

Feasibility Study for Upgrading the Dongxiengdee Biofertilizer Factory Subproject

Project Number: 48409-004
June 2018

Lao PDR: Climate-Friendly Agribusiness Value
Chains Sector Project

ABBREVIATIONS

ADB	-	Asian Development Bank
BOF	-	bio organic fertilizer
CC	-	climate change
CF	-	contract farming
CFAVC	-	Climate-Friendly Agribusiness Value Chain Project
CSA	-	climate smart agriculture
DAEC	-	Department of Agriculture Extension and Cooperatives
DAFO	-	District Agriculture and Forestry Office
DPIU	-	district project implementation unit
EA	-	executing agency
FAO	-	Food and Agriculture Organization
GAP	-	Gender Action Plan
IA	-	implementing agency
MAF	-	Ministry of Agriculture and Forestry
MOEM	-	Ministry of Environment and Mining
MOIC	-	Ministry of Industry and Commerce
NPMO	-	National Project Management Office
O&M	-	operation and maintenance
PAFO	-	Provincial Agriculture and Forestry Office
PIC	-	project implementation consultants
PPIU	-	provincial project
VPGE	-	vegetable producers group for export

NOTE

In this report "\$" refers to United States dollars.

I. SUBPROJECT SUMMARY

A. Subproject description

1. The Climate-Friendly Agribusiness Value Chain (CFAVC) project, under its sub-output 1.3 (agribusiness enterprise value chain infrastructure improved) will support “Upgrading of Organic Bio Fertilizer Production Factories with Service Provision to Farmers” (subproject 1.3 (3)). In this context “The Upgrading the Dongxiengdee State Enterprise Bio-fertilizer Factory” has been selected as the subject of a representative subproject feasibility study. The subject agribusiness enterprise of the feasibility study meets the criteria for support under sub project 1.3. (2) and its eligibility for project support will be revalidated by the Executing Agency (EA) during project implementation
2. The project will support the following subproject core activities:
 - (i) **Upgrading the physical infrastructure, production facilities and equipment of the Dongxiengdee State Enterprise Bio fertilizer Factory:** The current production line can process only 10 tons per day. To increase the annual production to 5,000 tons, and meet potential market demand, the factory needs to increase its capacity by installing an additional 10 tons per day production line;
 - (ii) **Establishing the internal control system to ensure the quality assurance of the final product:** A competent and reliable factory based testing laboratory, meeting recognized industry standards, is compulsory to ensure the consistent quality of raw materials and the final organic fertilizer product. The testing laboratory will be equipped with a basic set of laboratory equipment enabling it to conduct soil fertility, micro-nutrient analysis and microbiological testing.
3. Further details regarding the subproject description, design, and site location are given in section III below.
4. **Associated investments:** Project initiatives associated with this subproject will include:
 - (i) **Training and capacity building** for farmers on the optimum use of organic fertilizers and the climate smart techniques involved in their application. This initiative will be implemented under project output 2 (Agribusiness policy and capacity support services strengthened), sub-output 2.2 (capacity building for climate smart agriculture, agribusiness, and farm mechanization);
 - (ii) **Technology transfer and mechanization financial support** to farmers and farmers’ groups regarding fertilizer application will be supported and implemented under project output 1 (Critical Agribusiness Value Chains Infrastructure Improved and Made Climate-Resilient), sub-output 1.2 (1) infrastructure and technology transfer for climate smart agriculture improved.

B. Subproject context and rationale

5. The project seeks to promote improved resource efficiency and climate resilience of rice and vegetable value chains, in line with Government policy as stated in (i) the Five Year National

Socio-Economic Development Plan VIII (2016-2020) (8th NSEDP) (ii) the Ministry of Agriculture and Forestry's (MAF) "Agricultural Development Strategy (ADS) to 2025 and Vision to the year 2030". Government policy includes the promotion of high value and differentiated (niche market) agricultural products which include, especially, organic rice and vegetables. Furthermore, MAF is implementing a strategic plan for national organic agriculture development¹. Government policies in this context include the promotion of organic fertilizer usages by farmers and the reduction of the use of chemical fertilizers. There is a growing incidence of the use of fertilizers by Lao farmers, and cost of production savings are possible by substituting organic fertilizer for chemical fertilizer. While farmers are being encouraged to develop their own organic fertilizers through using a combination of organic wastes, e.g. bovine manure, there is a perceived demand for industrial certified organic fertilizers, manufactured in Lao PDR. Actual and potential market demand has been established through field surveys by the PPTA team and other recent projects².

6. Subproject context and rationale is discussed in further detail under section II below.

C. Subproject cost and financing plan

7. The subproject is estimated to cost \$660,450, inclusive of contingencies.

8. The beneficiary will contribute \$264,180 (40% of total cost) and the balance of \$396,270 (60% of total cost) will be financed from the ADB grant proceeds. The government will provide the ADB grant proceeds as one hundred per cent (100%) grant to the beneficiary.

9. The results of the economic and financial evaluation show that the subproject is economically and financially viable with an EIRR of 14.8% and FIRR of 10.6%, respectively. The sensitivity analysis indicates that the subproject is most sensitive to benefits reduction, but the performance remains above the required threshold levels.

D. Subproject Implementation Plan

10. The implementation schedule for the subproject is dependent upon the time needed for project approval by ADB and the government, as well as the length of time it takes to set up implementation structures and operational accounts. The subproject should be able to start in the fourth quarter of 2018 providing project implementation commences in the third quarter of 2018.

11. The executing agency for the project (CFAVC) will be the Ministry of Agriculture and Forestry (MAF). MAF will delegate the responsibility for overall project coordination and management to its Department of Planning and Cooperation (DOPC). In turn, DOPC will establish a national project management office (NPMO) that will be responsible for project coordination and management, including financial management of project accounts, procurement of goods and works, recruitment of consultants, and monitoring and reporting.

12. To ensure inter-agency cooperation at the national level, a national steering committee (NSC) will be established under the Food Security and Commodities Committee, which will establish a dedicated subcommittee for this purpose.

¹ Government of Lao PDR, MAF. 2016. *Strategic Plan for National Organic Agriculture Development 2025, Vision Towards 2030*. Vientiane.

² ADB. 2015. *Capacity Building for Efficient Utilization of Biomass for Bioenergy and Food Security in the GMS Project (ADB TA7833-REG) – Inclusive value chain and financial assessment of BOF companies in Lao PDR, - Mission Completion Report*. Manila

13. Implementing agencies: In the six project provinces of Champasak, Khammouane, Savannakhet, Saravan, Sekong, and Vientiane the implementing agencies will be the provincial agriculture and forestry offices (PAFOs). A provincial project implementation unit (PPIU) will be established in each PAFO to be responsible for financial management at provincial level, and coordination and management of implementation of subprojects. The PPIU will also coordinate and supervise the work of the district project implementation unit (DPIUs).

E. Subproject Impact and Risks

14. **Impact:** The subproject is aligned with the 8th NSEDP and the MAF ADS 2025 and vision to the year 2030. In this context, the subproject will increase vegetable productivity, quality and safety, value addition, market efficiency, and increase rural household incomes. Performance indicators and targets will include (i) increased production of organic fertilizer to > 5,000 tons per annum through enhanced production capacity; (ii) at least two registered and certified brands of organic fertilizer established and marketed; (iii) organic fertilizer sales increased by > 20%; (iv) an officially approved organic bio fertilizer production and quality manual produced and distributed; and (v) an organic fertilizer network / platform established through improved value chain linkages.

15. The subproject has the following key perceived risks: (i) availability of factory feedstock and instability of feedstock quality, (ii) competition from chemical fertilizer, imported organic fertilizer, and fertilizer produced by farmers themselves, (iii) unstable quality of final products, (iv) inadequacy of soil testing laboratories to meet standards, (v) financial risks particularly inadequate working capital, (vi) inadequate government sector support, and (vii) negative climate change impact on farmer profitability and thus demand for organic fertilizer.

16. Subproject risks and assumptions are further discussed under section VII below.

II. SUBPROJECT CONTEXT AND RATIONALE

A. Subproject rationale

17. In this sub section of the feasibility study, subproject rationale is discussed in terms of its context within current agriculture sector development, its conformity with government sector policy, relevance to climate change adaptation, and role in the agribusiness value chain.

18. **Subproject context within the agribusiness sector:** A ministerial decision on fertilizer management in Lao PDR, in October 2013, defined organic fertilizers as any fertilizers, derived by the processing of a combination of vegetable matter, animal matter and other unprocessed mineral materials. Organic fertilizers have been classified into (i) bioorganic fertilizer (BOF) comprising any organic fertilizers containing specific living micro-organisms in a defined quantity; and (ii) fortified organic fertilizer (fBOF) comprising any organic fertilizers enriched with one or more of three primary inorganic materials, viz, N, P₂O₅ and K₂O.

19. Organic fertilizer factories in Lao PDR emerged in the late 1990s when the MAF established seven organic fertilizer factories³ with technical support from Viet Nam. A baseline survey on organic fertilizer production in Lao PDR in 2015 (Reference: under ADB TA7833-REG – Inclusive value chain and financial assessment of BOF companies in Lao PDR) identified thirty-

³ Five factories ceased production by 2005; the two remaining factories are (i) Dongxiengdee state enterprise biofertilizer and (ii) the Maliny group company

two extant organic production factories⁴ in Lao PDR. Their annual production capacity ranges from 100 to 2,000 tons. However, many factories are inactive due to (i) the lack of an appropriate production technology causing poor product quality; (ii) limited available funding to increase production capacity and improve infrastructure, equipment and facilities; and (iii) limited market due to the lack of marketing promotion and efficiency.

20. Currently, Lao PDR organic fertilizer factories sell two types of products (BOF and fBOF). A recent study⁵ reported that regular users (rubber plantation owners, flower and ornamental growers) of commercial BOF are satisfied with the product quality and efficiency. The upgrading of organic production factory infrastructure with appropriate production technology will allow them to enhance the product quality and develop the new formula that meets the requirement of rice and vegetables, which are the main target project commodities.

21. The import of fertilizer reached 182,714 tons in 2014, which was mostly chemical fertilizer.⁶ However, this amount is underestimated because the import through the provincial borders is not yet considered. Per provincial agriculture statistics (2015), the use of fertilizers in the southern province of Lao PDR is estimated to be 350,000 tons per annum. The average is estimated at 28.4 kg per ha for rainfed lowland rice. The Lao Census of Agriculture 2010/11 showed that 57% of farmers in Lao PDR applied fertilizer to improve soil fertility; 26% of farmers applied both chemical and organic fertilizer in crop production, and 16% applied only the organic fertilizer.

22. **Subproject conformity with Government policy:** The Five Year National Socio-Economic Development Plan VIII (2016-2020) (8th NSEDP) is a means of implementing the National Strategy on Socio-Economic Development until 2025 and Vision until 2030. The 8th NSEDP aims to: (i) facilitate eligibility for graduation from LDC status by 2020; (ii) consolidate regional and international integration in the context of the launching of the ASEAN Economic Community in 2015; (iii) take further steps towards industrialization and modernization and to enhance the well being of the people and the prosperity of the country to achieve the ranking as an upper middle income country by 2030. The agriculture sector contributes to the 8th NSEDP through the MAF's long term framework for the development of the agriculture and forestry sector which is enshrined in the Agricultural Development Strategy (ADS) to 2025 and Vision to the year 2030. This document includes the following sectoral vision and aim: Ensuring food security, producing competitive agricultural commodities with comparative advantage, developing clean, safe and sustainable agriculture and a shift gradually to the modernization of a resilient and productive agriculture economy linking with rural development contributing to the national economic basis.⁷ The MAF's Strategic Plan for National Organic Agriculture Development 2025, Vision Towards 2030⁸ prioritizes clean agriculture as an important government strategy to enhance the production of safe food for consumers, sustainable agricultural production and the conservation of natural resources. Organic agricultural production, and hence the promotion of the use of organic fertilizers, is deemed to have a pivotal role in implementing this strategy. The MAF has the following key action plans in place to achieve its organic agriculture development objectives:

- (i) extension of target areas for organic agricultural production to 70,000 certified households / farms by 2030, through (a) institutional capacity building (b) promotion and awareness

⁴ Survey on October 2015 by ADB TA7833 team.

