so that the working group have the most current knowledge on which to package recommendations and make strategic decisions (with researchers joining (or communicating) to provide updates on their progress in developing means for cadmium mitigation and remediation); maintaining a catalogue of projects relating to cocoa growing/processing/trading in project countries; reviewing research findings as they come out in published research and from meetings, and from the project participants; prioritising what research work should focus on and how resources are distributed (focussing not just what individual groups wish to work on, but what the community should prioritise); explaining their plans/strategies on what work needs doing in each country, in parallel or separately but avoiding duplication; engaging with higher level bodies that set standards and strategies for research into cocoa (the project will advocate for inclusion of cadmium awareness, mitigation and remediation into other extension and awareness programmes such as general labour certification and those reaching roundtables of producers); fielding and recording enquiries from importers/companies regarding heavy metals in cocoa from the region (cooperating as a regional unit would be beneficial should there be need to liaise with and provide data to standard setting bodies or industry; they would come from a credible source). A partnership agreement between parties will be required before project funding is contracted; a relatively simple document should be made between partner organisations and should initially be made with minimum complication, with the assistance of ICCO.

67. A wider network would be engaged for project implementation and to disseminate information (including authorities and groups involved in extension). Additional partners/associates involved for project work and other involvement would be project associates (e.g. NGOs, other universities, international cooperation agencies, councils on science and technology, and existing networks). For example, in Peru a working group analysed harmonization of soil sampling methodologies, and the protocols have been approved. Project partners would interact with national bodies such as standard setting and food safety/SPS authorities, some of whom would be represented in the working group. Engagement of private sector actors would also be essential, including cocoa producers and exporters; for the fine flavour sector there is often a requirement for quality certification (sustainability certification e.g. Fairtrade, plus quality certification). Incorporating cadmium mitigation and remediation in such processes could be important since it is likely that chocolate manufacturers will be demanding this more and more.

68. As well as coordination between the project countries being low, direct interaction/alignment with work elsewhere in the region needs to be stronger (notwithstanding with some notable, laudable exceptions detailed in Section 4). To broaden reach and buy-in, the working group will identify who to approach in other countries (with assistance from IICA) and engage representatives at regional level (e.g. technical roundtables) and other bodies and blocks in the region, through attendance at events and meetings, and through personal communication. The aim here is to communicate research findings, policy advice and exchange other support beyond the project countries. These would include CARICOM countries and countries involved in CAF's ILAC programme.

***Activity 1.2**: Development of a common terminology, methodologies for measurement and manuals that bring together current best-practices for cadmium mitigation and remediation*

69. While researchers in each country are conducting valuable and good quality research, use of terminology when reporting results of projects on cadmium in cocoa is often confusing and inexact particularly when referring to the different parts of cocoa beans (e.g. bean, testa, nib, almond, skin, husk) and is not always evident which part the resulting analysis is referring to. The standard protocols / methodologies / equipment for sampling, extraction and analysis of Cd levels in soils and cocoa tissues as well as standard reference materials for analysis are not aligned between organizations and countries. Although each action no doubt has merit, this makes it difficult to make direct comparisons between studies and bodies of work. There is a need to resolve terminology issues with a common language regarding the anatomy of the cocoa pod tissues that are sampled, and for the units measured and recorded. This may appear a minor action but it is only through rigorous data and reporting that methods can be shared and evidence can be validated.

70. A glossary of terms will be created for cocoa researchers to follow (in heavy metals research in particular). This would be a list of synonyms, with explanation of the differences, and is important for technical documents. In agreeing a common terminology, compilation and comparison of best practice measures and recommendations would become easier straight away (Activities 1.3 and 4.1). National representatives would provide the terms they use (eg via a survey), using Codex and standards as a starting point where necessary. The production of this glossary/guide will be discussed and finalised at the inception meeting, which would include members from each project country.

71. During the scoping workshop (Lima, 2017), the group acknowledged that there could be difficulties in employing or enforcing common standards (for analytical work) when each country has their own approaches, setup, level of investment, and equipment. However, through harmonization of standards the authorities and research community can better regulate and give stronger evidence of compliance and efforts towards compliance. Therefore, further to aligning terminology, the use of agreed/standardized and robust methodologies for sampling and cadmium level analyses (and other physico-chemical measures) should be done to enable a good level of comparison between studies. Along with sampling and analytical methodologies, there needs to be agreement on standard reference materials to be used between institute for laboratory analysis of cadmium levels in soils and tissues. The current reference material level used by many institutes for cadmium detection in cocoa is 0.07ppm, which is too low. Chocolate has a lowest permitted ML of 0.1, and so 0.3 should be used as reference material, since this is closer to the actual regulation. Participants will agree on a reference material, and endorse it for use in other institutes. This could be an FDA reference material with fairly high cadmium level, which is used by some as a reference for compliance with the EU regulations. This would be used to calibrate equipment and validate measurements.

72. By understanding what we can do about mitigation/remediation practices presently known from recent and current research (however limited at a particular point in time), project stakeholders can be more specific in providing some support that is badly needed by cocoa value chain participants. There is an urgent need (which will persist during the project period) to bring together the current best practices for compiling, evaluating, validating and packaging, and sharing with beneficiaries. This activity will develop recommendations for each producing country based on research and knowledge to date (being updated during the project, and to include recommendations to avoid cocoa growing where necessary), forming a manual from the knowledge available for each country. The manual could include a decision tree and will use information on geological origin of cadmium and anthropogenic origin.

73. Each partner has both a good overview of, and detailed knowledge on, the results from their country, and these will be summarised and compared. The definition and understanding of low, medium and high cadmium soils will be made and within each country, high, medium and low cadmium areas will be identified, as decided by project partners for their respective countries, using the agreed criteria/guidelines. Practices to recommend, based on the current state of knowledge as the project progresses include agronomic cultural practices (pruning, grafting with rootstocks, some soil applications (organic matter, liming), avoidance (reducing cadmium input through screening fertilizers and floodwater), how to manage fertilizer use (plantations often use low amounts of fertilizer except Ecuador), soil type specific approaches (not necessarily site specific) based on low, medium and high cadmium levels. In addition, when cadmium levels are very high, avoidance of cocoa growing could be recommended (see Activity 3.3), with the only likely mitigation strategy being through genetic strategies. The distinction between established cocoa growing areas and newly expanding areas should be made.

74. Project partners and associate research contacts will work via virtual means during the first few months of the project to develop the structure for this document, and bring together enough recommendations to create an initial document for dissemination. This task will be facilitated through the Project Platform as a means with which to move the document forward and update it with new findings should they be developed so that it becomes a working document, for updating and adapting as needed. Since there are existing research projects and some (limited) methods that can be recommended, if feasible an initial draft would be a good 'quick win' for the project. This would then be built on later in the project (and under Activity 4.1) to develop into a guidance code to include stronger and targeted messages based on project findings and current research.

***Activity 1.3**: Consolidating country strategies together towards formation of an overarching regional strategy.*

75. The project Platform will assist members to bring together and update their national strategies for cocoa and heavy metal mitigation and remediation research and development. Each project country has such a document in progress or draft form at least (See Section 3 for more information) and can share expertise and experience from each to develop one another's capacity. The Platform would facilitate NPIAs to look for synergies and this would ultimately be used to agree a way forward at the national and regional levels incorporating what is feasible and relevant to other countries. Government designated Officials from the cocoa sectors will sign off on national strategies for mitigation and/or remediation of cadmium contamination in cocoa and cocoa products from Colombia, Ecuador, Peru and Trinidad and Tobago.

Expected Result 2: Technical capacity for LAC countries to analyse cadmium levels is developed and standardized

***Activity 2.1**: Development of technical training manuals based on standardized terminologies and protocols for analysis of cadmium levels*

76. In addition, the established norm of maximum levels approved by the Codex Alimentarius must be taken into account, also in the Codex the methods of analysis to determine the cadmium in cocoa include the atomic absorption spectrometry of flame (F-AAS), graphite furnace atomic absorption spectrometry (GF-AAS), inductively coupled plasma optical emission spectrometry (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS). The general preparation of the samples can be conducted by digestion in an open system (dry incineration, according to Lee & Low, 1985 or wet digestion, according to Yanus et al., 2014) or in a closed system (microwave, according to Nardi et al..,

2009; Jalbani et al., 2009). Sample preparation depends on the chosen detection method and the use of hydrogen peroxide, may be beneficial in samples with high fat content and in certain analytical methods, however, sample preparation should be according to the method procedure. For example, an open system, such as incineration, can affect the results in techniques with low detection limits, since contamination in these procedures is quite common (Nardi et al., 2009; Villa et al., 2014.

77. The project partners (working group participants and researchers) will propose specific procedures based on standardised methodologies, within working ranges, since different ways of sampling will lead to different results. Chief among these is analysis of cadmium in soil. Extraction methods vary according to soil, equipment and procedure too (for example sampling total cadmium, available cadmium or 'pseudo-total'). The plant is the other main variable. Associates in Peru are working on a guidelines document at present, and a project meeting would be needed to agree on sampling method validation. Comparing deviation and variation between labs can also identify which labs need assistance: the equipment being used would be assessed to see if it will accurately test for cadmium to an agreed standard. If this is not possible for all labs, then samples would have to be processed by those who have the necessary capability. Specific suggestions for these standards will be collected and debated on the project Platform, where a decision would be made on agreed parameters and protocols to adopt across the project countries. The group will also debate and agree on the level of cadmium to be considered a benchmark ML permissible for cocoa beans, such that downstream products should go on to be compliant with the regulation ML for each product type.

78. Most importantly, technical manuals will be developed for standardized protocols to be used by the laboratories in the project implementation countries for sampling, testing and analysis of cadmium contamination.

***Activity 2.2**: Capacity building/training within and between project partners in use of standard methodologies*

79. While expertise within each project partner is well developed in some fields, and to a different degree for different specializations, there is a need to build capacity in measurement of cadmium and adoption of agreed standardized protocols. Training will be held during project year 1 drawing on expertise within and beyond the project consortium. The participants will be the technical staff who have the remit of routine and project-related chemical testing of cocoa samples and will receive the technical manuals. This would include a study trip to Ecuador to hold training in application of methodologies relating to standard setting at University of ESPOL.

80. Develop a proficiency test (analytical aptitude tests or PT proficiency testing) among the laboratories accredited or authorized in the analysis of cadmium in each country, allowing the precision of these laboratories to be measured, as well as the development of a documentary evaluation and evidence on the ability of participating laboratories to produce accurate, safe and reliable results in all 4 countries. Prior to the proficiency test, an initial workshop is considered to address the analytical methods used and coordinate the development of the PTs.

Expected Result 3: Improved knowledge of cadmium presence in cocoa growing areas of project countries through analysis and mapping

81. While aggregation of current knowledge and delivery of best practices will contribute to addressing the issue of cadmium content in cocoa beans (collating all the tools at hand the current best practices, as in Activity 1.2) it is essential that investigation into the scale, location and impact of cadmium issues is conducted in project countries. This would lead to characterisation of the cadmium

problem and development of new cultural/agronomic/postharvest processes for cadmium mitigation. These are short term practical activities that could be achieved within the timescale of the project, and would contribute to the initial toolkit of interventions for farmers against the issue.

Activity 3.1: *Reviewing the scale of contamination and updating maps of hotspots*

82. Each country has some level of knowledge on areas of high and low cadmium presence, for example each having maps for at least discrete geographical areas from recent projects. This activity will fully review the mapping activities already carried out. Organisations have been mapping different parts of countries, and data needs to be collated and decisions made on what constitutes a 'hot spot', so the activity builds on and goes beyond producing maps of cadmium.

83. Strengthening of this knowledge is important for every country and datasets will be compiled and gaps identified. The project partners will collate all cadmium levels mapping data for their country, and bring the data together to compare approaches and units (e.g. soil total cadmium, bioavailable cadmium, and what plant tissues were sampled, if any). They will then each identify areas where no data, or only prediction data, exists and set priority areas of cocoa growing that should be targeted to fill gaps and go in for a deeper investigation (as part of Activity 3.2).

Activity 3.2*: Implement a programme of coordinated testing for cadmium in cocoa, soils, fertilizers and water to complete the mapping*

84. It is important to map the cadmium levels in beans, in order to determine areas for priority action. Looking at cadmium levels in the soils would be done in parallel, but since it's not currently a reliable predictor of the levels in the beans, the measurement in beans is essential. The task will vary in scale by country, with Peru and Ecuador focussing on certain regions (main cocoa areas). Mapping would be done at a fairly coarse level of resolution, and priority areas can be fine-mapped, to include areas of cocoa growing.

85. Once areas for further testing have been identified (Activity 3.1) bean and soil mapping of cadmium presence in each country will be strengthened through a coordinated sampling and testing process. This will employ common terminology and methods, agreed in Activity 1.2 and using the standardized protocols developed by this project. Testing of cocoa bean, soil, water (floodwater and irrigation) and any amendments/applications that are made will be done for the subset of areas.

86. It is very important that the cadmium content of soils is not increased through anthropogenic means. Understanding the effects of accidental addition of cadmium to cocoa farms via the application of fertilizers is an important activity that should achieve short term success in understanding how to manage cadmium. To make sure that (inorganic) fertilisers are not sources of cadmium contamination, mapping work will be followed up with screening of fertilizers and other amendments for cadmium presence. This will be done by testing fertilisers from key sources or suppliers, and cross-checking with cadmium maps and sampling data.

Activity 3.3*: Devise recommendations for high cadmium areas (hotspots)*

87. If areas of high cadmium levels are identified through mapping and sampling work, then these would be classed as high cadmium pockets or 'hotspots' in which growers may need to avoid growing cocoa, or target markets where the stringent cadmium level limit is not an issue. If soils are sampled with high cadmium but are not yet being used to cultivate cocoa, then it should be discouraged. If cocoa is already being grown in a hotspot, possible alternative market destinations could be explored that

would be less restrictive for cadmium content for example cocoa butter, cosmetic products (e.g. alternative uses for cocoa butter). These alterative market opportunities would not be 'fine flavour' of course (which is a priority for the LAC region) and may command a lower farm-gate price. Locally appropriate alternatives to cocoa growing would also need to be recommended to growers, and these would be informed by desk studies and consultations between partners to share current known options (coordinated by the working group as applicable across the countries and region).

88. In all cases, the avoidance of illicit crops should be paramount. Where possible, recommendations would be given during the early phase of the project, with follow-up work adding to this in subsequent months when more information is available on where to target such messaging.