⁵ ADB TA7833

⁶ Fertilizer import-export statistics of the Regulation Department, DOA/MAF.

⁷ MAF May 2015.

⁸ MAF, Department of Agriculture (DoA). February 2016.

- campaigns (c) support to organic farmers' groups, cooperatives and associations (d) introduction of incentives to producers, e.g. import taxes on chemical fertilizers;
- (ii) upgrading of the Lao PDR certification system to achieve the ASEAN standards to the level of ISO/IEC 17065 to facilitate organic product exports;
- (iii) promotional and awareness campaigns on the benefits of organic produce to producers, consumers, entrepreneurs, using a range of media outlets;
- (iv) development of dedicated organic markets in the Vientiane capital and the provinces;
- (v) human resource and capacity building; and
- (vi) development of organic produce organizations and institutes.

23. **Subproject relevance to climate change adaptation and policy:** Soil and nutrient management is essential to increase yields. This can be done through composting manure and crop residues, more precise matching of nutrients with plant needs, controlled release and deep placement technologies or using legumes for natural nitrogen fixation. The application of bio-fertilizers is one of the soil amendment practices that increases content of organic matter (OM) and soil fertility. The shift to organic fertilizer will prevent soil degradation, contribute to the reduction of GHG emissions and reduces the need for synthetic fertilizers. Within the framework of the Strategy on Climate Change of the Lao PDR (2010), the utilization of agricultural biomass for rehabilitating soil quality has been proposed under the adaptation options in the agriculture sector. In terms of the mitigation options, the water management, soil amendments, organic matter management, different tillage, rotation, and cultivar selection have been cited as a way of reducing GHG emissions.

24. **Subproject role within the agribusiness value chain:** Biofertilizer is one of the essential components of good agriculture practice and organic farming, which are considered as climate smart agriculture practices. The promotion of quality bio fertilizer to farmers within rice and vegetable value chains will facilitate the development of clean agriculture (GAP and organic agriculture) in Lao PDR.

B. Market demand for organic fertilizers

25. It is essential that there is an actual or perceived potential demand for organic fertilizers in Lao PDR to ensure that the subproject will be successful and sustainable. Market research undertaken through the ADB TA7833-REG: Inclusive value chain and financial assessment of BOF companies in Lao PDR project was followed up by the CFAVC PPTA team. The main findings of the PPTA team regarding demand for organic fertilizers, predominantly in Vientiane province, was as follows:

- (i) Organic vegetable producers have actively sought certified BOF since 2010 because they would prefer to purchase rather than compost their own organic fertilizer. The feedstock (rice husk and animal dung) has become difficult and costly (500 to 1,000 LAK per kg) to source. Consequently, the farmer compost production requires time and expense; producers prefer to focus on the organic vegetable production and marketing.
- (ii) The majority of organic rice producers still use the traditional methods of soil fertilization (direct application of crop residue/animal manure). BOF is an additional rice production cost and the preference is to buy BOF for non-organic crops cash crops thus reducing cost from chemical fertilizer application.
- (iii) Opportunities exist for organic fertilizer sales to the rubber, spices, and floriculture producers where existing BOF producers have already established their brands. The main

constraint appears to be the lack of aggressive promotion and marketing of organic certified and branded fertilizers.

C. Subproject objectives

26. The purpose of this subproject is to address the major challenges to the Dongxiengdee State Enterprise biofertilizer factory in terms of low demand and market access, inconsistent quality, and limited funding support.

D. Related development projects

27. The following ongoing development projects have relevance to the subproject, and with which it will coordinate its activities where considered appropriate.

28. **ADB Greater Mekong Subregion East-West Economic Corridor Agriculture Infrastructure Sector Project (EWEC).** The project supports the continuing transition of the East–West Economic Corridor (EWEC) from a transport corridor into an inclusive economic growth corridor, in line with the Greater Mekong Subregion (GMS) Strategic Framework. It aims to regenerate, replace and upgrade existing but underdeveloped or outdated agricultural infrastructure.⁹ The area of influence of the EWEC covers the southern provinces of Khammouane, Savannakhet and Saravan and targets areas with good agricultural potential with existing irrigation schemes. The agriculture infrastructure investments include irrigation infrastructure, as well as rural access infrastructure associated with the irrigation schemes. In these areas, organic certified fertilizer brands can be actively promoted.

29. **ADB Trade Facilitation: Improved Sanitary and Phytosanitary (SPS) Handling in Greater Mekong Subregion Trade Project (2012 – 2017):** ADB is helping Cambodia and the Lao People’s Democratic Republic strengthen sanitary and phytosanitary systems (SPS) to facilitate trade and protect public health. The project will establish and enhance surveillance and inspection programs for plant health, animal health, and food safety. It will improve training of specialists, and promote regional cooperation and harmonization of SPS measures. Organic fertilizer producers should liaise with this project to ensure conformity with regional standards regarding their product and organic agricultural trade in general.

30. **ADB TA 8163-REG: Implementing the Greater Mekong Subregion Core Agriculture Support Program (Phase II).** The project, approved by the ADB Board in October 2013, and funded by a Swedish grant (\$7.50 million), ADB TA Special Fund (0.5 million), Nordic Development Fund (\$5 million), and Multi-Donor Trust Fund under the Water Financing Partnership Facility (41.0 million) aims to (i) strengthen regional policy framework and capacity for agro food quality management (ii) establish electronic trade of environmentally friendly agro food production of smallholders (iii) increase adoption of gender-responsive and climate-friendly agriculture (iv) facilitate knowledge management and dissemination, and (v) strengthen regional cooperation on agriculture in GMS.

31. The subproject will build on lessons learned regarding organic agriculture from the following recently completed development projects.

32. **Sustainable Natural Resource Management and Productivity Enhancement Project (SNRMPEP):** The project was implemented between 2009 and 2015 under a financing plan

⁹ The term agricultural infrastructure refers to irrigation (pumping stations, weirs, canals, water management and control structures) and access infrastructure (low volume rural roads and bridges).

totaling \$ 37.475 million, comprising grants of \$20 million (ADB), \$15 million (IFAD), \$700,000 (Special Grant Fund – TAJSF) and \$41,775 government contribution. The sector project focused on sustainable agricultural resource conservation, in the five southern provinces of Lao PDR, viz, Attapeu, Champasak, Saravan, Savannakhet and Sekong. Under the SNRMPEP an agreement was signed for a public private community partnership (PPCP) for organic rice value chain promotion between Champasak, Provincial Agriculture and Forestry of Champasak (PAFO) and Urmatt Limited, a Thai private sector buyer of organic rice selling their own brand into the EU. In this arrangement Urmatt provided services to rice farmers on Khong Island, Champasak province, covering the provision of rice seeds, training and capacity building and a guaranteed paddy price.

33. **ADB Smallholders Development Project (SDP):** The SDP ran from 2003 until 2015, financed by two ADB loans of \$12 million (2003 to 2012) and \$5 million (2012 to 2015) and sought to promote sustainable commercial smallholder agriculture and associated agribusinesses in Vientiane, Khammouane, Savannakhet, and Champasak provinces. Focus was given to the development of farmer production and marketing groups (FPMGs). The SDP provided support to farmers in the form of training and capacity building in, inter alia, fertilizer application of farm based production of organic fertilizer.

III. SUBPROJECT DESCRIPTION AND DESIGN

A. Subproject description

(i) Subproject selection criteria

34. The representative subproject has been selected for support, based on its meeting the following project selection criteria for organic bio fertilizer agribusiness enterprises:

- (i) medium scale organic fertilizer companies with the current production capacity between 1,500 to 2,000 tons per annum;
- (ii) be a state owned or majority Lao-owned company with a recognized business license in line with the enterprise law;
- (iii) have a concession/exploitation agreement with authority concerned (MOM, the village authority, etc.) regarding feedstock exploitation;
- (iv) have an internal policy on green energy saving and climate change adaptation and mitigation;
- (v) contribute financial support to the subproject, either from own funds or “in kind” (e.g. land, materials and/or labor), > 10% of subproject cost, and demonstrate a sustainable financial situation and ability to operate efficiently and within a planned business framework;
- (vi) have identified actual and/or potential economically viable markets for organic fertilizers.
- (vii) be prepared to adopt a public private community partnership approach (PPCP), where appropriate, to marketing and farmer service provision to enterprise business activities;
- (viii) submit a business plan covering the proposed subproject investment;
- (ix) be prepared to make a minimum 10% contribution to the cost of the proposed investment which can be in kind e.g. land, materials and labor;
- (x) involve no involuntary resettlement or land acquisition, physical or economic dislocation;
- (xi) subproject to be capable of replication in other project areas

(ii) **Subproject description**

35. The project will support the following subproject activities:

- (i) **Core activity 1: Upgrading the physical infrastructure, production facility and equipment.** The current production line of the Biofertilizer state enterprise (Dongxiengdee) can process only 10 tons per day. To increase the annual production to 5,000 tons, the factory needs to install an additional production line with the production capacity of 10 tons per day. The set of production equipment typically found in the biofertilizer production line is included in the figures and table below.

Figure 1: Typical production line of biofertilizer production



Table 1: Biofertilizer production equipment

Equipment name	Specification	Quantity (unit)
Biaxial crusher	2.5 t/mn.	1
Biaxial blade mixer	500 kg/mn.	1
Disc granulator	4 - 6 t/h	1
Drying machine	95 cm x 12 m	1
Cooling machine	95 cm x 12 m	1

Rotary envelope machine		1
Grading screen		1
Belt conveyer	16" x 6 m	8

- (ii) **Core activity 2: Establishing the internal control system for quality assurance of final product.** The testing laboratory is compulsory to ensure the constant quality of raw materials and the final product. The testing laboratory shall be equipped with a basic set of laboratory equipment to conduct soil fertility and micro-nutrient analysis and microbiological testing as described below.

Table 2: List of laboratory testing equipment

Equipment name	Specification	Quantity (Unit)
Fast NPK soil testing equipment		2
Pocket fertilizer testing		2
Autoclave vertical	Inner size 55 x 75 cms (vol:178 lit)	1
Digital balance	(200 g, accuracy 0.01 mg)	2
Trinocular microscope	4x, oil immersion eyepieces WF 10x20mm field of view	1
pH meter	Electrode, range 0 to 14 pH, accuracy 0.01	1
Fermenter	500 ltr Fabricated	1
Water distillation unit	20l/hour	1
Bacteriological incubator	Temps – ambient +5 to 60 deg. C chamber size 60x60x60 cms	1
Hot air oven	Temp 50 to 250 Deg. Cent	1
Supplies equipment		

(iii) **Engineering and equipment requirements**

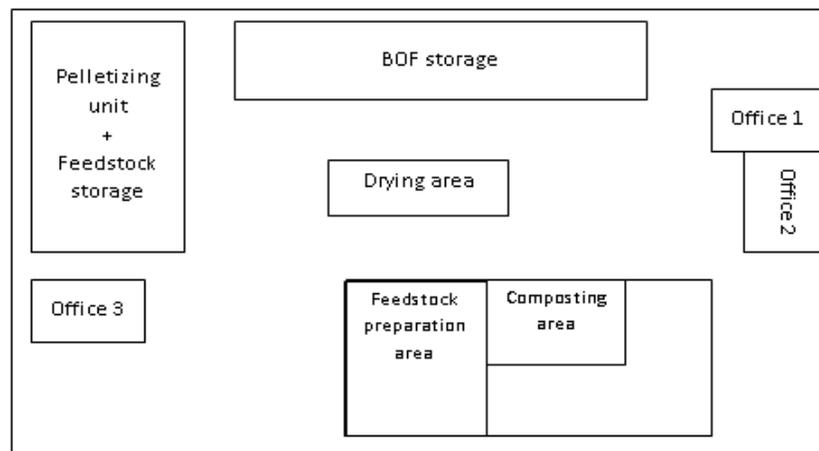
36. All equipment required for the installation of the new biofertilizer production line will be imported from overseas suppliers in countries such as Thailand and Viet Nam. In general, the supplying company will provide the technical assistance and training for the installation when the operator purchases. The laboratory equipment is available in the Lao PDR through international agents. Some suppliers provide the training on the equipment utilization as an additional aspect of the installation package.