***Activity 3.4**: Testing of cadmium uptake due to cycling of plant material*

89. All cocoa plantations are subject to recycling of plant material from senescing, composted, and (sometimes) pruned materials being left on the ground. There is evidence to suggest that this a potential source of further contamination of soil in the plantation and could be a major contributor that (while potentially difficult or expensive or having other consequences) may be an avoidable source of cadmium; there is a hypothesis that cycling through plant material could be a major contributing factor to cadmium levels. This potential for cadmium re-contamination (via re-distribution) needs to be confirmed and could be a fairly quick way to establish a solid recommendation for cadmium mitigation. Therefore, a short study should be carried out in two project countries to investigate the effects of recycling of plant material on cadmium content in soil, and to determine whether this affects the concentration of cadmium in beans. There is potential here for localised adaptations to then be developed and recommended. This is a feasible and quite urgent piece of work that would complement the understanding on cadmium sources and possible mitigation in the short term. Currently it is suggested that the work take place in Peru and Trinidad.

Expected Result 4: Awareness about cadmium issues is raised among value chain actors

***Activity 4.1**: Curriculum for training, Master Trainers trained and finalization of key messages for awareness raising in farmers and cocoa chain actors*

90. All stakeholders (growers, intermediaries, processors and traders) in affected areas are to be fully informed on all cadmium related issues. A curriculum for Training Master Trainers for reaching participants at each level of the cocoa value chain will be developed. Master trainers from cocoa extension service providers will be trained and recommendations made on the areas they should prioritise for further training/dissemination. This will inform actors in the cocoa supply chain of the current legislation and steps being taken within the countries and region as a whole to remedy the situation. The prioritized areas will include identifying avenues for distribution of awareness materials in each county (and linking with existing programmes, as noted above), and types of materials to be developed, with recommended target audience and defined timeframes. Communication materials need to be gender sensitive and have reference to women's roles in value chain activities where appropriate. Any content targeted at producer level should be gender inclusive.

***Activity 4.2**: Awareness-raising and distributing of best practices*

91. The project would initiate an awareness campaign with Trained Master Trainers for producers and collectors, via mass communications (largely through established methods/means/resources), and through education lead farmers of cooperatives, local government officials and trading companies. This would be achieved through a package of measures, in addition to training of lead farmers', which could

include cropping calendars, manuals, radio, public service television and would link with existing ICT resources (such as apps developed under other projects)). Training for small farmers in Good Agricultural Practices (GAP) under the modality of Field Schools (ECAs) by Master Trainers and trained lead farmers can also be possible once nations regulations for minimizing the spread of Covid-19 permits/are observed.

92. The purpose of the campaign would be to educate and update all cocoa stakeholders on the status of the problem with cadmium in the country (materials and activities would be tailored for the local context) and to provide manuals of the current best practices on mitigation and remediation methods and approaches that can be used by farmers, and to support carrying out the recommendations and monitoring for desired impacts of the practices. The key messaging would also be introduced into existing best practice and extension documentation.

93. The project will also publicise its efforts and results to the wider community: Information will be collected, packaged and provided for use in a representation to (for example) higher level stakeholders like standard setting bodies to present some of the key messages, supported by data from the project, partners and beyond (e.g. information on the impact of cadmium on health). Representatives of Ministries of Agriculture (or the appropriate food safety or trade body) should be involved in this process. The project will also continuously look for synergies with other programmes that are ongoing in the region.

Expected Result 5: Workshops and results dissemination

***Activity 5.0**: Virtual Project inception workshop*

94. Due to disruption caused to travel and quarantining of travels brought on by the Covid-19 pandemic, the inception workshop will be held virtually to launch the project in month two. Participation in the workshop will include the key implementing partners and all other relevant stakeholder organisations from the countries. Experts from Latin American cocoa producing countries also concerned by the issue of cadmium contamination (Nicaragua, Honduras, Bolivia, Costa Rica, Belize) will be invited to take part to the meeting to promote experience sharing and sub-regional cooperation.

95. The purpose of this meeting is for sensitizing relevant stakeholders of the project goals and activities, their roles and responsibilities and the benefits that it will bring to them. The project Steering Committee will be formed to agree and finalize the work plan, milestones, budgets and training and capacity building plans. The workshop would also provide the opportunity to discuss and agree progress and outputs for several technical activities such as the glossary of terminology.

***Activity 5.1**: Mid Term workshop*

96. A, (virtual if Covid-19 outbreaks restricts face to face) mid-term evaluation workshop will be held in Colombia at month 13 of the project to take stock of the overall project implementation, the results achieved, any potential constraints and limitations encountered and remedial measures proposed for futures directions of the project. Attendance to the meeting will include projects partners, scientists and representatives from relevant international organizations such as FAO or Bioversity.

***Activity 5.2**: End of project workshop*

97. A final evaluation workshop will be held in Ecuador in the penultimate month of the project to discuss the results achieved by the project and to ensure dissemination of the project outputs. Attendance

to the meeting will ideally include participants that took part in the inception workshop including project partners, representatives from national institutions and international development agencies, etc.

Expected Result 6: Project coordination, monitoring and evaluation

***Activity 6.1**: Project coordination*

98. The coordination of the project will ensure the effective exchange of information between the project partners, a smooth implementation of the activities and the efficient use of resources in the four participating countries. The PEA will be responsible for the coordination of project implementation by each National Implementing Agencies (NPIAs) and will establish a Project Steering Committee (PSC) that will include representatives from each partner country, as well as from the Project Supervisory Body (PSB). Each NPIA will be responsible for coordinating the project in his respective country, keeping within budget and liaising with the PEA.

99. The PEA will build and maintain communication channels during the project with research institutes and food safety authorities that have worked and are still working on cadmium and other heavy metal contamination to gain from their experience and expertise.

***Activity 6.2**: Project monitoring and evaluation*

100. The PEA will assume overall responsibility for monitoring of progress achieved during the project, based on the information provided by the NPIAs regarding project activities undertaken in each country. This information will be collated in half-yearly reports that will be submitted to funding partners for them to determine whether the objectives set out for that period of time have been achieved.

101. Evaluation of the project will be carried out by STDF, ICCO and co-financing institutions, as appropriate, based on the reports provided by the PEA and on the comparison of baseline and end line data collected. The project evaluation will provide the final assessment of the project in terms of implementation, achievements, outputs and any lessons to be learned for future projects.

10. ENVIRONMENTAL-RELATED ISSUES

102. The project interventions would not entail significant/systemic cause of harm to the environment, for example through significant chemical addition or advocacy. Most interventions to be advocated are based on the current state of knowledge and technology, and are likely to be dependent on cultural practises, so should not be increasing chemical load on the environment. The project would look at any necessary inputs (such as fertilisers or liming/biochar agents) being taken from sustainable sources of low cadmium levels. Avoidance of cadmium in added chemicals will be encouraged early during the project (Activity 3.2; reducing cadmium input through screening fertilizers and floodwater). Adding inputs like lime would have to be monitored for the effects on the environment (aside from on the cocoa trees). As noted above, if areas are found to be so high in available (or total) cadmium, farmers may have to be advised on what else to plant or alternative markets. These should be alternatives to elicit crop production and ideally be low on input demand.

103. In the long term, remediation of land to remove cadmium could be an ambition of the participants, which would have positive effects for other soil (and therefore environmental) chemical parameters.