(iv) **Subproject location and site**

37. The subproject will be in the main site, comprising around 1 ha, of the Dongxiengdee state enterprise biofertilizer factory in the Vientiane Capital (see Figure 2 below).

Figure 2: Location of the subproject site

38. The new line of the biofertilizer production will be installed in the current pelletizing unit (see Figure 3 below).

**Figure 3: New processing line layout and location**

B. Land Acquisition and Resettlement

39. Factory improvements, such as new and additional equipment, and new storage areas, will be accommodated within the existing factory compound. The factory is a state enterprise and is located on government land under a lease agreement already in operation for over 15 years. There is no additional land acquisition and no resettlement involved. The subproject falls outside the context of ADB SPS (2009) and is classed as Category C for land acquisition and resettlement.

C. Indigenous People

40. The subproject concerns the upgrading of a commercial biofertilizer factory located in Vientiane province. There are no IP/EMs impacted by the subproject. The subproject's overall impact will be to provide an improved quality fertilizer product in greater volume than before. The produce is available on the open market but availability is restricted due to quantity and

transportation logistics. Any impacts are considered outside the context of ADB SPS (2009) and the subproject is classified as Category C for IP impact.

D. Environment

(i) Environmental Criteria and Standards

41. **Screening and categorization:** At an early stage of the project, the environmental assessment process screens and categorizes proposed projects based on the significance of potential project impacts and risks. Screening and categorization are undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

- (i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
- (ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- (iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- (iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

42. **Standards:** Subprojects are obliged to conform to environmental standards of both the ADB and Lao-PDR government. Based on the ADB's Rapid Environment Assessment Checklist, the project is classified as Category B, requiring the preparation of an Initial Environment Examination report (IEE). The IEE can be reviewed as a separate linked document (LD12).

43. The IEE found that there will be no significant adverse environmental impacts associated with the proposed works since the proposed project will rehabilitate existing structures and the subproject is not located in environmentally sensitive areas. The generic mitigation measures described in the IEE will be used as tool for environmental management and monitoring that can minimize site-specific negative environmental impacts. However, the IEE will be updated, if necessary, upon completion of the detailed engineering design.

44. **Relevant ADB environmental policies and guidelines** used in the preparation of the IEE are:

- (i) Safeguard Policy Statement (SPS). ADB (2009);
- (ii) Operation Manual Bank Policies (BP) on SPS (2009);
- (iii) Environment Policy of the Asian Development Bank (2002);

- (iv) Environmental Assessment Guidelines (2003) – Annex 3: Content and Format of Initial Environmental Examination;
- (v) Environmental Guidelines for Selected Agricultural and Natural Resources Development Projects (November 1991), and
- (vi) Rapid Environmental Checklist (2013).

45. **The REA checklist for the preparation of IEE** was completed and verified by international and national environment specialists during the site visits during September and October 2016 in the project province. The main purpose of the site visits was the following:

- (i) assessment of the existing location and the surrounding environment of the subproject locations and identify if there are sensitive areas, archaeological sites and historical sites located in or near the project area;
- (ii) identify potential environmental and socioeconomic impacts on the proposed construction;
- (iii) consultation with the officials and staff of Provincial Department of Agriculture, Provincial Department of Environment, Provincial Department of Water Resource and Meteorology, Provincial Department of Rural Development and local authorities (villager chief and commune council) about the project;
- (iv) consultation with communities involved in the project, including those immediate beneficiaries to determine their levels of involvement and specifically discuss and scope relevant environmental issues with them; and
- (v) conduct social perception survey through key informant interviews to stakeholders.

46. Overall this subproject will result positively. Upgrading through infrastructural improvements to the Dongxiengdee State Enterprise Biofertilizer Factory will improve both the day-to-day capacity of the production facility as well as ensuring the quality of the product is maintained. The project fits well within the Lao PDR's strategy to promote organic production in agriculture as a niche marketing opportunity for farmers. It will contribute to improved agricultural production, expansion of clean agriculture products and it will fit within Lao PDR's strategy on climate change 2010, both in terms of adaptation options and GHG mitigation. An improvement of soil and nutrient conditions will not only be an essential to increase high yields but it would be also beneficial to microorganism in the soil.

IV. TOTAL INVESTMENT, FUNDING ARRANGEMENTS AND FINANCING PLAN

A. Investment costs and financing plan

47. **Investment cost.** The subproject is estimated to cost \$660,450 as shown in the table below.

Table 3: Investment Cost (US\$)

Item	Quantity		Cost (US\$)	
	UoM	Qty	Unit	Total
Storage facility (raw materials)	unit	1	100,000	100,000
Storage facility (finished product)	unit	1	100,000	100,000
Production equipment	set	1	176,000	176,000
Vehicle (truck)	unit	1	47,000	47,000
Laboratory equipment	set	1	98,500	98,500
BOF production manual development and publication	lump sum		50,000	50,000
Network creation and activity	lump sum		10,000	10,000
Registration and certification	lump sum		7,500	7,500
Field demonstrations and TA	lump sum		20,000	20,000
Mass media campaign	lump sum		10,000	10,000
Training and workshop	lump sum		10,000	10,000
Base cost				629,000
Physical contingencies		5%		31,450
Total capital cost				660,450

Source: Dongxiengdee State Enterprise Biofertilizer Factory

48. **Financing plan.** Of the total investment costs of \$660,450, 60% will be financed by the project in the form of a matching grant, and 40% by the subproject owners. It is assumed that the subproject owners will raise 10% equity and take commercial loans for the remaining 30%. The subproject financing plan is presented in the table below.

Table 4: Financing Plan (US\$)

Source	Amount	Percent
Government (grant)	396,270	60
Beneficiary contribution		
Commercial loan	198,135	30%
Equity	66,045	10%
Total	660,450	100

Source: Consultants' calculation

B. Estimation methods, unit costs and ratios

(i) Estimation methods

49. The Dongxiengdee State Enterprise Biofertilizer Factory was the subject of a case study, at the end of 2015, under the "Capacity Building for Efficient Utilization of Biomass for Bioenergy and Food Security in the GMS Project (ADB TA7833-REG) – Inclusive value chain and financial assessment of BOF companies in Lao PDR, - Mission Completion Report December 2015."¹⁰ During the course of the case study the cost of upgrading the factory by improving its physical infrastructure, production facilities and equipment was costed in detail. These costs have been reviewed and verified for inclusion in the feasibility study by the international and national procurement specialists and the experienced national agro-processing engineer, civil engineer (rural infrastructure specialist), and the Deputy Team Leader, during feasibility study field work.

¹⁰ ADB. 2015. Capacity Building for Efficient Utilization of Biomass for Bioenergy and Food Security in the GMS Project (ADB TA7833-REG) – "Inclusive value chain and financial assessment of BOF companies in Lao PDR, - Mission Completion Report December 2015. Manila.

Table 5: Estimated subproject costs

Nº	Activity/Items	Detail	Unit	Cost (\$)/Unit	Total (\$)	Remark
1	Activity 1: Upgrading the physical infrastructure, production facility and equipment	1.1. Set of production equipment	1	176,000	176,000	A set of equipment (crusher, mixer, disc granulator, drying machine, cooling machine, rotary envelope machine, grading screen, 8 belt convey) for the installed capacity of 10 tons /day
		1.2. Storage facility	2	100,000	200,000	Storage room (20 x50m) for the raw materials and final products
		1.3. Truck	1	47,000	47,000	
2	Activity 2: Establishing the internal system of quality assurance	2.1. Test and R & D Laboratory	1	98,500	98,500	A set of basic N, P, K analysis and microbiological testing
Total					474,500	

50. As mentioned above, this subproject requires the additional support of the sub-output 2.2, the cost related to the support activities are as shown in the table below. The estimated costs for good agricultural practice, good manufacturing practice (GMP) and hazard critical control points certification (HACCP) are based on information obtained from the Department of Agriculture (DOA), Department of Agricultural Extension and Cooperatives (DAEC).

Table 6: Cost of subproject associated investments under Project output 2.2

	Items	Quantity	Unit price (USD)	Amount (USD)	Remark
1	BOF production manual development & publication	1	50,000	50,000	Lump sum
2	Registration and certification	1	7,500	7,500	Estimated for 5 registered products
3	Network creation & activity	1	10,000	10,000	Lump sum
4	Field demonstrations & TA	1	20,000	20,000	Estimated for 5-year work plan
5	Mass media campaign	1	10,000	10,000	Estimated for 5-year work plan
6	Training & Workshop	1	10,000	10,000	Estimated for 5-year work plan
Total				107,500	

V. IMPLEMENTATION AND OPERATING ARRANGEMENTS

A. Execution and Implementation Agencies

51. The executing agency for the Project (CFAVC) will be the Ministry of Agriculture and Forestry (MAF). MAF will delegate the responsibility for overall project coordination and management to its Department of Planning and Cooperation (DOPC). In turn, DOPC will establish a national project management office (NPMO) that will be responsible for project coordination and management, including financial management of project accounts, procurement of goods and works, recruitment of consultants, and monitoring and reporting.

52. To ensure inter-agency cooperation at the national level, a national steering committee (NSC) will be established under the Food Security and Commodities Committee, which will establish a dedicated subcommittee for this purpose. The NSC will be chaired by a Vice Minister of MAF and will include representation from the Ministry of Finance (MOF); the Ministry of Planning and Investment; the Ministry of Industry and Commerce; MPWT; the Ministry of Foreign Affairs; the Water Resources and Environmental Administration; the National Land Management Authority; Lao Women's Union (LWU); the Committee for the Advancement of Women's Affairs and the provincial vice governors from the participating provinces. The NSC will meet annually or as required to review overall implementation progress, approve annual work plans and budgets, and provide overall policy guidance. The NPMO will provide secretariat services to the NSC.

53. The NPMO will be assisted by a team of project implementation consultants (PIC).

54. **Implementing agencies:** In the six project provinces of Vientiane, Khammouane, Savannakhet, Saravan, Champasak and Sekong, the implementing agencies will be the provincial agriculture and forestry offices (PAFOs). A provincial project implementation unit (PPIU) will be established in each PAFO to be responsible for financial management at provincial level, and coordination and management of implementation of subprojects. The PPO will also coordinate and supervise the work of the district project implementation units (DPIUs).

55. To assist in implementation at the district level, DPIUs will be established within participating district agriculture and forestry offices (DAFOs). The DPIUs will provide coordination and supervision of subproject activities at district level. They will be responsible to assist with (i) identification of associated initiatives; (ii) community development activities; (iii) environment management activities; (iv) indigenous people development activities; (v) gender action plan activities; and (vi) monitoring and reporting on physical progress of implementation.

B. Subproject Implementation Management

(i) Detailed design phase

56. The initial design and costing of this subproject has been undertaken by PPTA consultants and represents an initial feasibility study and preparation of the subproject within the confines of the resources and time available to the PPTA team. The NPMO should request a revision or verification of some details of the subproject's design. The NPMO will be responsible for the recruitment of consulting engineers to review the detailed designs, bid document preparation and if approved will supervise the construction, along with the PIC. Detailed designs will be reviewed by NPMO and the engineer from the PIC to ensure internationally acceptable design standards have been incorporated and that engineering designs address the potential impact from climate

change. Comments will be referred to the detailed design consultants for amendment and subsequent preparation of bidding documents. Detailed designs must be approved by the NPMO with input from the Director of the PAFO and submitted to the PSC for funding approval. Once funding approval has been provided, the recruitment of contractors can proceed. The detailed design consultants can also proceed with the preparation with bidding documents.

57. As the cost is likely to require only national competitive bidding (NCB), the NPMO will invite bids for construction, equipment and installation in accordance with ADB's and Government's requirements as set out in the project (CFAVC) procurement plan.