11. RISKS

Some of the risks foreseen during the implementation of the project are:

- Changes in the legislation/regulations establishing the limits of cadmium contamination in cocoa and cocoa products could become more or less restrictive. If restrictive changes occur then the work may be even more important in mitigating against problems of excess cadmium and may strengthen the case of control and mitigation of cadmium in cocoa beans, so this could strengthen the need for implementation of such activities by national cocoa governing entities.
- The governing entities, such as the ministries of agriculture, are those that have the functions and competences to implement public policies, such as guaranteeing food safety and maybe hesitant to commit the country to implement the agreed national strategies especially if there is a large cost implication. The PEA (IICA) and ICCO can work with these countries to develop appropriate project proposals to contribute towards meeting the financial implications to implement the agreed national strategies to mitigate cadmium in cocoa and cocoa products.
- Securing finance, such as co-financing from project partners is essential to carry out planned project activities on a timely basis. Having agreements in place and ensure partners are aware of their roles and responsibilities at inception will help to reduce this risk.
- As this is a regional project involving multiple partners from the LAC region, delays in decision making and implementation of activities involving multiple actors will be challenging. This will be mitigated through clarification of roles and responsibilities during the project development and initiation phases. An independent organisation can participate to assist this (IICA with support from ICCO).
- Poor collaboration between project partners: Project Supervisory Body (ICCO) can facilitate communications between partners and resolve any conflicts/disagreements that may arise; promote transparency in all project activities; encourage frequent engagement of all project partners at various meetings/events
- Partners in each country are assumed to be willing to share information. This should be the case since the problems in each country are similar and a desire to collaborate has been expressed and agreed. Project supervisory bodies have experience in negotiating data access and advocating for the benefits of open data sharing.
- Changes in key project personnel and partner agencies during the life of the project: robust, well-documented management systems will be established which are not dependent on individuals
- Sensitivities exist regarding heavy metal contamination in soils: Breach of confidentiality could compromise trade potential. Agreements will be developed for what information can and should be shared.
- Adverse climatic conditions, natural disasters are known to affect the LAC region including flooding, landslides, hurricanes, volcanic activity and earthquakes. These have the potential to impact on implementation of project activities in the participating countries. The project activities would be planned to minimize delays or continue in unaffected areas of the country/region.
- Finally, regulations to mitigate the spread of the Covid-19 pandemic, such as lockdowns, limitation on size of gatherings can severely impact the ability of trained Master Trainers to disseminate information to small farmers who are known to learn best in farmer field school or peer-2-peer learning environments. If these impediments to movement and gathering of people are still among the chosen methods to control the spread of the pandemic by the time Master trainers are trained, then a proxy of testing trained Master Trainers for retained learning post their training will be conducted.

12. SUSTAINABILITY

104. The project will be run by reputable, experts, well established organizations and embedded in a valuable partnership established for a common purpose to share technical expertise and collaborate on work that will lead towards protecting the cocoa industry from the threat of cadmium to trade. The formation in 2017 was catalysed by the STDF PPG workshop. Formation of a working group has been based on this partnership and other organizations will be able to join which would set the countries up for longer term collaboration within and between institutes in the region, and from which further projects could be developed and funding sought. Adoption and implementation of the Regional Strategy for Capacity Development and Research (developed during the PPG) would contribute even further to dealing with cadmium issues and is a framework for protecting cocoa crop and products in the longer term.

105. To date, the countries of Ecuador, Colombia and Peru have a coordination platform with the CIAT-Bioversity International Alliance; through which the project "Low cadmium and climate relevant innovation to promote sustainable cocoa production" is being implemented, financed with EU resources. Trinidad and Tobago will be encouraged to join this platform.

106. Added value of the project would be a catalytic role for expanding work in the region and part of the process will be to engage and disseminate beyond the direct project partners/beneficiaries. Bringing in project participants and wider stakeholders during the project would also encourage both ownership (within the project) and replicability to other initiatives. The project approach is replicable: demonstrating success of the project, or certain approaches, could lead to it being self–sustaining, and may even give the partners and related agencies the remit to expand the same (or a parallel) project to the region, or to adapt the approach to other SPS issues. Standards and approaches developed can used in different countries, and best practices can be tried in similar ecological areas/cropping systems.

107. The time when the EU's ML comes into force has arrived and other regulation setting bodies may then follow suit such as Codex or American authorities. Therefore, we feel that a longer-term outlook is important (as noted in the Regional Strategy for Capacity Development and Research document in which the medium- and longer-term research priorities identified in the scoping are outlined). The partnership includes research organizations and international trade and development organizations that can link with policy level authorities, so there is hope that positive advocacy for reasonable MLs from regulatory bodies may be possible, which could alleviate the issue.

108. Cocoa farm gate prices for fine and flavour cocoa must be increased to adequately compensate farmers for implementation of recommended bets practices to mitigate for cadmium levels in cocoa and cocoa products for the project to achieve the desired purpose. This position can be negotiated by the ICCO on behalf of its member countries in this project.

III. BUDGET

13. ESTIMATED BUDGET

109. The estimated total cost of the project is about US$ 550,583 out of which US$ 381,945 will be sourced from the STDF as grant financing, US$64,898 will be sourced the European Development Fund (EDF) for the Economic Partnership Agreement/CARICOM Single Market and Economy (EPA/CSME) programme. Budget summary tables are shown in **Appendix 3.**

14. COST-EFFECTIVENESS

110. As described above, the ML is now in force, and the possibility of further such restrictions from other importing bodies poses a serious threat to incomes and livelihoods. The issue may become compounded somewhat because Codex have recently released new guidelines on cadmium MLs in food stuffs (semi-finished products). If there is no response to the threat then cocoa growers in areas beset by problems of cadmium presence (and those for whom sales are affected by association, i.e. by the loss of market through avoidance of produce at the local or national level by importers) will surely suffer. For the relevant research institutes, national bodies and the international development community to do nothing would be putting cocoa growers' livelihoods at risk. The cost to growers is at present not quantified and this could be an aspect of the proposed project work in order to understand the impact of the incoming restrictions.

111. The coordination of efforts between organizations and the alignment of methodologies are seen as being far more efficient and cost-effective ways of developing and proposing solutions to the avoidance of cadmium in cocoa than were each research institute or company acting independently. Independent working not only risks activities being duplicated, but also that they are not directly comparable, which undermines their validity and their applicability over a wider range of countries (limiting their value). This is poor investment of resources compared with use of well aligned standards and methodologies yielding results that are comparable; it is better to take a coordinated approach with aligned (but not duplicated) activities. Methodologies and approaches will be shared with the broader region.

112. There is, to date, little evidence of in-country rejections, based on bean batches, but this is at present still anecdotal with no firm evidence. Incidences of rejection of samples by buyers, middlemen should be captured during the project; evidence for impacts on loss of income should be established in that the benefits of avoiding the issue need to be quantified as well as the costs of doing nothing.

113. In some cases, a cocoa grower does not have a viable alternative crop so the impact would be far greater. In heavily contaminated land, the project would not enforce mitigation activities but may well recommend that a farmer stop growing cocoa or use the cocoa produced for other purposes like cosmetics, or cocoa butter to make milk chocolate (since cadmium does not accumulate in the butter). Such produce would not be of 'fine flavour' standard of course. Maintenance of the Region's reputation for fine flavour cocoa is of major concern for stakeholders in the countries, and should be borne in mind. When considering recommending alternative markets, or crops, there would need to be something in place to support growers in getting a fair price, or developing value-add products.

114. At the project activity level, the work should be as cost effective as possible. The action will be managed and implemented by a core group of project partners, with minimal need for contracting third parties (external consultants or implementing agencies). Where expertise is not available within the partnership (or associate organizations) then this would be sought (e.g. for the above cost-benefit analysis) but on the whole the project would be implemented by the project partners. A large portion of the project costs represent in kind and cash contributions, largely in the form of staff time.

115. Project costs have been rationalised where possible through minimising travel budgets (e.g. by combining events and having international meetings in the countries with lower unit costs for subsistence). Use of existing resources, or development of materials from existing versions, such as training manuals, dissemination materials, represents a more efficient and cost-effective method for implementation than does beginning afresh with brand new materials. Use of means of mass

communications and spreading of messages to producers via intermediaries can be seen as cost-effective ways to approach a broad audience with project outputs, and the project will link with existing project outputs and resources. Capacity and equipment within each partner should be adequate for measurement of cadmium in cocoa beans/products, and countries' labs should be able to adopt the standards agreed during the project. Some investment may be necessary though, and some allowance for this has been made in the budget.

IV. PROJECT IMPLEMENTATION & MANAGEMENT

15. IMPLEMENTING ORGANIZATION

Project Executing Agency (PEA)

116. The Inter-America Institute for Cooperation on Agriculture (IICA) will be the PEA. The PEA would be responsible for the coordination of project which would be implemented by the individual National Implementing Agencies. Additional administrative and logistical support will also be required by the PEA, as well as the day to-day financial management of the project.

117. IICA delegations may choose to participate in the regional working group (they have representatives in all four project countries, are heavily involved in food safety, and have ongoing work in this field). They are intergovernmental and so could play a neutral brokerage role, and have a remit for food safety and are members of the STDF Working Group.

National Project Implementation Agencies (NPIAs)

118. **Trinidad and Tobago**: the NPIA for Trinidad and Tobago (T&T) will be The Cocoa Research Centre (CRC). The CRC would be responsible for the implementation of the project activities in T&T and the execution of financial resources to support the project activities. As a global leader in the conservation and characterization of cocoa germplasm, the CRC collaborates with international researchers in pathology, molecular diagnostics and morphological characterization. Other services provided include, analyses of factors influencing chemical and sensory quality attributes, optimization of micro-fermentations, development of cocoa quality standards, DNA fingerprinting and genetic diversity, cadmium mitigation and remediation research, and improving the efficiency of propagation. CRC also supports business entrepreneurs through training programmes, such as chocolate making course. Additionally, they produce a 70% dark chocolate bar for sale, made exclusively from their cocoa collection of over 2000 varieties. The CRC is proud to be custodian of the largest public collection of cocoa genetic resources in the world.

119. **Colombia**: The NPIA for Colombia will be the Colombian Agricultural Research Corporation (AGROSAVIA). AGROSAVIA is a decentralized non-profit public entity, of a scientific and technical nature, with the mandate for the generation of scientific knowledge and agricultural technological development through scientific research, adaptation of technologies, transfer and consulting in order to improve the competitiveness of production, equity in the distribution of the benefits of technology, sustainability in the use of natural resources, flexibility of scientific capacity and Colombian technology and contribute to raising the quality of life of the population. Specifically, for cocoa, Agrosavia hosts the Cocoa innovation network that seeks to contribute to improving the competitiveness of the cocoa production sector, through the generation and transfer of knowledge and technological offerings (TO) generated through the corporation of third parties, promoting environmental sustainability and the socioeconomic development of the main producing departments in Colombia.

120**.** **Peru**: The NPIA for Peru will be The Ministry of Agriculture and Irrigation (MINAGRI), through the General Agricultural Directorate. MINAGRI is in charge of promoting the sustainable productive and commercial development of agricultural products, access to national and international markets and financial and insurance services, in coordination with the sectors and institutions competent in the matter. MINAGRI also promotes a competitive national agricultural sector, with sustainable added value in accordance with the National Agrarian Policy, MINAGRI will be the Focal Point of coordination within the framework of the project implementing activities through two of its research and development agencies INIA and SENASA. The National Institute of Agrarian Innovation (INIA), is the governing body of the National System of Agricultural Innovation and is a Specialized Technical Organization of the MINAGRI, which contributes to equitable, sustainable and competitive economic growth through the provision of specialized services (research and technology transfer) in the field of Agrarian Innovation. The National Service of Agrarian Health (SENASA) is a specialized Technical Public Organisation of the MINAGRI with official authority in matters of agrarian health, quality of supplies, organic production and food safety. Both INIA and SENASA will be implementing project activities according to their functions and competences.

121. **Ecuador:** The NPIA for Ecuador will be Instituto Nacional de Investigaciones Agropecuarias (INIAP). INIAP is a public entity with legal personality and its own assets, attached to the governing ministry of agrarian policy (MAG), whose primary purposes are: to promote scientific research, generation, validation and dissemination of technologies in the agricultural sector and forest production, within the scope of its powers.

122. INIAP's mission is to provide specialized technology and services to drive national agricultural innovation. Its main objective is to research, generate knowledge, develop and adapt technologies, in order to increase the competitiveness of agro-productive chains and contribute to the country's food security. INIAP currently has seven Stations and seven Experimental Farms strategically located in various agro-ecological regions in the main food-producing areas of the country. In addition, it has the Department of Soil and Water Management (DMSA) and the Cocoa and Coffee Program (PCC) of the Pichilingue Tropical Experimental Station (EETP), located in the center of the Ecuadorian Coast, being strategic for cocoa cultivation. The DMSA Research group aims to determine the nutritional requirements of crops, as well as variations in the physical and chemical characteristics of the soil, due to the effects of anthropogenic actions and to design management techniques; meanwhile, the PCC is in charge of evaluating management and genetic improvement technologies of this crop.

123. The DMSA, for 29 years, has been investigating the presence of Cd in cocoa and almond soils (mapping, sources of contamination, use of mineral and organic amendments), the results of which have served as a basis for Ecuador and the cocoa producing countries in Latin America, to negotiate the maximum permitted limits of Cd in almonds in the Codex Alimentarius regulation; In addition, it has a laboratory equipped for the chemical and physical analysis of soils, tissue and water, a greenhouse, rooms for conferences and meetings.

16. PROJECT MANAGEMENT

124. *Project Steering Committee (PSC):* The PSC will be responsible for the overall coordination, monitoring, supervision and evaluation of the project. The PSC will provide strategic direction to project implementation and be a source of backstopping. The PSC will be composed of main project partner organisations and some additional key governmental bodies and may include authorities and groups involved in extension.

125. A partnership agreement will be required before project funding is contracted; letters/MoUs will be made at partner level, not country level, and should initially be made with minimum complication, with the PEA.

126. Additional partners/associates involved for project work and other involvement would be project associates (e.g. NGOs, other universities, international cooperation agencies, councils on science and technology, and existing networks). For example, in Peru, a working group is analysing harmonization of soil sampling methodologies, the working group and outcomes of which would be consulted. Engagement of players at regional level (e.g. technical roundtables) will be done through national partners and *ad hoc* involvement of relevant stakeholders. Engagement and involvement of private sector actors would also be essential important, including cocoa producers and exporters. This should lead to collaborative working approaches including sharing of samples, studentships, exchange activities.

127. The success of the project will depend largely on collaboration and cooperation of all project partners and how critical information is shared among the partners. The PEA will put in place a systematic mechanism or Platform for continuous flow of information among project partners.