(ii) **Construction phase**

58. Construction supervision will be provided by the PAFO with the assistance of the PIC and in collaboration with the Enterprise and contractors. The contractor will maintain a construction and equipment installation log from which the PIC will assess the physical progress of the work against the schedule in the contract and authorize payments accordingly. If issues arise then the NPMO will be advised accordingly. Strict adherence to quality standards will be enforced. After the construction and warranty period, as defined in the contract with the contractors, has lapsed the new processing line and laboratory equipment will be handed to the Champasak PAFO who will transfer it legally to the VPGE.

(iii) **Operational phase**

59. The provision of the maximum advisory input in the first two years of operation will be the key to the subproject's sustainability. The PAFO will be responsible for maintaining close contact with the BOF management, and the Project (CFAVC) will support the Enterprise's operations directly or indirectly through the PAFO in undertaking the following key activities (i) in association with project training advisers assisting in the development of capacity building programs; (ii) networking in the sphere of marketing and ensuring that domestic organic fertilizer buyers are linked with the Enterprise; and (iii) verification for brand certification.

60. The NPMO and M&E consultant will monitor the impact of the subproject investment by carrying out annual impact monitoring surveys relating to factory management and operation, trading progress and make recommendations for improvement.

(iv) **Role of the PAFO**

61. The following tasks will be completed by PAFO under the overall supervision of the NPMO:

- (i) In association with project training advisers, assist in the development of capacity building programs related to climate smart agriculture (CSA) and mechanization related to organic fertilizer usage by farmers and farmers' groups;
- (ii) The PAFO will organize and arrange open days to the VPGE site for project candidate subproject to demonstrate the work undertaken;
- (iii) The PAFO will have an oversight on the technical and infrastructure aspects of the factory processing equipment and laboratory equipment performance; and
- (iv) Assist the NPMO M&E consultants in monitoring the impact from the subproject investment by carrying out annual impact monitoring surveys relating to factory management and operation, vegetable marketing progress and in making recommendations for improvement.

(v) **Role of contractors**

62. The equipment installation contractors will be responsible for following the detailed design, the installation of equipment process and the quality of work to be established under the contract and will prepare and submit progress logs in order that PAFO and NPMO can monitor progress. The contractor will be responsible for a timely handover of the infrastructure in accordance with the contract.

(vi) **Role of program implementation consultants**

63. During the preparation of the detailed design, the PIC will support the preparation of the detailed engineering and equipment supply and installation as required. An agro processing specialist will be part of the PIC and there will be assessment that adequate provision has been made to accommodate the potential impact from climate change relating to extreme weather events. The PIC will also review bid documentation to ensure that they conform to the requirements of ADB and the government.

64. The PIC will ensure that quality assurance is maintained during construction / installation supervision and will wherever possible, work with the trainers to ensure the satisfactory management and operation of the factory. Approval for payments under the construction contract must be ratified by the PIC before being authorized for payment through the NPMO.

65. The PIC will work with the contractors and with the PAFO to ensure efficient subproject implementation. The PIC in conjunction with the NPMO will ensure inter-agency coordination.

(vii) **Role of subproject beneficiaries**

66. The biofertilizer factory owners (vegetable producers group for export [VPGE]) will provide land or purchase land to site the factory. It is expected that the beneficiaries will with PAFO and project support, appoint a manager and staff to manage and operate the factory and its business of collection, post-harvest handling marketing group, and HVC.

67. The project aims to transfer the factory to the VPGE when ready for operation. The cost of managing the factory and its business operations will be supported by the project on a sliding scale during the duration of the project. The cost for minor repairs and maintenance will be covered by the VPGE.

C. Subproject Implementation Schedule

68. The implementation schedule for the subproject is dependent upon the time needed for program approval through ADB and government, as well as the length of time it takes to set up implementation structures and operational accounts. The construction should take no longer than 6 months. The subproject should be able to start in the fourth quarter of 2018 providing project implementation commences in the third quarter of 2018.

D. Procurement

69. The following procurement packages are envisaged at this stage:

- (i) **Supply of set of production equipment:** A set of equipment (crusher, mixer, disc granulator, drying machine, cooling machine, rotary envelope machine, grading screen, 8 belt convey) for the installed capacity of 10 tons /day. The package will be

- procured as a goods package following NCB method. The package will be subject to prior review of ADB if it turns out to be the first NCB of the project, otherwise it will be subject to post review of ADB. The estimated cost of the package is USD 176,000.
- (ii) **Construction of storage facility:** Storage room (20 x50m) for the raw materials and final products. The package will be procured as a civil works package following NCB method. The package will be subject to prior review of ADB if it turns out to be the first NCB of the project, otherwise it will be subject to post review of ADB. The estimated cost of the package is USD 200,000.
 - (iii) **Supply and installation of laboratory equipment:** A set of basic N, P, K analysis and microbiological testing equipment: The package will be procured as a goods package following NCB method. The package will be subject to prior review of ADB if it turns out to be the first NCB of the project, otherwise it will be subject to post review of ADB. The estimated cost of the package is USD 98,500.
 - (iv) **Supply of truck:** The package will be procured as a goods package following shopping method. The package will be subject to post review of ADB. The estimated cost of the package is USD 47,000.
 - (v) **Development, printing & supply of BOF Production manual:** The package will be procured as a goods package following shopping method. The package will be subject to post review of ADB. The estimated cost of the package is USD 50,000.

70. The executing agency for the project will be the Ministry of Agriculture and Forestry (MAF). MAF will delegate the responsibility for overall project coordination and management to its Department of Planning and Cooperation (DOPC). In turn, DOPC will establish a national project management office (NPMO) that will be responsible for procurement of goods and works and recruitment of consultants.

71. All procurement of goods and works will be undertaken in accordance with ADB's Procurement Guidelines (2015, as amended from time to time).

72. For goods, ICB procedures will be used for goods valued at \$1,000,000 or above; national competitive bidding (NCB) procedures will be used for goods valued below \$1,000,000 but equal to \$100,000 or above; and shopping procedures will be used for goods valued below \$100,000. For works, ICB procedures will be used for works valued at \$3,000,000 or above; NCB procedures will be used for works valued below \$3,000,000 but equal to \$100,000 or above; and shopping procedures will be used for works valued below \$100,000.

73. All consultants will be recruited according to ADB's Guidelines on the Use of Consultants (2013, as amended from time to time).

74. Except as the Asian Development Bank (ADB) may otherwise agree, the following process thresholds shall apply to procurement of goods and works.

Table 7: Procurement of Goods and Works		
Method	Threshold	Comments
International Competitive Bidding (ICB) for Works	#3,000,000 and above	
International Competitive Bidding (ICB) for Goods	\$1,000,000 and above	
National Competitive Bidding (NCB) for Works	\$100,000 to \$2,999,999	<p>NPMO to procure all NCB packages.</p> <p>The first package shall follow prior review procedures. The first draft English version of the procurement documents should be submitted by NPMO for ADB review and approval regardless of the estimated contract amount. ADB-approved documents should be used as a model for all subsequent NCB procurement financed by ADB, and need not be submitted to further prior review.</p>
National Competitive Bidding (NCB) for Goods: \$1,000,000 or more	\$100,000 to \$999,999	Same as NCB for works
Shopping for Works	Below \$100,000	<p>NPMO or PPIUs to procure all shopping packages.</p> <p>The first package shall follow prior review procedures. The first draft English version of the procurement documents should be submitted by NPMO for ADB review and approval regardless of the estimated contract amount. ADB-approved documents should be used as a model for all subsequent shopping procurement financed by ADB,</p>

		and need not be submitted to further prior review
Shopping for Goods	Below \$100,000	Same as shopping for works
Direct Contracting for Works and Goods	Below \$ 5,000	Post review
Consulting Services		
Method	Comments	
Quality and Cost Based Selection	Prior review, 90:10 (PIC and FME)	
Consultants' Qualification Selection	Prior review (EMA)	
Lease-Cost Selection	Prior review (external auditor)	
Single Source Selection	Prior review (IRRI)	
Individual Consultants (ICS)	Prior review	

VI. SUBPROJECT OUTCOME AND IMPACT

A. Subproject Outcome and Impact

(i) Performance Indicators

75. Performance indicators and targets will include: (i) increased production of organic fertilizer to > 5000 tons per annum through enhanced production capacity; (ii) at least two registered and certified brands of organic fertilizer established and marketed; (iii) organic fertilizer sales increased by > 20%; (iv) an officially approved organic bio fertilizer production and quality manual produced and distributed; (v) an organic fertilizer network / platform established through improved value chain linkages; (vi) the subproject will generate additional demand for hired labor to work in the factory due to the increased HVC throughput; and (vii) at least two women will be employed in the factory in managerial positions.

(ii) Evaluation Arrangements

76. The first month after the factory has been completed and prior to its transfer to the VPGE, a review of the implementation arrangements will be undertaken. Performance indicators will

include (i) beneficiaries; (ii) rural livelihoods; (iii) increases in production and decreases in post-harvest losses; and (iv) value chain linkages and marketing efficiency.

(iii) **Reporting Arrangements**

77. In line with the overall project performance management system (PPMS) framework, a participatory benefit monitoring and evaluation program will be carried out following a design that supports data requirements (segregated by gender and IPs) of a result based management system that is linked to the DMF. Specifically, indicators and targets for all desired subproject outputs, outcomes, and impacts will be defined for annual and, or episodic points in the subproject cycle in accordance with the indicators in the DMF. The PPMS will provide a clear indication of subproject efficiency (planned outputs against allocated inputs) and effectiveness (achievement of subproject outcomes and impacts because of implementing planned interventions and investments). PPMS activities will be conducted periodically to assess whether subproject inputs have delivered the expected benefits to the intended beneficiaries. The PPMS will also detect deviations between the plan and execution of the subproject. Any deviations between the plan and achieved results (outputs, outcomes, and impacts) will be recognized by NPMO in a timely manner, thereby allowing corrective management actions and decisions to be taken.

B. Economic and Financial Evaluation

78. The direct and quantifiable benefits of the subproject come from the net margins of the product generated from the new production line. These are benefits that accrue from the purchase of raw materials from different suppliers, processing them into high quality product and marketing them. Only these benefits are quantified and included in the economic analysis.

79. The results of the economic and financial evaluation show that the subproject is economically and financially viable with an EIRR of 14.8% and FIRR of 10.6%, respectively. The sensitivity analysis indicates that the subproject is most sensitive to benefits reduction, but the performance remains above the required threshold levels.

80. The financial projections of the subproject for the period 2019-2035 show that the subproject is financially sustainable. Net cash inflows accumulated during the period are adequate to finance the replacement of equipment on the 11th year without the need to incur long-term borrowings. Please refer to appendix 5 for further information.

C. Social Impact Assessment

81. A social and gender impact assessment and subproject gender action plan is included in Annex IV.

D. Environmental Impact Assessment

82. The IEE was prepared following the ADB Safeguard Policy Statement (SPS) (2009), the 2003 ADB Environmental Assessment Guidelines, the ADB Environmental Guidelines for Selected Irrigation and Drainage Development Projects and relevant environmental policies and guidelines of the government. The project is classified under ADB guidelines/rules as a Category B project. Such projects are judged to have some adverse environmental impacts, most of which is occurring during construction phase, but to a lesser degree and/or significance than those for category A projects. An IEE is required to determine whether or not significant environmental

impact warranting an environmental impact assessment (EIA) are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

83. **During pre-construction:** The issues related to project location encompass the rehabilitation of the existing structures which include design and layout where necessary to improve the BOF processing to achieve greater efficiencies.

84. **During implementation:** The major issue during implementation concerns compliance with the EMP regarding BOF processing including and management of smell and sources of dust, improving OH&S management initiatives, ensuring site cleanliness, and protection to existing vegetation.

85. **Post-construction:** Main concern is the maintenance of the OH&S management initiatives, ensuring site cleanliness, and protection to existing vegetation.

86. **Rapid Environmental Assessment:** The initial Rapid Environmental Assessment (REA) for the Project identified a medium climate risk, however the AWARE classification is that of high risk.¹¹ This PPTA has therefore completed a Climate Risk Assessment and Management document, tabled as SD10. In addition, there is a need to undertake a Climate Risk and Vulnerability Assessment for the whole project including construction and operational (Post construction) periods. This work has been included in the TOR for the International Climate Change and Environmental Specialist to complete during Implementation, and to be site specific.

87. The IEE includes an EMP which will be implemented by a contractor to avoid or minimize negative environmental effects by following the IEE documents.

VII. CRITICAL RISKS

88. Organic biofertilizer manufacturers in Lao PDR encounter the following major issues constraining sector development:

- (i) **Instability of quality due to the lack of appropriate infrastructures and production technology:** The factory still uses obsolete production equipment since establishment in 1998 despite the enterprise having good production technology and skilled persons. These issues cause product instability which has a negative effect in the market. Recent studies reported little response of lowland rice to commercial organic fertilizer during the first year of application and only combining this application with inorganic fertilizer has improved efficiency. However, the studies have recognized that the application of bioorganic fertilizer may improve soil fertility, especially soil organic carbon and plant nutrients in in the long term (P Sengxua et al, 2001). However, conversely, it should be noted that the regular users (rubber plantation owners, flowers and ornamental growers) of commercial fBOF are satisfied with product quality and efficiency.
- (ii) **Low production due to the limited investment capacity:** The enterprise needs significant investment capital and working capital to ensure the production during the peak demand season (May to October) because the shelf life of bioorganic fertilizer is short (six months). The operating expenses are between \$66 to 88 per ton. Loans are one of the options practiced by the Enterprise to service its short-term operation expenses. However, access to the long-term loans due to the

¹¹ As documented in the Climate Risk Assessment and Management.

Enterprise status (case of State enterprise) are problematic. Thus, it is difficult for the factory to increase the production capacity and improve the infrastructure under current circumstances.

- (iii) **Low market demand due to the lack of marketing campaign:** A large proportion of bio-organic fertilizer was sold through the promotion of the chemical-free agriculture project, with field demonstrations with pioneer farmers and the Enterprise business network. However, there is no longer an efficient functioning distribution channel, and marketing campaigns to promote bio-organic fertilizer are essential.
- (iv) **Government sector support:** Government reduces support to agribusiness development through insufficient budget allocation to MAF line agencies;
- (v) **Climate change impact:** Negative impact of climate change on farming systems will reduce crop yields and profitability.

ANNEX I: DESIGN AND MONITORING FRAMEWORK

Subproject results chain	Performance with targets and baselines	Data sources and reporting	Risks
<p>Impact: Aligned with the National Socio-Economic Development Plan VIII (2016-2020) (8th NSED) and the MAF Agricultural Development Strategy to 2025 and vision to the year 2030 - increased agricultural productivity, quality and safety, value addition, and increased rural household incomes through the development of climate-friendly organic farming agribusiness value chains.</p>			
<p>Outcome:</p>			
<p>Resource efficiency and climate resilience of the organic farming agribusiness value chain improved</p>	<ul style="list-style-type: none"> • Average HH earnings of organic farmers rise by 30% by 2026 (base 2018); • Women mainstreamed into organic FGs management through at least 2 females in the FG management team 	<ul style="list-style-type: none"> • Agricultural and household census reports; • Bank of Lao PDR annual reports; • MAF Statistical Yearbook / production and investment statistics; • Project progress reports based on PPMS indicators; • Project MTR; • PCR; • Project progress reports based on PPMS indicators; 	<ul style="list-style-type: none"> • Government reduces support to agribusiness development through insufficient budget allocation to MAF line agencies; • Negative impact of climate change on farming systems will reduce organic crop yields and profitability, and lower capacity usage of the BOF
<p>Output 1:</p>			
<p>Critical climate-resilient climate-resilient organic farming agribusiness value chain infrastructure improved</p>	<p>By 2021:</p> <ul style="list-style-type: none"> • Installation of a second 10 t production line at the BOF • Internal control system to ensure the quality assurance of the final product established <p>By 2024:</p> <ul style="list-style-type: none"> • > two registered and certified brands of organic fertilizer established and marketed • organic fertilizer sales increased by > 20% • increased production of organic fertilizer to > 5,000 tons per annum • officially approved organic bio fertilizer production and quality manual produced and distributed 	<ul style="list-style-type: none"> • PCR; • MTR; • financial statements (P&L account / Balance sheet etc.) 	<ul style="list-style-type: none"> • Market instability due to GoL interventions; • Negative impact of climate change on organic crop production; • Collapse of international organic crop markets to levels under cost of production

Output 2:

Climate smart
agriculture promoted

- > 2 women will be employed in the BOF in managerial positions,
- Hired labor increased by >10%

By 2021:

- > 25% of members of organic FGs supplying the BOF trained in CSA at least 25% being women;

By 2022:

- >75% of members of organic FGs clients of the BOF GAP/organic certified;
- Organic crop production by FGs supplying BOF increased by 15%;
- Post-harvest losses reduced by 10%

- Participating PAFOs not fully committed to subproject to undertake associated activities to FGs;
- Insufficient take up by FGs of subproject services, extension, mechanization.

Key activities and with milestones

- 1.0 Infrastructure / upgrade of BOF
- 1.1 Installation of second 10 tons per day organic biofertilizer production line/ supply of one truck
- 1.2 Establishment of internal production control system including laboratory equipment
- 1.3 Construction of factory storage facility
- 1.4 Development, printing & supply of BOF Production manual
- 1.5 BOF completion of GMP certification
- 1.6 BOF completion of HACCP certification
- 2.0 Training & capacity building
- 2.1 Training of organic farmers in CSA / organic farming techniques
- 2.2 Organic FG member completion of GAP certification
- 2.3 Mechanization & technology transfer to farmers

Inputs

Financing (Infrastructure & equipment only)

Nb: FG training, capacity building & GAP/ organic crop certification will be funded from a lump sum allocated to Project sub outputs 2.2 and 1.2 respectively.

ADB: \$396,270 (loan to GoL)

Government: Nil

Beneficiary: \$ 66,045 equity; \$198,135 (commercial loan)

Co-financiers: Nil

Consultancy:

Oversight of PIC only (non-specific)

ADS = Agricultural Development Strategy to 2025 and vision to the year 2030, BOF = Dongxiengdee State Enterprise Biofertilizer Factory, CSA = climate smart agriculture; FG = farmers group, GAP = good agricultural practice, GMP = good manufacturing practice, GoL = Government of Laos, HACCP = hazard critical control points, HH = households; MAF = Ministry of Agriculture and Forestry, MTR = mid term report, PCR = project completion report, PIC = project implementation consultants, PPMS - project performance and management system.

ANNEX II: LAND ACQUISITION AND INDIGENOUS PEOPLES/ETHNIC GROUPS

A. Land Acquisition and Resettlement Screening

89. The following checklists are to be used in the identification and selection of SPs for implementation. The objective of the checklists is to ensure that only Category B or C SPs are selected according to project selection criteria.

Involuntary Resettlement Impact Categorization Checklist

	Involuntary Resettlement Effects	Yes	No	Not Known	Remarks
	Will the activity require permanent or temporary land acquisition?		X		Sufficient land available within compound
	Is the site and land needed for acquisition known?				N/A:
	Is the ownership status and current usage of land to be acquired known?	X			State enterprise on land
	Is the area of land required from each affected HH known?				N/A
	Will land be acquired involuntarily?				N/A
	Will land be acquired voluntarily?	X			
	Will easement be utilized within an existing Right of Way (ROW)?				N/A
1	Was any facility constructed recently on new land in anticipation of obtaining further assistance for the facility from this ADB project?		X		
	Was the land acquired legally under GoL? (unknown = No)	X			Only legally acquired land will be considered
	Are there any outstanding complaints about the land used or acquired for the existing facilities?		X		
	Will the activity require permanent or temporary relocation or displacement of any people (titled or non-titled)?		X		
	Are there any non-titled people (squatters) who live at the site or within the COI / Right of Way / public land?		X		
	Will there be any loss of housing or accommodation or other residential structures?		X		
	Will there be any loss of residential land?		X		

Involuntary Resettlement Effects	Yes	No	Not Known	Remarks
Will there be any loss of vegetable gardens or agricultural plots?		X		
Will there be any losses of crops, fruit trees or private structures?		X		
Will there be loss of income sources and means of livelihoods due to land acquisition?		X		
Will any small or informal businesses have to be moved or closed temporarily or permanently?		X		
Will there be temporary or permanent loss of employment as a result of the closure of any businesses resulting from the renovation?		X		
Involuntary restrictions on land use or on access to legally designated parks and protected areas				
Will people lose access to natural resources, communal facilities and services?		X		
If land use is changed, will it have an adverse impact on social and economic activities?		X		
Will access to land and resources owned communally or by the state be restricted?		X		
Information on Displaced Persons:				
<p>Any estimate of the likely number of persons that will be displaced by the Project? [] No [X] Yes</p> <p> If yes, approximately how many?</p> <p> _____None_X_____</p>				
<p>Are any of them poor, female-heads of households, or vulnerable to poverty risks? [X] No [] Yes</p>				
<p>Are any displaced persons from indigenous or ethnic minority groups? [X] No [] Yes</p>				

B. Project Data			
Country/Project No./Project Title	:	PPTA 8897 –LAO: Climate-Friendly Agribusiness Value Chains Sector Project Laos: Upgrading the Dongxiengdee State Enterprise Biofertilizer Factory Subproject Feasibility Study	
Department/ Division	:	Southeast Asia Department/ Environment, Natural Resources and Agriculture Division (SERD)	
Processing Stage	:	Inception	
Modality	:		
[] Project Loan [] Program Loan [] Financial Intermediary [] General Corporate Finance [X] Sector Loan [] MFF [] Emergency Assistance [] Grant [] Other financing modalities:			
C. Involuntary Resettlement Category			
		[] New	[] Recategorization — Previous Category [X]
Category A	Category B	Category C	Category FI
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
D. Comments			
Project Team Comments: The project is classified as category C for involuntary resettlement and/or involuntary land acquisition. Construction will be limited to rehabilitation of existing structures.		SDES Comments:	
E. Approval			
Proposed by:		Reviewed by:	
Project Team Leader, {Department/Division}		Social Safeguard Specialist, SDES	

Indigenous People Ethnic Minority Impact Screening Checklist:

This checklist is used to screen impacts and aid in project IP safeguard classification:

Subproject: Biofertilizer Factory

Screening Form for Impacts on Ethnic Groups		Yes	No	Not Known	Remarks
Key concerns (Please provide elaborations on the remarks column)					
A	Indigenous People Identification				
1	Are there socio-cultural groups present in or use the project area who may be considered as “tribes” (hill tribes, schedules tribes, tribal peoples), “minorities” (ethnic or national minorities), or “indigenous communities” in the project area?		X		
2	Are there national or local laws or policies as well as anthropological researches/studies that consider these groups present in or using the project area as belonging to “ethnic minorities”, schedules tribes, tribal peoples, national minorities, or cultural communities?				N/A

3	Do such groups self-identify as being part of a distinct social and cultural group?				N/A
4	Do such groups maintain collective attachments to distinct habitats or ancestral territories and/or to the natural resources in these habitats and territories?				N/A
5	Do such groups maintain cultural, economic, social and political institutions distinct from the dominant society and culture?				N/A
6	Do such groups speak a distinct language or dialect?				N/A
7	Has such groups been historically, socially and economically marginalized, disempowered, excluded, and/or discriminated against?				N/A
8	Are such groups represented as “Indigenous peoples” or as “ethnic minorities” in any formal decision-making bodies at the national or local levels?				N/A
B					
9	Will the project directly or indirectly benefit or target indigenous peoples?		X		
10	Will the project directly or indirectly affect indigenous peoples’ traditional socio-cultural and belief practices? (e.g. child-rearing, health, education, arts, and governance)		X		
11	Will the project affect the livelihood systems of indigenous peoples? (e.g. food production, system, natural resource management, crafts and trade, employment status)		X		
12	Will the project be in an area (land or territory) occupied, owned, or used by indigenous peoples, and/or claimed as ancestral domain?		X		
C Identification of Special Requirements <i>Will the project activities include:</i>					
13	Commercial development of the cultural resources and knowledge of indigenous peoples?		X		
14	Physical displacement from traditional or customary lands?		X		
15	Commercial development of natural resources (such as minerals, hydrocarbons, forests, water, hunting or fishing grounds) within customary lands under use that would impact the livelihoods or the cultural, ceremonial, spiritual uses that define the identity and community of indigenous peoples?		X		
16	Establishing legal recognition of rights to lands and territories that are traditionally owned or customarily used, occupied or claimed by indigenous peoples?		X		
17	Acquisition of lands that are traditionally owned or customarily used, occupied or claimed by indigenous peoples?		X		