V. REPORTING, MONITORING & EVALUATION

17. PROJECT REPORTING

128. *Inception, mid-term project and end-of-project workshop meetings:* A virtual inception workshop will be held to launch the project in month two. In addition, a second workshop will be held mid-term in Colombia to monitor the progress of the project during month 13 at which the team will review progress and plan the year ahead in further detail. An end-of-project workshop will be held in Ecuador in the penultimate month of the project to discuss lessons learned and collate data relating to indicators measured, for comparison with baseline data in carrying out project evaluation. Meetings in countries will be dictated by current Covid-19 travel restrictions and quarantine measures.

129. *Progress Reports:* The PEA will develop and deliver a report after project inception, which will be followed by six monthly progress reports. Partner contributions will be collated and consolidated into one report for feedback and approval from the funding bodies. These reports will include reporting against indicators and proposed M & E work, which will summarise the progress of the project against agreed milestones. Budgetary spend and progress/issues from this side will be detailed and summarised. Project meeting reports will be incorporated into the six-monthly ones, and a final end-of-project report will consolidate project findings, achievements and the outlook on the issue of heavy metal contamination in cocoa, and the situation as it develops during the project lifespan.

130. The end-of-project report will be shared electronically with all project partners, research institutes and food safety authorities.

18. MONITORING AND EVALUATION, INCLUDING PERFORMANCE INDICATORS

131. An M & E strategy will be developed that meets the required indicators in the project Logical Framework (Appendix 1) which may also meet other multiple stakeholder needs – government, corporate, farmers, and partner organizations. This information can also be used for accountability to investors/donors, future assessments of project impact, institutional learning, and improvement and support of sound decision making during the project and for any follow-on work.

132. Further, NPIAs will collect and analyse data including awareness levels, along with indications of production and income levels which would form part of the baseline data for the project. This would involve measuring the situation at the start of the project, for comparison with the situation later on and at the end of the project. Baseline data for the project will include measuring awareness of the cadmium issue among different value chain actors, cadmium levels in some samples of beans and produce, and collection and analysis of data including production and income levels (measuring the situation at the start of the project, for comparison with the situation later on and at the end of the project).

133. NPIAs would use the benchmark to demonstrate its achievements in each country in terms of increasing awareness of the issues and mitigating practices relating to cadmium in cocoa, and potentially capturing data or stories about maintaining market access and incomes for value chain participants, through measurement of progress against indicators at the end of the project.

134. Evidence of increased awareness of cadmium issues in cocoa and adoption of mitigation and remediation practices can be measured at the field level by NPIAs. At the technical and implementation level, improved regional knowledge sharing and coordination will be captured and assessed. All of this information will also be important for advocacy initiatives that would use evidence such as case studies, communicating qualitative stories of change for users.

19. DISSEMINATION OF THE PROJECTS RESULTS

135. There are activities in the project outline, logframe and budget that serve to disseminate key messages developed by the project.

136. Project communication materials such as manuals, advisory methods and materials would be updated during the project with improved best practice recommendations or technologies for mitigating or reducing cadmium content in cocoa. Externally, project findings will be communicated with some caution across borders so as not to highlight the issue of cadmium in cocoa of LAC region origin to the general public in a way that causes undue concern. Where possible, scientific papers would be published (prioritising open access journals), project stories (such as case studies of participants and beneficiaries) would be published via partners' websites and other open access sources (e.g. social media).

137. The results of the project will be useful as inputs to the work of two electronic working groups of the Codex Committee on Contaminants in Foods i.e. 1) "Establishment of maximum levels for Cd in remaining categories of chocolates and cocoa-derived products"; and 2) "Development of a Code of practice for the prevention and reduction of Cd contamination in cocoa beans".

APPENDIX 1: LOGICAL FRAMEWORK

Results	Measurable indicators / targets	Sources and means of verification	Assumptions and risks
Goal: Countries (Colombia, Ecuador, Peru, and Trinidad & Tobago) maintain market access for cocoa and cocoa-derived products	Project countries maintain market share for cocoa and cocoa products export disaggregated by country *STDF Indicator: Evidence of market access and exports/imports directly facilitated through STDF support, with particular attention to climate change, environment, gender and inclusion* Increase in value of exports of cocoa and cocoa derived products from project countries disaggregated by country *STDF Indicator: x U$ value of exports for target HS code products and target markets (i.e., regional, intra-regional, global, etc.)*	Import and export data on cocoa from LAC region (from regional and international markets)	A: EU will enforce the directive (from January 2019) A: Market for cocoa from LAC has not been diminished irreversibly R: Other countries and trading blocs may follow suit in introducing similar or even more stringent legislation
Purpose: Countries (Colombia, Ecuador, Peru, and Trinidad & Tobago) comply with international standards and import requirements for cadmium limits in cocoa and cocoa-derived products	Number of rejections of cocoa and cocoa derived products from project countries disaggregated by country *STDF Indicator: # of SPS non-compliance alerts/notifications*	Rejections databases from importing countries UNIDO Standards Compliance Analytics (SCA) platform Monitoring of cadmium in cocoa beans carried out in-country Published information on cadmium levels in products	A: Best practices for cadmium mitigation and remediation are going to be effective R: Political disturbances unrest may hamper work in project areas (contingency required) R: Competition from other crops including illicit crops R: Natural disasters and Covid-19 control measures may slow down project progress
Outcome 1: Standardized testing protocols and best practices applied by laboratories in project countries	Drafting of standardized testing protocols to be used by laboratories in project countries *STDF Indicator: # of STDF initiatives and PPGs/PGs contributing to changes in SPS legislation, regulation, policies, strategies, structures and/or processes, including attention to cross-cutting issues (climate change, environment, gender, inclusion)* # of labs adopting the new standardizes testing protocols *STDF Indicator: Evidence of improved implementation and enforcement of food safety, animal and/or plant health measures for trade, with attention to climate change, environment, gender and inclusion*	Reports from meetings Glossary of terminology Standardized cadmium testing protocols Official endorsement of national strategies for mitigating cadmium in cocoa in project countries # of tests conducted by laboratories in project countries using standardized protocol	A: Testing protocols are used and enforced A: Project partners and other organizations willing to share information A: Agreement on which aspects of existing research contributes to best practice R: There may not be capacity in-country to conduct cost benefit analysis (A: country partner can support, with lead taken from external party)