	Anticipated project impacts on Indigenous Peoples	Anticipated positive effect	Anticipated negative effect on EGs.
	Subproject activity		
1	Outputs: 1. <u>Critical agribusiness value chain infrastructure improved and made climate-resilientclimate-resilient:</u> <i>Sub-output 1.1: Climate-resilientClimate-resilient Rural infrastructure improved</i> <i>Sub-output 1.2: Crop production infrastructure</i> <i>Sub-output 1.3: Agribusiness enterprise value chain infrastructure improved</i>	Improved quality of produce. Improved linkages to VCs and markets, closer linkages to private sector agribusinesses. Increased marketability of produce and better prices for higher quality produce.	None.

a.	B. Project Data	
b.	Country/Project No./Project Title	Laos - Climate-Friendly Agribusiness Value Chain Sector Project: Upgrading the Dongxiengdee State Enterprise Bio-fertilizer Factory Subproject Feasibility Study
e.	Department/ Division	Southeast Asia Department/ Environment, Natural Resources and Agriculture Division (SERD)
g.	Processing Stage	Feasibility
i.	Modality	
		<input type="checkbox"/> Project Loan <input type="checkbox"/> Program Loan <input type="checkbox"/> Financial Intermediary <input type="checkbox"/> General Corporate Finance <input checked="" type="checkbox"/> Sector Loan <input type="checkbox"/> MFF <input type="checkbox"/> Emergency Assistance <input type="checkbox"/> Grant <input type="checkbox"/> Other
	C. Indigenous Peoples Category	
		<input type="checkbox"/> New <input type="checkbox"/> Re-categorization <input checked="" type="checkbox"/> Previous Category
		<input type="checkbox"/> Category A <input type="checkbox"/> Category B <input checked="" type="checkbox"/> Category C <input type="checkbox"/> Category FI
	D. Project requires the broad community support of affected Indigenous Peoples communities.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	E. Comments	
	The SP is classed as Category C for IPs. The SP concerns upgrading plant and equipment at a commercially operated state enterprise in Vte Province producing biofertilizer. It is located in a mainstream Lao area. The SP is outside the context of SPS (2009).	SDES Comments:
	F. Approval	
	Proposed by:	Reviewed by:
	Project Team Leader, {Department/Division} Date:	Social Safeguard Specialist, SDES Date:
	Social Development Specialist, {Department/Division} Date:	Endorsed by: Director, SDES Date:
	Director, {Division} Date:	<input type="checkbox"/> Highly Complex and Sensitive Project Approved by: Chief Compliance Officer Date:

ANNEX III: SOCIAL AND GENDER IMPACT ASSESSMENT AND GENDER ACTION PLAN

A. Introduction

90. The biofertilizer factory at Dongxiengdy Village, Naxaythong District, Vientiane Capital is a wholly-owned Lao state enterprise. According to the Director¹² it was established in 1997 and began fertilizer manufacturing operations using machinery, equipment and technical assistance granted by the Socialist Republic of Vietnam.

91. Today, the factory Director estimates that undertaking the needed improvements to upgrade the factory would require an investment of approximately \$600,000.

92. The original factory business plan was to produce and sell approximately 1,000 tons of bio-fertilizer per year, but in practice only 500 tons of biofertilizer is produced annually.

93. Currently, the factory lacks the resources required to produce large quantities of bio-fertilizer and for this reason only small quantities of fertilizer are produced to meet current orders. The factory's clients include farmers in several provinces of the country - Khammouane, Savannakhet, Vientiane Province, Vientiane Capital and Bolikhamsay. Biofertilizer is used in the cultivation of paddy, fruit trees, rubber trees, flowers and other crops.

B. Use of bio-fertilizer

94. According to factory staff, there is still a lack of awareness amongst the general public about biofertilizer and its benefits. Field monitoring of biofertilizer use by farmers would provide useful feedback concerning the effectiveness or otherwise of bio-fertilizer compared with alternatives.

95. Purchases of biofertilizer in some locations has stopped, although the reasons for this are not known. Unfortunately, resources for monitoring activities in the field are not available.

C. Source of raw materials for biofertilizer production

96. Approximately 95% of the raw materials needed by the factory is obtained from rural areas.

97. An important raw material is buffalo and cow dung. This is mainly supplied to the factory from farmers in four villages (Tinhou village, Phonsavanh and Nakhouloung and Nabua) in Bolikham District, Bolikhamsay Province. There are approximately 25 – 30 farm households in these villages where livestock rearing is an important livelihood. In Khammouane Province there are four villages in two districts – Nong Bok District and Buarapha District which supplies the factory with buffalo and cow dung. Farmers receive 850,000 Lao Kip in cash for one ton of manure.

98. A third important supplier of cow and buffalo dung for the factory is the Don Dou abattoir, located approximately 12 km south of Vientiane city.

¹² Interview with factory Director and PPTA Social Development and Gender Specialists – November 2016

99. Bat Dung is another raw material used in the manufacture of biofertilizer. The main suppliers are a group of approximately 25 households who collect bat dung from a cave near to Nakham village, in Phuong District, Vientiane province.

100. The factory organizes transportation of dung from villages, and this is deducted from the price paid to farmers for purchasing the manure. Costs range from \$150/ton if the manure is transported to the factory from the slaughter house in Vientiane centre, up to 300 USD / ton if manure is transported from Savannakhet (and \$250/ton if transported from Khammouane).

101. Clients wishing to purchase biofertilizer contact the factory directly. If the client is located in Vientiane, then the factory covers the transport costs because of the negligible distance. However, for customers who are located at long distances from the factory, transportation and the hiring of trucks is the responsibility of the client.

D. Gender division of labor for collection of raw materials

102. At village level there are collectors who source livestock manure for sale to the factory. These collectors are generally women who act as brokers and sell the manure to larger buyers who are usually men. Local female collectors are usually aged between 35-45 years and are often village shop owners.

103. Traders and collectors require permission and certification from village authorities for handling this type of material.

104. The female village collector visits farm households explaining how many kilos of cow or buffalo manure she would like to purchase. She usually buys from farmers who have large numbers of livestock. In some localities, female collectors hire labourers to manually collect and transport manure. Laborers are both male or female, but are more commonly male.

105. Regarding the collection of bat dung from caves, it is usually the men who work inside the cave and women work outside the cave packing the bat dung into sacks. This manure collection activity is usually carried out after crop harvesting.

E. Gender division of factory employees and staff

106. Following the upgrading of the factory facilities, the Director says that approximately 20 workers will be employed in the factory. Currently there are only seven employees. Of the seven permanent staff there are four females: each is responsible for administration; marketing; and finance and one female is a manual laborer. There is equal pay for equal work.

107. There are three male staff and all have positions of higher management: the factory Director, Deputy Director and Head of the Finance Division.

F. Female marketing staff

108. The female staff member responsible for marketing is a Business Management graduate and had been working at the factory for three years.

109. One of the problems employees face is apparently low salaries (for the Marketing Executive her salary is currently one million Lao Kip per month). Salaries are also frequently paid late – with delays of up to three months not uncommon. Benefits such as health insurance coverage is not included in the Marketing Executive's salary. There are no annual end-of-year

bonuses to staff. Salary increases for factory employees was recommended to bring them up to living wage standards (i.e. up to two million Lao Kip per month in the case of the Marketing Executive).

G. Current working conditions

110. The employees are supplied with uniforms and wear protective clothing for work. However, workers did not receive any orientation or technical training related to the use of factory machinery and equipment, which is considered to be very old and in poor condition.

111. Regarding toilet facilities and sanitation, the facilities are very unsatisfactory, with an unsanitary latrine onsite for use by both male and female staff.

H. On-the-job training

112. It was recommended that on-the-job-training for factory workers should also cover basic information about health and hygiene, since it was reported that some of the employees are from rural areas and have little knowledge of primary health care issues related to the job.

I. Recommendations

113. One of the recommendations was that a farmer outreach program should be set up to raise awareness of the advantages of biofertilizer use in agriculture. A major advantage of biofertilizer is that it is less costly than chemical fertilizer imported from Thailand, and would therefore be especially attractive for poor farmers.

114. The outreach team should be made up of three persons – two females and one male in order to ensure the effectiveness of communication with both male and female farmers in the village. Regular campaigns and visits to villages would provide valuable follow up and feedback for the factory from farmers.

115. A management committee could be established at the factory with the inclusion of female staff members to improve the effectiveness of operations; to discuss working conditions and to plan activities such as monitoring and implementing awareness campaigns.

J. Gender Action Plan

Project outputs	Gender activities/actions	Performance indicators/targets	Responsible agency(ies)	Budget
Output 1: Improved and climate-resilient climate-resilient critical biofertilizer factory infrastructure				
Gender Objective 1.1: Ensure women and men's equal participation in decision-making related to critical agribusiness infrastructure	<p>1.1.1 Involve women and Sub-CAW Gender Focal Points and Lao Women's Union (LWU) representatives actively and meaningfully in each individual event for all relevant consultations and planning of activities related to improvement and climate resiliency of critical infrastructure supported by the project.</p> <p>Conduct a gender awareness training for factory employees (linked to MAF Gender Strategy 2.5.4) for FS 3 / subproject including (i) project gender requirement/targets (ii) awareness raising on land titling (iii) impact of agri-chemicals, HIV and human trafficking (iv) division of labor (v) access to and control resources, decision making.</p> <p><i>This would mean paying attention to the following aspects: convenient time, adequate venue, information sharing with visual aids/illustrations, having female facilitators, child care arrangements even if informal, etc.</i></p> <p>Linked to Output 1.1a, 1.1b of CFAVC DMF; linked to MAF Gender Strategy Output 2.5.4 – increasing the participation of women in decision-making</p>	Women are at least 40% of participants in each event (point of reference: current female population of biofertilizer factory: 4 out of 7 in subproject 3).	EA, IA, and MAF Gender Unit (DAW), Sub-CAW Gender Focal Points, LWU and TA	Refer to Output 1 costs related to subproject implementation
Gender Objective 1.2: Job creation for women	<p>1.2.1 Ensure women benefit from jobs created by the project related to biofertilizer factory infrastructure construction/rehabilitation as well as serving in management committees of biofertilizer state enterprise</p> <p><i>This would mean that information about such employment opportunities will be shared through adequate channels to reach out women in the nearby communities.</i></p> <p><i>Core labor standards will be complied with (equal pay for work of equal value, no child labor) for all civil works related to the project.</i></p> <p><i>Other measures that are needed will be taken so that interested women can grasp such opportunities.</i></p> <p>Linked to Output 1.2c, 1.2d, 1.3g and 1.3h of CFAVC DMF; linked to MAF Gender Strategy Output 2.5.4 – increasing the participation of women in decision-making</p>	At least 30% of workdays created will be filled by women disaggregated by skilled/unskilled and type of work (baseline 0) Improved future biofertilizer factory to have women serving on management committee (baseline 0; target 3)	EA, IA, and MAF Gender Unit (DAW), Sub-CAW Gender Focal Points, LWU and TA	Refer to Output 1 costs related to subproject construction
	<p>1.2.2 Provide infrastructure-related skills enhancement for women in construction/rehabilitation (e.g. masonry and building skills), and operation and maintenance of equipment and machinery.</p>	Number and percentage of women trained by type of activity. Baseline 0; target: 30% women	EA and IA	Refer to Output 1 costs related to subproject capacity building

	Linked to Output 1.2c and 1.2d of CFAVC DMF; linked to MAF Gender Strategy Goal 2.4.4 – increasing participation of women in technical training			
Gender Objective 1.3: Uptake of bio fertilizers by farmers	1.3.1 As part of the promotion campaigns about biofertilizers, raise awareness among women and men in the communities about the benefits of biofertilizers for value chain improvement/climate change and cost-cutting. Linked to Output 1.3i of CFAVC DMF	Indicators: Number of women farmer beneficiaries of biofertilizers (exact baseline unknown; target TBD).	EA and IA	Refer to Output 1 costs for implementation of renewable energy and inputs
Output 2: Strengthened agribusiness policy and capacity support services				
Gender Objective 2.1: Strengthen women farmers' (individual and member of cooperatives) involvement along climate-friendly agribusiness value chains (VCs)	2.1.1 Involve women farmers and Sub-CAW Gender Focal Points and LWU representatives actively and meaningfully in each individual event for all factory capacity-building activities (training courses, study tours) supported by the project: (Linked to MAF Gender Strategy III. Program 2; and Goal 1.1 Objective 11) (1) technical factory-related capacity-building activities including those related to climate change adaptation and mitigation; (linked to MAF Gender Strategy Goal 2.4.4 – increasing participation of women in technical training) (2) trainings on how to operate and maintain a range of agricultural machinery; (3) management and business skills trainings. <i>This would mean paying special attention to the following aspects: adequate venue, timing, duration, way that invitation is being done (not to head of household), use of visual aids and other illustrated materials, use of female facilitators/demonstrators and extension agents, child care arrangements even if informal, etc.</i> Linked to Output 2.2b, 2.2c, 2.2d, 2.2e of CFAVC DMF	Target for 1 and 3: Women are 40% of participants in each event (point of reference: female population: 4 in subproject 3 Indicators/targets for 2: (i) Number and percentage of women farmers trained in each event; (ii) women represent 50% of increased labor pool of individuals who can operate factory machinery over the baseline (baseline: 0).	EA, IA, Sub-CAW Gender Focal Points, LWU	Refer to Output 2 costs related to training
Gender Objective 2.2: Female factory staff participation in capacity-building activities related to biofertilizer production and climate-friendly agribusiness VCs	2.2.1 Ensure relevant female factory staff have equal opportunities to participate in capacity-building activities with regard to biofertilizer production and climate-friendly agribusiness VCs. Linked to Output 1.2f, 2.2b, 2.2c, 2.2d, 2.2e of DMF; linked to MAF Gender Strategy Activity 12 Goal 1.1 Objective 1.2	Target: 40% women participants (aggregate). (Baseline: 4 female staff out of 7 in the factory).	EA, IA	Refer to Output 2 costs for institutional strengthening
Gender Objective 2.3: Institutionalize gender mainstreaming in the	2.3.1 At project inception, conduct a gender analysis for each of the Lao targeted value chains (VC) and	Report prepared with clear recommendations based on	EA, IA, TA Project	Refer to Output 2 costs for training

climate-friendly agribusiness VCs sector	develop a set of clear recommendations to strengthen women farmers' involvement along the different VCs. Linked to Output 2.1a of CFAVC DMF	gender analysis of the Lao targeted VCs. (Baseline: 0)	Gender Specialists	
	2.3.2 Integrate key recommendations from the above mentioned gender analysis of VCs and key features of the MAF Gender Policy into the Agribusiness policy and other related documents prepared under the project. <i>This would also mean that gender stakeholders (MAF Gender Unit and gender focal points) participate in policy committees and meetings.</i> Linked to Output 2.1a of CFAVC DMF; linked to MAF Gender Strategy 2.2 (Strategy 2030), Objective 2.	Key recommendations from gender analysis of targeted VCs integrated in the draft Agribusiness Policy. (Baseline: 0)	EA, MAF Gender Unit (DAW)	Refer to Output 2 costs for institutional strengthening
	2.3.3 Integrate a session on gender equality in climate-friendly agribusiness VCs (based on gender analysis report mentioned above) into the training program and awareness raising activities for relevant project stakeholders (i.e. relevant departments in MAF, agricultural extension officers, local leaders and government officials, MAF Gender Unit and Gender Focal Points, and LWU). Linked to Output 2.1a of CFAVC DMF	Number of sessions provided on gender equality in climate-friendly agribusiness VCs; target groups; number of people trained disaggregated by sex. (Baseline: 0)	EA, TA Gender Specialists	Refer to Output 2 costs for training
	2.3.4 Actively involve the MAF Gender Unit, the Sub-CAW Gender Focal Points, and the LWU as key partners in project implementation and monitoring, especially for the GAP activities. <i>This also entails partnering with the Sub-CAW and LWU as facilitators for agricultural extension and technical capacity-building, awareness-raising and information sharing targeted at farmers including provision of market information.</i>	Project implementation and monitoring reports for GAP by Sub-CAW Gender Focal Points and LWU	EA, IA, Sub-CAW Gender Focal Points, LWU,	Refer to Output 2 costs for training

** ToR of International and National Gender Specialists stipulate that they will be responsible for collecting quantitative data to formulate GAP baseline and target indicators

ADB = Asian Development Bank, DAFO = District Agriculture and Forestry Office, DAW = Division for the Advancement of Women, LWU = Lao Women's Union, MAF = Ministry of Agriculture and Forestry, PAFO = Provincial Agriculture and Forestry Office, PMU = Project coordination office, PPMU = Provincial Project Management Unit, Sub-CAW = Subcommittee for the Advancement of Women, TA = technical assistance, TBD = to be decided, PPMS = Project Performance Monitoring System

116. Project management gender related activities to be implemented by NPMO/PPIUs:

- (i) Appoint gender focal points for the project in the NPMO/PPIUs - representatives from the MAF Gender Unit and sub national Dept. of Agriculture gender focal points at provincial levels.
- (ii) Prepare annual work plans to implement the activities of the GAP.
- (iii) Gender consultants (national and international) to be recruited and build capacity of the gender focal points and NPMO/PPIUs staff in gender analysis and mainstreaming, and support GAP implementation, monitoring and reporting.
- (iv) Collect and analyze data disaggregated by sex where relevant and integrate gender sensitive indicators (from the DMF and the GAP) in the Project Performance Monitoring System.
- (v) Ensure regular monitoring and reporting (at least semi-annually to ADB) on the progress of GAP implementation.

ANNEX IV: ECONOMIC AND FINANCIAL ANALYSIS

1. The economic and financial analysis of the proposed subproject, the Dongxiengdee State Enterprise Biofertilizer Factory subproject, was conducted in accordance with ADB's *Guidelines for the Economic Analysis of Projects* and *Financial Management and Analysis of Projects*.¹³ The sub-output (Agribusiness Enterprise Value Chain Infrastructure Improved) of the project will support "Upgrading of Organic Bio Fertilizer Production Factories with Service Provision to Farmers". In this context, the Dongxiengdee State Enterprise Biofertilizer Factory was selected as the subject of a representative subproject feasibility study.

A. Methodology and Assumptions

2. The evaluation was conducted through a comparison of the without-project and with-project scenarios. The assumptions used in the evaluation were as follows:

- (i) Economic and financial analyses and the calculation of the economic internal rate of return (EIRR) and financial internal rate of return (FIRR) were undertaken at constant 2016 prices; the domestic price numeraire was adopted in the analysis.
- (ii) An exchange rate of Kip8,100 per US\$1.00 was used.
- (iii) In the economic analysis, the financial values of the inputs and outputs were converted to their economic values using the appropriate conversion factors; tradable goods were converted using the shadow exchange rate factor (SERF) of 1.11; for non-tradable goods, market price in the project area was used and a standard conversion factor of 0.9 was applied; a shadow wage rate factor of 0.8 for rural unskilled labor was applied.¹⁴ Transfer payments such as taxes, duties and subsidies were excluded in the economic analysis.
- (iv) Economic life of the subproject is assumed for 20 years with proper and adequate maintenance of the subproject facilities; subproject equipment are assumed to be replaced on the year.
- (v) Subproject operation is assumed at an average of 300 days each year during its economic life with the subproject equipment utilized at an average of 60% of its capacity of 10 tons per day.
- (vi) The economic opportunity cost of capital (EOCC) is assumed at 12%.
- (vii) The projected financial statements consisting of the income statement, cash flow statement and the balance sheet are stated at current prices; price escalation factor of 1.4% for 2017 and 1.5% for 2018 and thereafter were used for foreign currency costs and 2.5% for 2017 and 3.0% for 2018 and thereafter were used for domestic currency costs.

B. Without Project and With Project Situations

3. The current production line of the factory can process only 10 tons per day. The factory cannot increase its capacity due to equipment obsolescence. To increase the annual production and meet potential market demand, the factory needs to increase its capacity by installing an

¹³ ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila; ADB. 2005. *Financial Management and Analysis of Projects*. Manila

¹⁴ The economic conversion factors are identical to those used in two recent ADB-financed projects in Lao: (i) Northern Rural Infrastructure Development Sector grant project (Grant 0235-LAO) and (ii) Northern Smallholder Livestock Commercialization Project (RRP LAO 47300).

additional production line. The factory currently does not have a reliable factory based testing laboratory to ensure the quality assurance of the final product.

4. The Project will upgrade the physical infrastructure, production facilities and equipment of the factory by installing an additional 10 tons per day production line. In addition, the Project will support the establishment of an internal control system to ensure the quality assurance of the final product. A competent and reliable factory based testing laboratory, meeting recognized industry standards, will be provided to ensure the consistent quality of raw materials and the final organic fertilizer product. The testing laboratory will be equipped with a basic set of laboratory equipment enabling it to conduct soil fertility, micro-nutrient analysis and microbiological testing.

C. Economic Analysis

5. **Economic benefits.** The direct and quantifiable benefits of the subproject come from the net margins of the product generated from the new production line. These are benefits that accrue from the purchase of raw materials from different suppliers, processing them into high quality product and marketing them. Only these benefits are quantified and included in the economic analysis.

6. The subproject will benefit the suppliers that provide the factory with increased raw materials requirements for the new production line. The promotion of the bio-organic fertilizer will reduce the use and importation of chemical fertilizer from the neighboring countries, save the country some foreign exchange reserve, and contribute to the local business development. Labor that will be employed under the subproject will likewise benefit.

7. The data used in quantifying benefits and costs and the conversion of financial values into economic values are presented in the Tables below.

Table 7: Production Input and Output Economic Price Adjustment

Item	Price Kip/kg	Input (tons/year)	Process Loss (%)	EPA
Biofertilizer				
Raw materials	200	1,800		1.00
Finished product	1,500		5%	1.00
Capital and O&M costs				
Tradable			SERF	1.11
Non-tradable			SCF	0.90
Unskilled labor			SWRF	0.80

O&M = operation and maintenance, EPA = economic price adjustment, SCF = standard conversion factor; SERF = shadow exchange rate factor, SWRF = shadow wage rate factor.

Source: Consultants' estimates

Table 8: Investment Cost in Financial and Economic Prices (\$)

Item	Financial	Economic
Storage facility (raw materials)	100,000	85,580
Storage facility (finished product)	100,000	85,580
Production equipment	176,000	165,057
Vehicle (truck)	47,000	44,078
Laboratory equipment	98,500	92,376
BOF production manual development and publication	50,000	40,909
Network creation and activity	10,000	8,182
Registration and certification	7,500	6,136
Field demonstrations and TA	20,000	16,364
Mass media campaign	10,000	8,182
Training and workshop	10,000	8,182
Base cost	629,000	560,626
Physical contingencies	31,450	28,031
Total capital cost	660,450	588,658

Source: Consultants' calculation

8. **Results of economic evaluation.** The results of the economic and sensitivity analysis are summarized in the Table below. The subproject is economically viable in the base case scenario and robust against downside risks. The subproject economic performance is most sensitive to benefits reduction, but the performance remains above the required threshold levels (Kip 0 for NPV, 12% for EIRR). Table 13 shows the details of the EIRR calculation.