Output 1.1: Regional platform established on standardized testing protocols by lead research agencies from Colombia, Ecuador, Peru and Trinidad and Tobago	Regional platform of lead research agencies from project countries to build consensus established *STDF Indicator: #, type of collaborative networks, relationships, initiatives at global, regional and/or national level that support the delivery of change in SPS systems, including attention to partnerships addressing climate change, environment, gender and inclusion* Four National strategies developed for Colombia, Ecuador, Peru and Trinidad and Tobago, based on agreed standardized protocols for testing and mitigating of cadmium levels in cocoa and cocoa products *STDF Indicator: # and type of STDF knowledge products completed/published*	Documents signed by officials from Colombia, Ecuador, Peru and Trinidad and Tobago endorsing national strategies based on agreed standardized protocols for testing and mitigating of cadmium levels in cocoa and cocoa products	A: Authorities in partner countries will accept the recommendations from the project Platform/Network
Activities: 1.1.1.			
Output 1.2: Technical staff trained in agreed standardized protocols to analyze Cadmium Levels in cocoa and cocoa products	# of Scientists and technicians from Colombia, Ecuador, Peru, and Trinidad Tobago trained in agreed standardized laboratory protocols for cadmium testing in cocoa and cocoa products *STDF Indicator: Evidence of uptake and application of good practices and knowledge products produced by STDF to inform and support SPS capacity development led by global/regional/national bodies* One glossary of standardized regional terminologies One manual for testing protocols for cadmium levels in cocoa and cocoa products developed and agreed upon		A: Other countries in LAC will accept and can implement standardized protocols A: Relevant authorities in Colombia, Ecuador, Peru and Trinidad and Tobago take definitive actions to implement agreed protocols and strategies to mitigate for cadmium levels in cocoa and cocoa products
Activities: 1.2.1.			
Outcome 2: Knowledge on best practices to mitigate cadmium levels transferred to farmers from master trainers	Number of farmers reached by master trainers with best practices on cadmium mitigation and remediation in the project countries *STDF Indicator: # of people reached (disaggregated by women/men and geography/region) with STDF good practices, knowledge products* At least 10 bulletins/messages developed and one paper submitted to journal for publication	Reports from meetings Newspaper articles, videos, radio talk shows for massive awareness raising among cocoa producers. Bulletins/messages for Government Information Services to raise awareness on cadmium contamination in cocoa chain actors.	A: Farmers in hotspot areas apply best practices on cadmium mitigation/remediation. R: Necessary facilities may not be available to trained research groups and technicians in country to fully implement agreed protocols and best practices for cadmium mitigation in

	STDF Indicator: # and type of STDF knowledge products completed/published	Paper submitted to peer reviewed journal	cocoa and cocoa products in all 4 countries
Output 2.1: Improved knowledge of countries on possible sources for cadmium presence in the cocoa growing areas through analysis and mapping of hotspots	At least 4 updated maps on cadmium hotspots in cocoa growing areas of project countries *STDF Indicator: # and type of STDF knowledge products completed/published* Evidence of tests conducted on at least 4 potential sources of cadmium contamination for cocoa in project countries One manual with appropriate best practices to mitigate/ remediate cadmium levels in cocoa and cocoa products from hotspots *STDF Indicator: # and type of STDF knowledge products completed/published*	Updated technical maps for cadmium presence in cocoa soils in project countries Reports from tests conducted Manual on agreed best practices to mitigate for cadmium levels in cocoa and cocoa products from hotspots for project countries	R: Information on cadmium issues in country may not be openly shared between partners at project onset
Activities: 2.1.1.			
Output 2.2: Master trainers from cocoa extension service providers trained on best practices to mitigate cadmium levels in hotspots	One curricula developed for training Master Trainers of cocoa extension service providers in agreed best practices for mitigating cadmium contamination in cocoa and cocoa products from hotspots *STDF Indicator: # and type of STDF knowledge products completed/published* At least 30 Master Trainers trained from cocoa extension service providers in project countries for massive dissemination of best practices to cocoa farmers *STDF Indicator: # of people reached (disaggregated by women/men and geography/region) with STDF good practices, knowledge products*	Curricula for Training of Master trainers in best practices to mitigate cadmium levels Reports of the training activities	A: Master Trainers are facilitated in raising awareness at farmer and cocoa chain-actors levels in all 4 countries R: Retained memory in Master Trainers may have to be measured
Activities: 2.2.1.			

Activities: 1.1 Platform to share knowledge and methodologies across the region and relevant knowledge systematized 1.2 Standardized terminology and methodologies for measurement and management of cadmium in cocoa 1.3 User appropriate manual and Official endorsement of updated national strategies. 2.1 Curriculum and Technical manual with agreed standards and reference materials for sampling and analysis methodologies 2.2 Training technical staff within and between project partners in use of standard methodologies 3.1 Updating maps of cadmium contamination in identified hotspots 3.2 Implement a programme of coordinated testing for cadmium in cocoa, soils, fertilizers and water to complete the mapping. Testing of cadmium uptake due to cycling of plant material 3.3 Devise appropriate mitigation recommendations for high cadmium areas (hotspots) 3.4 Testing Cd uptake due to cycling of plant materials 4.1 Curriculum developed and Trained Master trainers from cocoa extension providers 4.2 Awareness-raising and distributing of best practices 5.1-5.3 Workshops and Results Dissemination 6.1-6.2 Project Coordination, Monitoring and Evaluation	**Output 1 (US$ 76,020)** - Framework of Support for Coordination and Information Sharing on Best Practices for cadmium Mitigation and Remediation. **Output 2 (US$ 33,611)** - Enhanced and standardized Capacity to Analyze Cadmium Levels**. Output 3 (US$ 107,516)** - Improved Knowledge of Cadmium Presence in Cocoa Growing Areas Through Analysis and Mapping. **Output 4 (US$ 74,188)** - Awareness on Cadmium Issues Among Stakeholders in the Cocoa Supply Chain. **Output 5 (US$ 112,597)** - Workshops and Results Dissemination. **Output 6 (US$ 111,930)** - Project Coordination, Monitoring and Evaluation	Progress reports on project implementation; mid-term evaluation report; annual audit reports and project completion reports	A: Funding available: in-kind/financing available in-country for training A: Willingness and availability of extension services private and public A: Support from project associates or national political representatives can be leveraged to interact with standard setting bodies R: Political disturbances unrest may hamper work in project areas (contingency required) R: Competition from other crops including illicit crops R: Natural disasters: earthquake, flooding, volcanic activity, extreme weather events

APPENDIX 2: WORK PLAN

No.	Activities	Project Year 1				Project Year 2				Lead Partner / (Collab Partners)
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Expected Result 1:										
1.0	Virtual Inception workshop									PEA, ICCO (with all partners)
1.1	Platform/network formed for consensus building among research agencies in 4 countries and relevant knowledge systematized									PEA with Lead partner from each country
1.2	Standardized terminologies, testing protocols and best practices manual developed to manage cadmium issues in cocoa and cocoa products from LAC towards meeting regulatory requirements									Lead partner from each country, PEA
1.3	User appropriate manual and updated national strategies signed by Officials for mitigating cadmium levels in cocoa and cocoa products from 4 countries									Lead partner from each country
Expected Result 2:										
2.1	Curriculum and Technical manual with agreed standards and reference materials for sampling and analysis methodologies									Lead partner from each country
2.2	Trained technicians from 4 countries in agreed standardized testing protocols									Ecuador with lead partners, PEA
Expected Result 3:										
3.1	Updated hotspot maps upon reviewing scale of contamination									Lead partner from each country
3.2	Programme of coordinated testing for cadmium in cocoa, soils, fertilizers and water to complete the mapping									Lead partner from each country
3.3	Recommendations devised for high cadmium areas (hotspots)									Lead partner from each country
3.4	Testing of cadmium uptake due to cycling of plant material									Lead partner from each country
Expected Result 4:										
4.1	Curriculum developed and Trained Masters trainers from cocoa extension providers									Lead partner from each country, PEA
4.2	Awareness-raising and distributing of best practices									Lead partner from each country, PEA
Expected Result 5:										
5.1	Virtual Inception Workshop									PEA, ICCO, Lead partners from each country
5.2	Mid Term workshop									Colombia, PEA, ICCO, Lead partners from each country
5.3	End of project workshop									Ecuador, PEA, ICCO, Lead partners from each country
Expected Result 6:										
6.1	Project coordination									PEA, Lead partners from each country
6.2	Project management monitoring and evaluation									PEA, Lead partners from each country