Table 9: Economic Evaluation Results and Sensitivity Analysis

Scenario	Change	NPV ^{1/} (Kip million)	EIRR (%)	SI ^{2/}	SV ^{3/}
Base Case		2,806	21.61%		
Increase in Capital Costs	+ 10%	2,306	19.33%	-3.12	-32%
Increase in Raw Materials	+ 10%	2,567	20.83%	-5.25	-19%
Increase in O&M Costs	+ 10%	2,176	19.55%	-3.43	-29%
Decrease in Benefits	+ 10%	1,157	16.14%	1.44	70%

1/ NPV = Net Present Value discounted at EOCC of 12%

2/ SI = Sensitivity Indicator (ratio of % change in EIRR above the cut-off rate of 12% to % change in a variable)

3/ SV = Switching Value (% change in a variable to reduce the EIRR to the cut-off rate of 12%)

Source: Consultant's calculation

9. **Distribution and poverty impact analysis.** The benefits and costs of the subproject are shared among different stakeholder groups. The subproject benefits will accrue primarily to government with the factory being a state-owned enterprise. An assessment of the distribution of benefits and costs is presented in Table 14. The analysis indicates that the overall share of the poor to subproject's net benefits is about 29%.

Table 10: EIRR Calculation (Kip million)

Year	Capital Cost	Raw		Benefits	Net Inflow (Outflow)
		Materials Purchased	O&M Cost		
2017	4,768				(4,768)
2018		350	852	1,924	722
2019		359	947	2,437	1,131
2020		360	957	2,541	1,225
2021		360	957	2,561	1,243
2022		360	958	2,564	1,247
2023		360	958	2,565	1,247
2024		360	958	2,565	1,247
2025		360	958	2,565	1,247
2026		360	958	2,565	1,247
2027	2,564	360	958	2,565	(1,317)
2028		360	958	2,565	1,247
2029		360	958	2,565	1,247
2030		360	958	2,565	1,247
2031		360	958	2,565	1,247
2032		360	958	2,565	1,247
2033		360	958	2,565	1,247
2034		360	958	2,565	1,247
2035		360	958	2,565	1,247
2036		360	958	2,565	1,247
2037		360	958	2,565	1,247
NPV	6,302	2,679	7,049	18,465	2,806
EIRR					21.61%

Source: Consultants' calculation

Table 11: Distribution and Poverty Impact Analysis

Item	FNPV	ENPV	Externality	Government	
				Factory	Labor
Project Benefits		18,465	18,465	18,465	
Project Costs (includes O&M)					
Traded	5,942	5,472	(470)	5,472	
Non-traded	7,428	6,840	(588)	6,840	
Unskilled labor	1,486	1,368	(118)	1,486	(118)
Subtotal	14,856	13,680	(1,175)	13,798	(118)
Net benefits	(14,856)	4,784	19,640	4,667	118
Proportion of poor (%)				29%	40%
Benefits of poor			1,400	1,353	47
Share of poor to net benefits (%)			29%		

ENPV = economic net present value, FNPV = financial net present value

Source: Consultants' calculation

D. Financial Analysis

10. **Investment cost.** The subproject is estimated to cost \$660,450 as shown in the table below.

Table 12: Investment Cost (\$)

Item	Quantity		Cost	
	UoM	Qty	Unit	Total
Storage facility (raw materials)	unit	1	100,000	100,000
Storage facility (finished product)	unit	1	100,000	100,000
Production equipment	set	1	176,000	176,000
Vehicle (truck)	unit	1	47,000	47,000
Laboratory equipment	set	1	98,500	98,500
BOF production manual development and publication	lump sum		50,000	50,000
Network creation and activity	lump sum		10,000	10,000
Registration and certification	lump sum		7,500	7,500
Field demonstrations and TA	lump sum		20,000	20,000
Mass media campaign	lump sum		10,000	10,000
Training and workshop	lump sum		10,000	10,000
Base cost				629,000
Physical contingencies		5%		31,450
Total capital cost				660,450

Source: Dongxiengdee State Enterprise Biofertilizer Factory

11. **Financing plan.** The beneficiary will contribute 40% of the investment cost by a combination of commercial loans and own equity and the balance of 60% will be financed from the ADB proceeds. The government will provide the ADB grant proceeds as one hundred per cent (100%) grant to the beneficiary. The subproject financing plan is presented in the Table below.

Table 13: Financing Plan (\$)

Source	Amount	Percent
Project (grant)	396,270	60
Beneficiary contribution		
Commercial loan	198,135	30
Equity	66,045	10
Total	660,450	100

Source: Consultants' calculation

12. **Weighted average cost of capital.** The calculation of the weighted average cost of capital (WACC) of the subproject is presented below.

Table 17: Weighted Average Cost of Capital

Item	Loan	Grant	Equity	Total
Weight (%)	0.0%	90.0%	10.0%	100.0%
Nominal Cost (%)	0.0%	12.0%	12.0%	
Tax Rate (%)	24.0%	0.0%	0.0%	
Tax Adjusted Nominal Cost (%)	0.0%	12.0%	12.0%	
Inflation Rate (%)	1.5%	1.5%	3.5%	
Real Cost (%)	0.0%	10.3%	8.2%	
Weighted Component of WACC (%)	0.0%	9.3%	0.8%	
Weighted Average Cost of Capital (Real Terms)				10.1%

Source: Consultants' calculation

13. **Results of financial evaluation.** The results of the financial and sensitivity analysis are summarized in the Table below. The subproject is financially viable in the base case scenario and robust against downside risks. The subproject financial performance is most sensitive to revenues reduction, but the performance remains above the required threshold levels (Kip 0 for NPV, WACC for FIRR). Table 19 shows the details of the FIRR calculation.

Table 18: Financial Evaluation Results and Sensitivity Analysis

Scenario	Change	NPV ^{1/} (Kip million)	FIRR (%)	SI ^{2/}	SV ^{3/}
Base Case		2,516	17.15%		
Increase in Capital Costs	+ 10%	1,936	15.15%	2.85	35%
Increase in Raw Materials	+ 10%	2,241	16.41%	1.05	96%
Increase in O&M Costs	+ 10%	1,722	15.02%	3.04	33%
Decrease in Revenues	+ 10%	615	11.94%	7.42	13%

1/ NPV = Net Present Value discounted at WACC

2/ SI = Sensitivity Indicator (ratio of % change in FIRR above the WACC cut-off rate to % change in a variable)

3/ SV = Switching Value (% change in a variable to reduce the FIRR to the WACC cut-off rate)

Source: Consultant's calculation

14. **Financial sustainability.** The financial projections (income statement, cash flow statement and balance sheet) of the subproject for the period 2019-2035 (Appendix 1) show that the subproject is financially sustainable. Net cash inflows accumulated during the period are adequate to finance the replacement of equipment on the 11th year without the need to incur long-term borrowings.

Table 14: FIRR Calculation (Kip million)

Year	Capital Cost	Raw Materials Purchased	O&M Cost	Revenue	Net Inflow (Outflow)
2017	5,350				(5,350)
2018		350	934	1,924	640
2019		359	1,038	2,437	1,039
2020		360	1,049	2,541	1,133
2021		360	1,050	2,561	1,151
2022		360	1,050	2,564	1,154
2023		360	1,050	2,565	1,155
2024		360	1,050	2,565	1,155
2025		360	1,050	2,565	1,155
2026		360	1,050	2,565	1,155
2027	2,734	360	1,050	2,565	(1,579)
2028		360	1,050	2,565	1,155
2029		360	1,050	2,565	1,155
2030		360	1,050	2,565	1,155
2031		360	1,050	2,565	1,155
2032		360	1,050	2,565	1,155
2033		360	1,050	2,565	1,155
2034		360	1,050	2,565	1,155
2035		360	1,050	2,565	1,155
2036		360	1,050	2,565	1,155
2037		360	1,050	2,565	1,155
NPV	7,112	3,028	8,743	20,934	2,516
FIRR					17.15%

Source: Consultants' calculation

Appendix 1: Financial projections of the subproject for the period 2017-2027

Bio-fertilizer State Enterprise											
Income Statement											
(Kip million, Current Prices)											
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenue		2,001	2,617	2,822	2,939	3,040	3,140	3,240	3,343	3,447	3,553
Operating Expenses		1,336	1,501	1,564	1,618	1,672	1,726	1,781	1,838	1,895	1,953
Income before Depreciation and Interest Expense	0	666	1,116	1,258	1,321	1,369	1,414	1,459	1,505	1,552	1,600
Depreciation		358	358	358	358	358	358	358	358	358	358
Interest Expense		0	0	0	0	0	0	0	0	0	0
Net Income	0	307	758	899	962	1,010	1,055	1,101	1,147	1,194	1,241
Bio-fertilizer State Enterprise											
Cash Flow											
(Kip million, Current Prices)											
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sources of Funds:											
Net Income		307	758	899	962	1,010	1,055	1,101	1,147	1,194	1,241
Add: Depreciation		358	358	358	358	358	358	358	358	358	358
Interest Expense		0	0	0	0	0	0	0	0	0	0
Internal Cash Generation	0	666	1,116	1,258	1,321	1,369	1,414	1,459	1,505	1,552	1,600
Capital Contribution	535										
Grant for Project Capital Expenditure	4,815										
Borrowing for Project Capital Expenditure	0										
Total Sources of Funds	5,350	666	1,116	1,258	1,321	1,369	1,414	1,459	1,505	1,552	1,600
Application of Funds:											
Project Capital Expenditure	5,350										3,788
Debt Service Payment:											
Principal Payment		0	0	0	0	0	0	0	0	0	0
Interest Expense		0	0	0	0	0	0	0	0	0	0
Total Debt Service Payment		0	0	0	0	0	0	0	0	0	0
Working Capital Needs excluding Cash		401	(44)	23	15	13	13	14	14	14	14
Other Assets/Liabilities Changes											
Total Application of Funds	5,350	401	(44)	23	15	13	13	14	14	14	3,802
Net Cash Inflow (Outflow)	0	265	1,160	1,235	1,306	1,355	1,400	1,446	1,492	1,538	(2,202)
Bio-fertilizer State Enterprise											
Balance Sheet											
(Kip million, Current Prices)											
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ASSETS											
Fixed Assets											
Fixed Assets	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	9,137
Accumulated Depreciation		358	717	1,075	1,434	1,792	2,151	2,509	2,868	3,226	3,585
Net Fixed Assets	5,350	4,991	4,633	4,274	3,916	3,557	3,199	2,840	2,482	2,123	5,552
Work in Progress											
Total Fixed Assets	5,350	4,991	4,633	4,274	3,916	3,557	3,199	2,840	2,482	2,123	5,552
Current Assets											
Cash		265	1,425	2,660	3,966	5,321	6,721	8,167	9,659	11,197	8,995
Accounts Receivable		167	218	235	245	253	262	270	279	287	296
Inventories		305	343	357	370	382	394	407	420	433	446
Other Current Assets		152	171	179	185	191	197	203	210	216	223
Total Current Assets	0	888	2,157	3,431	4,765	6,147	7,574	9,047	10,567	12,133	9,960
Total Assets	5,350	5,879	6,790	7,705	8,681	9,704	10,773	11,887	13,048	14,256	15,512
LIABILITIES AND EQUITY											
Current Liabilities											
Accounts Payable & Other Current Liabilities		223	375	391	405	418	432	445	459	474	488
Currently Maturing Long-Term Debt		0	0	0	0	0	0	0	0	0	0
Total Current Liabilities	0	223	375	391	405	418	432	445	459	474	488
Long-Term Debt		0	0	0	0	0	0	0	0	0	0
Total Liabilities	0	223	375	391	405	418	432	445	459	474	488
Equity											
Capital	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350
Retained Earnings	0	307	1,065	1,964	2,927	3,937	4,992	6,092	7,239	8,433	9,674
Reserves											
Total Equity	5,350	5,657	6,414	7,314	8,276	9,286	10,341	11,442	12,589	13,783	15,024
Total Liabilities and Equity	5,350	5,879	6,790	7,705	8,681	9,704	10,773	11,887	13,048	14,256	15,512
check total	0	0	0	0	0	0	0	0	0	0	0
Current Ratio		4.0	5.7	8.8	11.8	14.7	17.6	20.3	23.0	25.6	20.4
Working Capital, excluding Cash		401	357	380	395	408	421	435	449	463	477
% Debt on Debt plus Equity		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
# Days Accounts Receivable		30	30	30	30	30	30	30	30	30	30
Debt Service Coverage Ratio	NA	NA	NA	NA	NA						

Source: Consultants' calculation