APPENDIX 3: BUDGET

Activity	Project Activity	Inputs Required	Sub Total Cost	5% Cont.	Total Cost	Sources of Financing		
						STDF	Co-financing	Counterpart
Output 1	**Platform for Consensus building and Information Sharing on Best Practices for cadmium Mitigation and Remediation**							
Activity 1.1	Platform/network formed for consensus building among research agencies in 4 countries with relevant research literature catalogued and organized	Technical assistance (Platform Lead Consultant)	15,000	750	15,750	15,750	-	-
		Technical assistance-(NPIA)	8,000	400	8,400	-	2,100	6,300
		Technical assistance (Information Specialist)	8,000	400	8,400	8,400	-	-
		Consumables lumpsum	4,000	200	4,200	3,150	1,050	
Activity 1.2	Standardized terminologies, testing protocols and best practices developed to manage cadmium issues in cocoa and cocoa products from LAC towards meeting regulatory requirements	Technical assistance	8,000	400	8,400	4,200	2,100	2,100
		Technical assistance (Technical translator)	15,000	750	15,750	15,750		-
Activity 1.3	User appropriate manuals and updated national country strategies signed by Officials for mitigating cadmium levels in cocoa and cocoa products from 4 countries	Communication Specialist	12,000	600	12,600	12,600	-	-
		Technical assistance	2,400	120	2,520	-	630	1,890
Output 2	**Enhanced and standardized Capacity to Analyze Cadmium Levels**			-	-			
Activity 2.1	Curriculum for standardized methodologies for measurement and management of cadmium in cocoa	Technical assistance	6,000	300	6,300	-	-	6,300
		Technical assistance (consultant)	1,650	83	1,733	1,733	-	-
Activity 2.2	Capacity building/training within and between project partners in use of standard methodologies	Accommodation and Subsistence	9,660	483	10,143	6,762	3,381	-
		Consumables lumpsum	-	-	-	-	-	-
		Equipment lumpsum	-	-	-	-	-	-
		Flight	4,300	215	4,515	2,625	1,890	-
		Technical assistance	10,400	520	10,920	-	2,100	8,820
Output 3	**Improved Knowledge of Cadmium Presence in Cocoa Growing Areas Through Analysis and Mapping**			-	-			
Activity 3.1	Reviewing of the scale of contamination and identification of hotspots	Technical assistance	7,000	350	7,350	-	1,575	5,775

Activity 3.2	Implement a programme of coordinated testing for cadmium in cocoa, soils, fertilizers and water to complete the mapping	Consumables lumpsum	24,300	1215	25,515	16,681	8,834	-
		Labour and field materials lumpsum	15,000	750	15,750	10,500	5,250	-
		Local travel lumpsum	12,500	625	13,125	10,500	2,625	-
		Technical assistance	8,400	420	8,820	-	990	7,830
Activity 3.3	Devise recommendations for high cadmium areas (hotspots)	Technical assistance	12,000	600	12,600	-	900	11,700
Activity 3.4	Testing of cadmium uptake due to cycling of plant material	Consumables lumpsum	3,996	200	4,196	3,147	1,049	-
		Labour and field materials lumpsum	12,000	600	12,600	9,450	3,150	-
		Local travel lumpsum	1,600	80	1,680	1,260	420	-
		Technical assistance	5,600	280	5,880	-	-	5,880
Output 4	**Awareness on Cadmium Issues Among Stakeholders in the Cocoa Supply Chain**			-	-			
Activity 4.1	Curriculum for and Training of Master Trainers	Technical assistance	3,600	180	3,780	-	420	3,360
		Technical assistance (consultant)	2,200	110	2,310	2,310	-	-
Activity 4.2	Awareness-raising and distributing of best practices **Output 1 (US$ 76,020)** - Framework of Support for Coordination and Information Sharing on Best Practices for cadmium Mitigation and Remediation. **Output 2 (US$ 33,611)** - Enhanced and standardized Capacity to Analyze Cadmium Levels**. Output 3 (US$ 107,516)** - Improved Knowledge of Cadmium Presence in Cocoa Growing Areas Through Analysis and Mapping. **Output 4 (US$ 74,188)** - Awareness on Cadmium Issues Among Stakeholders in the Cocoa Supply Chain. **Output 5 (US$ 112,597)** - Workshops and Results Dissemination. **Output 6 (US$ 111,930)** - Project Coordination, Monitoring and Evaluation	Consumables lumpsum	37,000	1850	38,850	31,500	7,350	-
		Local travel lumpsum	2,000	100	2,100	1,575	525	-
		Local travel lumpsum (for personnel)	3,600	180	3,780	2,835	945	-
		Personnel	8,000	400	8,400	8,400	-	-
		Technical assistance	11,800	590	12,390	-	3,310	9,080
		Technical assistance (consultant)	2,750	138	2,888	2,888	-	-
Output 5	**Workshops and Results Dissemination**			-	-			
Activity 5.0	Virtual Project inception workshop	Logistics	6,000	300	6,300	4,200	2,100	-
Activity 5.1	Mid Term Workshop	Accommodation and Subsistence	6,400	320	6,720	5,880	840	-
		Accommodation and Subsistence (consultant)	800	40	840	840	-	-
		Flight	9,725	486	10,211	8,715	1,496	-
		Flight (consultant)	1,000	50	1,050	1,050	-	-
		Local travel lumpsum	800	40	840	840	-	-

		Technical assistance	10,080	500	10,580	-	-	10,584
		Technical assistance (consultant)	2,750	138	2,888	2,888	-	-
		Workshop venue, equipment and logistics	10,000	500	10,500	10,500	-	-
Activity 5.2	End of Project Workshop	Accommodation and Subsistence	15,400	770	16,170	14,910	1,260	-
		Accommodation and Subsistence (consultant)	1,150	58	1,208	1,208	-	-
		Flight	19,350	968	20,318	18,818	1,500	-
		Flight (consultant)	1,000	50	1,050	1,050	-	-
		Technical assistance	10,080	504	10,584	-	-	10,584
		Technical assistance (consultant)	2,750	138	2,888	2,888	-	-
		Workshop venue, equipment and logistics	10,000	500	10,500	10,500	-	-
Output 6	**Project Coordination, Monitoring and Evaluation**			-	-			
Activity 6.1	Project coordination	Technical assistance (consultant)	36,000	1800	37,800	37,800	-	-
		Local Travel Lumpsum	12,000	600	12,600	12,600	-	
Activity 6.2	Project monitoring and evaluation	Accommodation and Subsistence	6,900	345	7,245	5,796	1,449	-
		Flight	4,500	225	4,725	3,225	1,500	-
		Consumables lumpsum	5,000	250	5,250	5,250	-	-
		Technical assistance	17,200	860	18,060	-	4,515	13,545
		Technical assistance (outsourced service)	15,000	750	15,750	15,750	-	-
Activity 6.3	Independent End of Project Assessment	External Evaluator	10,000	500	10,500	10,500	-	
		Total	**491,641**	**24,585**	**516,226**	**347,224**	**65,254**	**103,748**
	Overhead fees (10%)					34,722		
		Grand Total			**550,948**	**381,946**	**65,254**	**103,748**

APPENDIX 4: LETTERS OF SUPPORT